



Denton County

Kitchen & Laundry Addition

**Permitting Documents
Project Manual**

Bidding Documents

June 14, 2019

HDR Project No. 10105890





William Edward Prindle
4/20/19



3.28.19
Rodrigo Vizcaino



6/13/19
David E. Williams

Matthew G. Palazzetti



6-13-19



4/26/19

TABLE OF CONTENTS

DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS

- 00 01 09 - PROJECT MANUAL - PREFACE
- 00 11 19 - ADVERTISEMENT REQUEST FOR COMPETITIVE SEALED PROPOSALS
- 00 21 16 - INSTRUCTIONS TO PROPOSERS
- 00 21 16.1 - PREVAILING WAGE RATES JAIL KITCHENLAUNDRY RFP#19-2534
- 00 26 00 - SUBSTITUTIONS PRIOR TO PROPOSAL SUBMISSION
- 00 31 32 - SUBSURFACE DRILLING AND SAMPLING INFORMATION
- 00 42 16 - PROPOSAL FORM
- 00 45 16 - PROPOSER QUALIFICATIONS
- 00 52 13 - AGREEMENT

DIVISION 01 — GENERAL REQUIREMENTS

- 01 14 16 - COORDINATION WITH OCCUPANTS AND WORK RESTRICTIONS
- 01 21 13 - CONTINGENCY ALLOWANCES
- 01 22 00 - UNIT PRICES
- 01 23 04 - CHANGES IN WORK
- 01 25 13 - SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT
- 01 26 13 - REQUESTS FOR INFORMATION (RFI)
- 01 29 00 - APPLICATIONS FOR PAYMENT AND SCHEDULE OF VALUES (GC)
- 01 30 01 - ELECTRONIC SUBMITTAL PROC
- 01 31 19 - PROJECT MEETINGS
- 01 32 16 - CONSTRUCTION SCHEDULES
- 01 32 26 - PROGRESS REPORTS AND PHOTOS
- 01 33 00 - SUBMITTAL PROCEDURES
- 01 41 00 - CODES, REGULATIONS, AND GUIDELINES
- 01 42 11 - ABBREVIATIONS - ORGANIZATIONS AND STANDARDS
- 01 42 13 - ABBREVIATIONS FOR UNITS OF MEASURE - ENGLISH SYSTEM OF UNITS (IP)
- 01 42 14 - INTERNATIONAL SYSTEM OF UNITS (SI) STANDARDS
- 01 42 15 - ABBREVIATIONS FOR UNITS OF MEASURE INTERNATIONAL SYSTEM OF UNITS (SI)
- 01 42 16 - DEFINITIONS
- 01 42 19 - REFERENCE STANDARDS
- 01 43 43 - COORDINATION DRAWINGS (GC)
- 01 45 23 - TESTS AND INSPECTIONS
- 01 50 00 - CONSTRUCTION FACILITIES, TEMPORARY CONTROLS AND UTILITIES
- 01 61 00 - ACCEPTABLE MANUFACTURERS AND PRODUCTS
- 01 71 21 - SPECIALTY ENGINEERING REQUIREMENTS
- 01 73 29 - CUTTING AND PATCHING
- 01 74 19 - CONSTRUCTION WASTE MANAGEMENT
- 01 74 23 - CLEANING
- 01 77 00 - CONTRACT CLOSEOUT (GC)
- 01 78 23 - OPERATION AND MAINTENANCE DATA
- 01 78 26 - INTERIOR FINISH FIRE PERFORMANCE DATA
- 01 78 36 - WARRANTIES AND GUARANTEES
- 01 78 39 - PROJECT RECORD DOCUMENTS
- 01 78 43 - SPARE PARTS, TOOLS AND MAINTENANCE MATERIALS
- 01 79 00 - SYSTEM DEMONSTRATIONS
- 01 81 21 - INDOOR AIR QUALITY MANAGEMENT (IAQ) DURING CONSTRUCTION
- 01 91 00 - GENERAL COMMISSIONING REQUIREMENTS
- 01 99 60 - ENERGY CONSERVATION CODE REVIEW

DIVISION 02 — EXISTING CONDITIONS

- 02 41 00 - DEMOLITION

DIVISION 03 — CONCRETE

- 03 05 00 - CONCRETE
- 03 08 13 - CONCRETE TESTING AND EVALUATION - OWNER
- 03 11 00 - CONCRETE FORMWORK
- 03 11 31 - VOID FORMS
- 03 20 00 - CONCRETE REINFORCING
- 03 31 00 - CONCRETE MATERIALS AND PROPORTIONING
- 03 31 10 - CONCRETE MIXING, PLACING, JOINTING, AND CURING
- 03 35 00 - CONCRETE FINISHING AND REPAIR OF SURFACE DEFECTS

DIVISION 04 — MASONRY

- 04 05 05 - COLD AND HOT WEATHER MASONRY PROCEDURES
- 04 05 10 - MASONRY CLEANING
- 04 05 13 - PORTLAND CEMENT - LIME MORTAR AND GROUT
- 04 05 23 - MASONRY ACCESSORIES
- 04 22 00 - CONCRETE MASONRY (CMU)

DIVISION 05 — METALS

- 05 12 10 - STRUCTURAL STEEL
- 05 21 10 - STEEL JOISTS
- 05 31 23 - METAL ROOF DECKING
- 05 36 00 - COMPOSITE METAL FORM DECK
- 05 45 23 - EQUIPMENT SUPPORT SYSTEM
- 05 50 10 - MISCELLANEOUS METAL FABRICATIONS

DIVISION 06 — WOOD, PLASTICS, AND COMPOSITES

- 06 10 53 - ROUGH CARPENTRY
- 06 20 00 - FINISH CARPENTRY

DIVISION 07 — THERMAL AND MOISTURE PROTECTION

- 07 16 04 - CONCRETE FLOOR MOISTURE TESTING
- 07 16 05 - WATER VAPOR EMISSION CONTROL SYSTEM
- 07 21 00 - BUILDING INSULATION
- 07 54 25 - FULLY ADHERED TPO ROOFING
- 07 62 00 - FLASHING AND SHEET METAL
- 07 72 13 - PREFABRICATED ROOF CURBING
- 07 81 23 - INTERIOR INTUMESCENT FIREPROOFING (IFP)
- 07 84 00 - FIRESTOPPING
- 07 92 13 - EXTERIOR JOINT SEALANTS
- 07 92 16 - INTERIOR JOINT SEALANTS

DIVISION 08 — OPENINGS

- 08 11 13 - HOLLOW METAL (HM) DOORS AND FRAMES
- 08 30 00 - FIRE AND SMOKE RATED CURTAINS WITH EGRESS
- 08 31 16 - ACCESS PANELS AND DOORS
- 08 33 24 - OVERHEAD COILING DOOR - SECURITY (CD-S)
- 08 33 30 - COILING FIRE AND EGRESS ASSEMBLY
- 08 71 00 - DOOR HARDWARE
- 08 81 23 - EXTERIOR GLASS AND GLAZING
- 08 81 26 - INTERIOR GLASS AND GLAZING
- 08 88 53 - SECURITY GLAZING

DIVISION 09 — FINISHES

- 09 06 10 - DCKL 4.3.19
- 09 22 16 - NON-STRUCTURAL METAL FRAMING
- 09 22 36 - METAL LATH
- 09 24 23 - PORTLAND CEMENT PLASTER (PC)
- 09 29 00 - GYPSUM WALLBOARD
- 09 30 00 - TILING

- 09 65 36 - STATIC DISSIPATIVE RESILIENT TILE FLOORING (SDRT)
- 09 67 14 - SEAMLESS URETHANE FLOORING (SUF)
- 09 67 81 - CONCRETE FLOOR SEALER (CFS)
- 09 91 13 - EXTERIOR PAINTING
- 09 91 23 - INTERIOR PAINTING

DIVISION 10 — SPECIALTIES

- 10 14 23 - SIGNS, SCHEDULE, AND GRAPHICS
- 10 26 00 - WALL PROTECTION SPECIALTIES
- 10 28 13 - TOILET AND BATH ACCESSORIES
- 10 44 00 - FIRE PROTECTION SPECIALTIES

DIVISION 11 — EQUIPMENT

- 11 13 16 - DOCK SEAL
- 11 13 19 - DOCK LEVELERS AND EQUIPMENT
- 11 19 00 - DETENTION EQUIPMENT
- 11 19 19 - TAMPER RESISTANT FASTENERS
- 11 40 00 - FOOD SERVICE EQUIPMENT

DIVISION 12 — FURNISHINGS

- 12 32 00 - ARCHITECTURAL CASEWORK
- 12 36 63 - SOLID SURFACE FABRICATIONS (SSF)

DIVISION 20 — GENERAL MECHANICAL

- 20 05 00 - SPECIAL MECHANICAL REQUIREMENTS
- 20 05 19 - PIPING SPECIALTIES
- 20 05 23 - MANUAL VALVES
- 20 05 29 - PENETRATIONS AND SUPPORTS
- 20 05 50 - MECHANICAL SOUND AND VIBRATION CONTROL
- 20 05 53 - MECHANICAL IDENTIFICATION SYSTEMS
- 20 05 93 - TESTING AND BALANCING
- 20 07 00 - PIPE, DUCT AND EQUIPMENT INSULATION
- 20 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

DIVISION 21 — FIRE SUPPRESSION

- 21 10 00 - FIRE PROTECTION SYSTEMS

DIVISION 22 — PLUMBING

- 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS
- 22 10 16 - PLUMBING PIPING
- 22 11 00 - WATER DISTRIBUTION SYSTEM
- 22 11 23 - PLUMBING PUMPS
- 22 13 00 - SANITARY SEWERS
- 22 14 00 - STORM DRAINAGE SYSTEM
- 22 31 16 - WATER SOFTENER
- 22 33 00 - DOMESTIC WATER HEATERS
- 22 42 00 - PLUMBING FIXTURES

DIVISION 23 — HEATING VENTILATING AND AIR CONDITIONING

- 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS
- 23 11 23 - NATURAL GAS PIPING SYSTEM
- 23 21 13 - HYDRONIC PIPING SYSTEMS
- 23 23 00 - REFRIGERANT PIPING SYSTEM
- 23 31 13 - AIR DISTRIBUTION SYSTEM
- 23 35 00 - EXHAUST AND VENTILATING FANS
- 23 36 00 - AIR TERMINAL UNITS
- 23 73 14 - KITCHEN MAKE UP AIR UNITS
- 23 74 14 - PACKAGED ROOFTOP AIR HANDLING UNITS
- 23 74 23 - PACKAGED OUTDOOR, HEATING - ONLY MAKEUP - AIR UNITS

23 81 29 - VARIABLE REFRIGERANT FLOW HVAC SYSTEM
23 82 43 - ELECTRIC HEATERS

DIVISION 25 — INTEGRATED AUTOMATION

25 50 00 - BUILDING MANAGEMENT AND CONTROL SYSTEM

DIVISION 26 — ELECTRICAL

26 00 10 - ELECTRICAL GENERAL REQUIREMENTS
26 00 11 - WIRING EQUIPMENT FURNISHED BY OTHERS
26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 33 - CONDUITS
26 05 34 - BOXES
26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS
26 09 23 - LIGHTING CONTROL DEVICES
26 22 13 - LOW VOLTAGE DISTRIBUTION TRANSFORMERS
26 24 16 - PANELBOARDS
26 27 26 - WIRING DEVICES
26 28 00 - OVERCURRENT PROTECTIVE DEVICES
26 28 16 - ENCLOSED SAFETY SWITCHES
26 41 13 - LIGHTNING PROTECTION SYSTEM
26 43 13 - SURGE PROTECTIVE DEVICES (SPD)
26 51 13 - BUILDING LIGHTING
26 56 00 - SITE LIGHTING

DIVISION 27 — COMMUNICATIONS

27 05 32 - WIRED TELECOMMUNICATION SYSTEMS

DIVISION 28 — ELECTRONIC SAFETY AND SECURITY

28 05 00 - BASIC MATERIALS & METHODS FOR ELECTRONIC SYSTEMS
28 05 05 - UNINTERRUPTIBLE POWER SUPPLY SYSTEMS
28 05 10 - DETENTION AREA INTERCOM SYSTEM
28 05 15 - DETENTION DOOR CONTROL SYSTEM
28 13 13 - CARD ACCESS CONTROL SYSTEM
28 23 13 - VIDEO SURVEILLANCE SYSTEM
28 31 00 - FIRE ALARM SYSTEM

DIVISION 31 — EARTHWORK

31 10 00 - SITE CLEARING
31 22 00 - SITE EXCAVATION AND ROUGH GRADING
31 22 19 - TOPSOILING AND FINISHED GRADING
31 23 33 - TRENCHING, BACKFILLING AND COMPACTING FOR UTILITIES
31 25 00 - SOIL EROSION AND SEDIMENTATION CONTROL
31 63 29 - DRILLED PIERS

DIVISION 32 — EXTERIOR IMPROVEMENTS

32 13 13 - CONCRETE PAVING AND CURBS
32 17 23 - PAVING STRIPING AND MARKING
32 31 14 - SECURITY CHAIN LINK FENCE AND GATES
32 31 15 - GATE OPERATOR - SLIDING
32 84 23 - IRRIGATION SYSTEM
32 92 23 - SODDING

DIVISION 33 — UTILITIES

33 10 00 - WATER DISTRIBUTION
33 31 00 - SANITARY SEWER
33 40 00 - STORM DRAINAGE



DIVISION 00

PROCUREMENT AND CONTRACTING
REQUIREMENTS



SECTION 00 01 09
PROJECT MANUAL - PREFACE
JAIL KITCHEN/LAUNDRY
RFP #19-2534

- A. The Project Manual is the volume usually assembled for the Work which may include the Procurement Requirements, Contracting Requirements, and Specifications.
- B. Project Manual: Volume or volumes which include but is not limited to four distinct parts:
 - 1. Introductory Requirements:
 - a. Located within Division 00.
 - b. Not part of the construction contract unless incorporated by reference in a contracting requirements document.
 - c. Not specifications.
 - 2. Procurement Requirements, instruct bidders about procedures for preparing and submitting their bids:
 - a. Located within Division 00.
 - b. Not part of the construction contract unless incorporated by reference in a contracting requirements document.
 - c. Not specifications.
 - 3. Contracting Requirements, General Conditions define processes, rights, responsibilities, and relationships of parties to the contract:
 - a. Located within Division 00.
 - b. Part of the construction contract.
 - c. Not specifications.
 - 4. Specifications (6 digit format), establish the quality levels of materials and systems required for the project:
 - a. Division 01, General Requirements
 - b. Division 02 - 19, Facility Construction
 - c. Division 20 - 29, Facility Services
 - d. Division 30 - 39, Site and Infrastructure
 - e. Division 40- 49, Process Equipment
- C. Project Manual is formatted based on guidelines established by the Construction Specifications Institute.
 - 1. Division:
 - a. Standard category of construction information.
 - b. Divisions form basic framework of project specification.
 - c. Division titles appear in table of contents of project manual.
 - 2. Section:
 - a. Individual sections dealing with Procurement Requirements, Contracting Requirements, and Specifications.
 - b. Sections are included in project manual as needed to meet requirements.
 - c. Section titles appear in table of contents of project manual.
 - 3. Part: Organizational device to divide specification section into three distinct groupings of related information.
 - a. PART 1 - GENERAL: Defines specific administrative and procedural requirements unique to the section.
 - b. PART 2 - PRODUCTS: Describes quality of items that are required for incorporation into project under the section.

- c. PART 3 - EXECUTION: Describes preparatory actions and how products are to be incorporated into project.
 - 4. Article: Major subject consisting of related paragraphs within part of specification section.
 - 5. Paragraph: One or more sentences, dealing with particular item or point, separated from preceding text by beginning on new line. Groups of paragraphs of related information constitute an article.
- D. Specification Language:
- 1. Basic grammatical moods of sentences can be used to clearly and concisely convey specification requirements.
 - 2. The simple imperative mood is method for instructions covering installation of products and equipment. The verb which clearly defines action becomes first word in the sentence. The imperative sentence is concise and readily understandable. Example: "a. Spread adhesive with notched trowel."
 - 3. Streamlining is used to list products, materials, reference standards, and other itemized specifications. This technique places subject first and hence provides key words for quick reference. Example: "a. Sealant: Silicone."
 - 4. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" shall be included by inference where colon (:) is used within sentences or phrases.
 - 5. In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an", but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.
- E. Definitions:
- 1. See Section 00 52 13.
 - 2. Definition of "Base" and "Optional" manufacturers: See Section 01 61 00.
 - 3. The terms bid, proposal, and offer shall be considered interchangeable and shall be defined as the response submitted to the formal solicitation.
 - 4. The terms bidder, proposer, and offeror shall be considered interchangeable and shall be defined as the firm, company, person, or entity who submits a response to the solicitation.

END OF SECTION

SECTION 00 11 19
ADVERTISEMENT
REQUEST FOR COMPETITIVE SEALED PROPOSALS
JAIL KITCHEN/LAUNDRY
RFP #19-2534

PART 1 - GENERAL

1.1 INVITATION

- A. Owner invites Competitive Sealed Proposals for Single-Prime Contract on general construction work to include work of all trades.
1. Project Title: Jail Kitchen/ Laundry
 2. Project Address: Denton County Law Enforcement Center
127 N. Woodrow, Denton, TX 76205

 3. Owner Name: Denton County Commissioners Court
Owner's Representative: DeWayne Snider, Construction Project Manager

 4. Architect: HDR
8750 N. Central Expressway
Dallas, Texas 75231
Phone 972 960 4000
Attention: John Hultberg

 5. Proposals shall be lump sum basis for general construction work to include work of all trades with funding to come from bond funds and tax notes.
 - a. Segregated proposals will not be accepted.

1.2 DESCRIPTION

- A. In general, Work consists of approximately 16,500 SF of new construction. The building consists of a Kitchen Addition of approximately 12,900 SF and a Laundry addition of approximately 3,500 SF

1.3 COMPLETION

- A. Completion of this work in timely manner is of the essence.
- B. Liquidated Damages in the amount of \$500.00 will be assessed for each calendar day beyond established Substantial Completion date that work is not Substantially Complete. If thirty (30) days after Substantial Completion of the Work the Contractor is unable to achieve Final Completion of the Project as determined by Denton County, liquidated damages will be assessed at \$1,000.00 per calendar day. See Section 9.11 Liquidated Damages of the Agreement of Construction for full description of liquidated damages.

1.4 PROPOSAL RECEIVING AND OPENING

- A. Sealed Proposal Receiving:
1. Proposal Receiving Date and Time: Thursday, July 18, 2019, no later than 2:00 pm.
 2. Proposal Receiving and Opening Location (either by mail or hand delivered):
 - a. Denton County Purchasing Department
401 W. Hickory, Suite 324
Denton, Texas 76201
940.349.3130
 3. Proposals are valid only if deposited at designated receiving location prior to receiving time.
 4. All proposals shall be registered by automatic time clock at time of deposit.

5. Proposals deposited after receiving time will be returned unopened.

1.5 OBTAINING PROPOSAL DOCUMENTS

- A. Plans, Specifications and Contract documents may be examined without charge at the Denton County Purchasing Department, 401 W. Hickory, Texas 76201. They may be obtained at Denton County's online portal [eBid DentonCounty](#).
- B. Bid documents may be purchased from ARC:
 - 1. ARC
4200 Spring Valley Drive
Farmer's Branch, Texas 75244
214.631.2800
Contact: Damon Bottorff
- C. Bidder shall have the option of purchasing a complete set of documents for \$750.00 or a Compact Disk with the documents on it from ARC for \$25.00.

1.6 PROPOSAL SECURITY

- A. Submit Proposal Security with Proposal Form in the amount of 5 percent of the maximum amount of Proposal Price payable without recourse to Denton County.

1.7 BONDS

- A. Successful Proposer shall submit Owner's Performance and Payment Bonds in amount of 100 percent of Contract amount on the forms provided in the specifications.

1.8 WITHDRAWAL

- A. Proposals may not be withdrawn prior to 90 calendar days after date of bids opening.

1.9 REJECTION OF PROPOSALS

- A. Owner reserves right to waive any informalities or to reject any or all Proposals.
- B. Owner further reserves right to reject any and all Proposals, and to re-advertise for Proposals.
- C. Owner reserves the right to reject any bid submitted by a Vendor owning delinquent property taxes to Denton County.

1.10 PRE-PROPOSAL CONFERENCE

- A. Pre-proposal conference will be held to review submittal procedures, review documents, and tour site.
 - 1. Location: Denton County Law Enforcement Center, Lobby Training Room; 127 N.Woodrow, Denton, TX 76205.
 - 2. Date: Tuesday July 9, 2019
 - 3. Time: 1:00 PM
- B. Any bidders desiring to participate in the walk through tour, are required to have a current photo ID or driver's license.
 - 1. No more than three representatives from each will be allowed tour.
 - 2. Cell phones may be returned to your vehicle (time will be allowed) or will be collected along with IDs and returned at the end of tour.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 00 21 16
INSTRUCTIONS TO PROPOSERS
JAIL KITCHEN/LAUNDRY
RFP #19-2534

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. In accordance with Government Code, Chapter 2269, Subchapter D, the Owner will select a contractor for the construction of this project through competitive sealed proposals. The project consists of all labor, supervision, materials, services and equipment required in conjunction with all work. The Owner will select such services in accordance with Section 2254.004 of the Government Code, and such services include inspection services, testing of construction materials engineering, and verification testing.
- B. The Architects estimate for this project is \$7,528,359.00 including Contingency Allowance for all work as described in the Drawings, Technical Specifications, and other Contract Documents prepared by the Architect.
- C. The estimated construction time for this project is 365 days.
- D. This Request of Competitive Sealed Proposal as advertised will be considered an inclusion of the specifications and conditions.
- E. The term "Owner" as used throughout these documents will mean Denton County Commissioners Court, Texas.
- F. Proposals will be submitted on the forms provided by Owner. All figures must be written in ink or typewritten. However, mistakes may be crossed out, corrections inserted adjacent thereto and initiated in ink by the person signing the proposal.
- G. Formal advertised proposals indicate date and time by which the proposals must be received in the Purchasing Department. Proposals received after that time will be returned unopened to the Offeror.
- H. The Offeror will note any exceptions to the conditions of this request for proposal. If no exceptions are stated, it will be understood that all general and specific conditions will be complied with, without exception.
- I. Offerors may request withdrawal of a posted sealed proposal prior to the scheduled opening time, provided the request for withdrawal is submitted to the Purchasing Division in writing. Owner reserves the right to reject any and all proposals by reason of this request.
- J. In the event there are inconsistencies between the general provisions and other terms or conditions contained herein, the former will take precedence.
- K. If it becomes necessary to revise any part of this request for proposal, a written addendum will be issued and posted on Denton County's online portal [eBid DentonCounty](#). Owner is not bound by any oral representations, clarifications, or changes made in the written specifications by Owner's employees, unless such clarification of change is provided to offerors in written addendum form from the Owner or Architect.
- L. All proposals will be awarded to the offeror that offers the best value for the Owner based on the published selection criteria contained herein.

- M. It is agreed that the successful offeror will not assign, transfer, convey or otherwise dispose of the contract or its right, title or interest in or to the same, or any part thereof, without previous written consent of Owner and any sureties.
- N. When an original and copies are required, if there are discrepancies between the original proposal and copies, the original proposal will prevail.
- O. Owner is exempt from State Retail Tax and Federal Excise Tax. The price proposed must be net, exclusive of taxes.
- P. All offerors will comply with all Federal, State, and local laws relative to conducting business in the Denton County. The laws of the State of Texas will govern as to the interpretation, validity, and effect of this proposal, its award and any contract entered into.
- Q. The successful offeror agrees by entering into this contract, to defend, indemnify and hold Owner harmless from any and all causes of action or claims of damages arising out of or related to offeror's performance under this contract.
- R. Advanced disclosures of any information to any particular offeror which gives that particular offeror any advantage over any other interested offeror in advance of the opening of proposal, whether in response to advertising or an informal request for proposal, made or permitted by a member of the governing body or an employee or representative thereof, will operate to void all proposals of that particular solicitation or request.
- S. Minority business enterprises will be afforded full opportunity to submit proposals in response to this invitation and will not be discriminated against on the grounds of race, color, creed, sex, or national origin in consideration for an award.
- T. The tentative schedule for this Request for Proposal is as follows:
 - Release RFP to Vendors – 6/28/2019
 - Advertisement Dates – 6/30 and 7/7/2019
 - Pre-Proposal Conference – 7/9/2019
 - Deadline for Questions and Substitutions – 7/11/2019
 - Proposal Submission Deadline – 7/18/2019
 - Last day to evaluate and rank proposals (45 days per statute) – 9/1/2019

1.2 EXAMINATION OF CONTRACT DOCUMENTS AND SITE

- A. It is the responsibility of each Offeror before submitting a Proposal, to:
 - 1. examine the Contract Documents thoroughly,
 - 2. visit the site to become familiar with local conditions that may affect cost, progress, performance or furnishing of the Work,
 - 3. consider federal, state and local Laws and Regulations that may affect cost, progress, performance or furnishing of the Work,
 - 4. study and carefully correlate Offeror's observations with the Contract Documents, and
 - 5. notify Owner's Representative of all conflicts, errors or discrepancies in the Contract Documents. The owner must be notified by the deadline for Questions and Substitutions,
 - 6. visit with local utilities, including cable companies, and other entities that may have underground or above-ground infrastructure in the work area for infrastructure location.
- B. The submission of a proposal will constitute an incontrovertible representation by Offeror that Offeror has complied with every requirement of this section, that without exception the proposal is premised upon performing and furnishing the Work required by the Contract Documents and such means, methods, techniques, sequences or procedures of construction as may be indicated in or required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work. No pleas of ignorance of conditions that may be encountered in their execution of the Work under this contract, that is a result of

failure to make the necessary examinations and investigations herein above indicated, will be accepted as an excuse for the failure or omission on the part of the Contractor to fulfill in every detail all the requirements of the Contract Documents. In no event shall a claim for extra compensation or for an extension of time be allowed for failure to thoroughly examine all requirements of Contract Documents.

1.3 QUALIFICATION OF OFFERORS

- A. To demonstrate qualifications to perform the Work, each Offeror must submit all required documentation with your proposal submittal including, but not limited to, financial data, previous experience, present commitments and other such data as may be called for in the RFP. Each proposal must contain evidence of the Offeror's qualifications to do business in the State of Texas or covenant to obtain such qualifications prior to award of the contract. In determining an Offeror's qualifications, the evaluation factors had been identified herein. Each offeror may be required to show that he has properly completed similar type work and that no claims are now pending against such work. No proposal will be accepted from any offeror who is engaged in any work that would impair his ability to fully execute, perform or finance this work.

1.4 RECEIPT AND OPENING OF PROPOSALS

- A. Denton County Commissioners Court (herein called the "Owner"), invites proposals for construction.
- B. Proposals will be received at place and time indicated in Advertisement for Competitive Sealed Proposals.
- C. Proposals received late will not be opened.
- D. Properly prepared proposals will be opened publicly and read aloud. A summary of the amounts of the base Proposal Price and major alternates (if any) will be made available and read aloud to Offerors after the opening of proposals. All other information contained in the proposals will not be disclosed until after the award of the contract. A tabulation of the Proposal Prices which are read will be available upon request as soon as it has been assembled and verified.
- E. The Owner considers all proposal information, documentation and supporting materials submitted in response to this Request for Proposal to be non-confidential and/or non-proprietary in nature, and therefore, shall be subject to public disclosure under the Texas Public Information Act (*Texas Government Code*, Sec. 552.001, et seq.) after the award of the contract except for trade secrets and confidential information which the Offeror identifies as proprietary. Any material that is to be considered as CONFIDENTIAL/PROPRIETARY in nature must be clearly marked on each applicable page as such by the proposer. Marking your entire proposal CONFIDENTIAL /PROPRIETARY is not in conformance with the Texas Public Information Act.
- F. All required documents and form(s) shall be submitted by the time and place indicated in the Advertisement. One (1) *unbound* original shall be enclosed in an opaque sealed envelope, marked with the project title, name and address of the Offeror. The Proposal shall be accompanied by the Proposal Security (Bid Bond) and other required documents. If the proposal is sent through the mail or other delivery system the sealed envelope shall be enclosed in a separate envelope with the notation "PROPOSAL ENCLOSED" on the face of it. Each Offeror should, prior to submitting his proposal, check the receipt of all Addenda or letters of clarification issued and acknowledge such receipt on the outside of the envelope containing his Proposal.

1.5 METHOD OF SUBMISSION

- A. Owner invites proposals on general construction work to include work of all trades.

- B. Throughout Request for Proposal (RFP) documents including instructions to proposers, specifications, contract documents and plans, any reference to bid is interchangeable with proposal for the satisfaction of response to this solicitation as a proposal. In accordance with Government Code, Chapter 2269, Subchapter D, Denton County will select a contractor for the construction of this project through competitive sealed proposals. The project consists of all labor, supervision, materials, services and equipment required in conjunction with all work. The Owner will select such services in accordance with Section 2254.004 of the Government Code, and such services include inspection services, testing of construction materials engineering, and verification testing.
- C. See Proposal Form for specific requirements regarding proposals and cost breakdown.

1.6 PREPARATION OF PROPOSAL

- A. Submit on forms furnished herein.
- B. Fill out in ink or typewritten, without erasure, interlineation or changes.
- C. Make Proposal in name of principal and if co-partnership, give names of all parties.
- D. Give offeror's complete address.
- E. If Proposals are submitted by an agent, provide satisfactory evidence of agency authority.
- F. If blank is available on Proposal Form, indicate number of consecutive calendar days for construction Substantial Completion of Work.
- G. Fill in all proposal prices in both words and figures.
- H. In case of inconsistency between portions of Proposal Documents or within Proposal Documents; propose and provide better quality or greater quantity of Work. Bring all inconsistencies to Architect's attention, prior to submission of proposal, for Architect's interpretation.
- I. Submit proposal in sealed envelope.
- J. Indicate on outside of envelope, name of offeror, offeror's address, and name of Project for which proposal is submitted.
- K. If forwarded by mail, enclose sealed envelope containing Proposal Form in another envelope addressed as indicated.
- L. One (1) original of your firm's proposal should be submitted. The original proposal should be submitted in a single unbound volume separated by and tabbed by section. The tabs should identify the sections by name rather than simply a number or alphabet.
- M. There is no express or implied obligation for the Owner to reimburse Offerors for any expense incurred in preparing proposals in response to this RFP and the Owner will not reimburse responding offerors for these expenses, nor will the Owner pay any subsequent costs associated with the provision of any additional information or presentation, or to procure a contract for these services.
- N. All forms and requested information must be filled out and submitted with the Proposal for consideration. Failure to include completed information as requested may result in the rejection of the Proposal. Besides the Proposal Form and Proposal Security (Bid Bond), submit the following Forms:
 - I. Contractor Background and Qualifications
 - II. Contractor's Safety Record
 - III. Contractor's Quality Control Program

- IV. References
 - V. Contractor's Bonding and Financial Resources
 - VI. Relevant Work Experience
 - VII. Organizational plan and Approach
 - VIII. Provision for Required Disciplines and Skills
 - IX. Contractor's Cost Reduction Suggestions
- O. If the Form(s) do not provide sufficient space to adequately respond to a question, the Offeror should attach additional sheets as necessary, referencing the page and question numbers to which the response pertains. A proposal showing omissions, alterations, conditions, exceptions or other qualifiers which modify the Proposal Form(s) may be rejected as irregular.

1.7 PROPOSAL SECURITY

- A. Offerors must submit with their Proposal a proposal security (bid bond) in the amount of five (5%) percent of the maximum amount of Proposal Price payable without recourse to the Owner, from a surety company holding permit from the State of Texas to act as a surety, as a guarantee that Offeror will enter into a contract and execute bond and guarantee forms within ten (10) days after notice of award of contract. Proposals without acceptable proposal security (bid bond), as stated above, may not be considered.
- B. Proposal Security shall be in effect from the opening of the Proposal and will be retained until an Offeror has executed the Construction Agreement and furnished the required contract security or more than ninety (90) calendar days from the date of opening of the Proposal have lapsed. All Proposals are irrevocable and cannot be withdrawn for ninety (90) calendar days following the date scheduled for the opening of the Proposals.
- C. The Bid Security of the Successful Offeror will be retained until such Offeror has executed the Construction Agreement and furnished the required contract security, whereupon the Proposal Security will be returned. If the Successful Offeror fails to execute and deliver the Construction Agreement and furnish the required contract security within ten (10) days after the Notice of Award, Owner may annul the Notice of Award and the Proposal Security of that Offeror will be forfeited. The Proposal Security of other Offerors whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until 5 days after the Construction Agreement is executed.

1.8 WITHDRAWAL OR REVISION OF PROPOSAL

- A. Proposals may be modified or withdrawn by an appropriate document duly executed, in the described manner that a proposal must be executed, and delivered to the place where proposals are to be submitted at any time prior to the opening of proposals.

1.9 IRREGULAR PROPOSAL

- A. Bid is considered irregular and may be rejected for following reasons unless otherwise provided by law:
 - 1. If Proposal Form furnished is not used or is altered.
 - 2. If there are unauthorized additions, conditional offers, or irregularities of any kind which may tend to make proposal incomplete, indefinite, or ambiguous.
 - 3. If offeror adds any provisions reserving right to accept or reject any award, or to enter into contract pursuant to an award.
 - 4. If unit or lump sum prices contained in proposal schedule are obviously unbalanced either in excess of, or below, reasonable cost analysis values.
 - 5. If offeror fails to insert Unit Prices for every such item indicated.
 - 6. If offeror fails to complete Proposal Form and/or Qualification Documents where information is requested, so proposal may be properly evaluated.
 - 7. Failure to submit Proposal Security (Bid Bond).

- B. Owner reserves right to reject any or all proposals and to waive irregularities or informalities as may be in Owner's interest.
- C. Offerors may be disqualified and rejection of proposals may be recommended to the Owner for any (but not limited to) of the following causes: 1) Evidence of collusion among proposers; 2) Lack of appropriate qualifications and experience relative to the size and scope of the work proposed; 3) Unsatisfactory performance; or 4) Failure to complete projects.

1.10 INTERPRETATIONS AND ADDENDA

- A. All questions shall be posted to Denton County's on-line bidding system, [eBid DentonCounty](#), by the stated deadline. Proposers are responsible for ensuring all answers to questions are reviewed prior to proposal submittal. Answers provided to posted questions address minor irregularities and are for clarification purposes only and do not revise or modify the specification requirements. Answers to questions that result in revisions to the specifications will be addressed by Addendum. No oral statement of any person shall modify or otherwise change, or affect the specifications.
- B. Proposer submitting request is responsible for prompt delivery of such requests.
- C. No oral interpretations will be made.
- D. Owner or Architect is not responsible for any other explanations or interpretations which anyone presumes to make.
- E. Interpretations or supplemental instructions will be in form of written addenda or clarification.
- F. Any addenda issued during the time allowed for the preparation of proposals shall be covered in the proposal and, in executing the contract; they shall become a part thereof. Failure of a Proposer to receive any addendum shall not release the Proposer from any obligations under his proposal, provided said addendum was posted and distributed by Denton County's online portal [eBid DentonCounty](#). Offerors are responsible for ensuring all addenda are reviewed prior to proposal submittal. All addenda will be issued through and can be reviewed at Denton County's online portal [eBid DentonCounty](#). Identify the receipt of any Addenda on the Proposal Form, Section 00 42 16.
- G. Failure to receive such addendum does not relieve offeror from any obligation under proposal as submitted.
- H. Proposer desiring approval of material or equipment not specified must comply with Section 00 26 00.

1.11 BASE OFFER

- A. General: Proposal must include Base Offer.
- B. In event Alternate does not affect proposer's work, enter "No Change."
- C. Absence of any entry will be assumed to indicate zero price or time change.

1.12 CONTINGENCY ALLOWANCE

- A. Base Offer must include Contingency Allowance.
- B. Description of Contingency Allowance: See Section 01 21 16.

1.13 ALTERNATES

- A. Order of Alternates: Owner reserves right to accept any or all Alternates.
- B. Description of Alternates: See Section 01 23 00.

1.14 METHOD OF AWARD

- A. Proposals will be opened publicly to identify the names of the Offerors and their respective proposed contract amount and contract time. Other contents of the proposals will not be disclosed prior to award or rejection by Owner.
- B. Proposals will be evaluated by the Owner in consultation with the Architect. The Offeror understands and must agree that if a contract is awarded, it will be awarded to the Offeror submitting the best value to the Owner. The Owner is not bound to accept the lowest priced Proposal if that Proposal is judged not to be the best value for the Owner, as solely determined by the Owner. The weighted criteria for evaluation and selection of the successful Offeror for this award will be based upon the factors listed below:
- 60 % Proposed construction contract amount
 - 20 % Firm's Experience & Qualifications
 - Background and Qualifications
 - Safety Record
 - References
 - Bonding and Financial Resources
 - Relevant experience with projects in similar size and scope
 - 15 % Staffing Plan
 - Organizational Plan and Approach
 - Provisions for Required Disciplines and Skills
 - 5 % Contractor's Proposed Schedule to Completion
- C. After opening the proposals and within forty-five (45) days of the opening, the Owner will evaluate and rank each proposal with respect to the published selection criteria described under this Section. After opening, the evaluation committee shall complete an initial evaluation and rank the firms on the basis of the initially submitted proposal, or the Owner may request clarifications from any or all of the firms. The Owner shall select the offeror that submits the proposal that offers the best value based on the weighted selection criteria and the ranking evaluation. Other than the data read at the public opening, the Owner shall not disclose any information derived from the proposals submitted by competing Offerors in conducting such discussions.
- D. If the Owner determines that it is unable to reach a satisfactory agreement with the first ranked Offeror, the Owner will formally, and in writing, terminate discussions with that Offeror and proceed to the next Offeror in the order of the selection ranking until a contract can be negotiated or all proposals are rejected.
- E. Owner reserves the right to reject any and all proposals, to waive any and all informalities and irregularities and to negotiate contract terms with the Successful Offeror, and the right to disregard all non-conforming, non-responsive, unbalanced or conditional offers. Also, Owner reserves the right to reject the proposal of any Offeror if Owner believes that it would not be in the best interest of the Project to make an award to that Offeror, whether because the proposal is not responsive or the Offeror is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by Owner. Discrepancies in the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.
- F. In evaluating proposals, Owner will consider the qualifications of the Offerors, whether or not the proposals comply with the prescribed requirements, time of construction, and such alternates, unit prices and other data, as may be requested in the Proposal Form or prior to the Notice of Award.

- G. Owner may consider the qualifications and experience of subcontractors, suppliers, and other persons and organizations proposed for those portions of the Work as to which the identity of subcontractors, suppliers, and other persons and organizations must be submitted as provided. Owner may also consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.
- H. Owner may conduct such investigations as Owner deems necessary to assist in the evaluation of any proposal and to establish the responsibility, qualifications and financial ability of Offerors, proposed subcontractors, suppliers and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.
- I. If the contract is to be awarded, Owner will give the Successful Offeror a Notice of Award within 45 days after the day of the proposal opening.

1.15 PRE-PROPOSAL CONFERENCE

- A. Pre-proposal conference will be held to review proposal procedures, review documents, and tour site. This meeting is not mandatory, but attendance is highly recommended. Immediately following the meeting, a site tour will be conducted. Representatives of the Owner and Architect will be present to discuss the project and proposal documents. Offerors are highly encouraged to attend and participate in the conference.
 - 1. Location: Denton County Law Enforcement Center, Lobby Training Room; 127 N. Woodrow, Denton, TX 76205
 - 2. Date: Tuesday, July 9, 2019
 - 3. Time: 1:00 PM

1.16 DISCLOSURE OF CERTAIN RELATIONSHIPS

- A. Chapter 176 of the Texas Local Government Code requires that any vendor or person considering doing business with a local government entity disclose in the Questionnaire Form CIQ, the vendor or person's affiliation or business relationship that might cause a conflict of interest with a local government entity. By law, this questionnaire must be filed with the records administrator of Denton County no later than the 7th business day after the date the person becomes aware of facts that require the statement to be filed. See Section 176.006, Local Government Code. A person commits an offense if the person violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor.

A copy of the new law is available at <http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm>

The forms for reporting are available at <http://www.ethics.state.tx.us/forms/CIQ.pdf>.

By submitting a response to this request, the vendor represents that it is in compliance with the requirements of Chapter 176 of the Texas Local Government Code. If required, send completed forms to the Denton County Clerk's Office located at 1450 E. McKinney, Suite 1103, Denton, TX 76209-4524.

1.17 DISCLOSURE OF INTERESTED PARTIES:

- A. In compliance with Section 2252.908 of the Texas Government Code, Denton County Commissioners Court may not enter into a contract with a business entity as a result of acceptance or award of this solicitation unless the business entity submits a disclosure of interested parties form as required by this statute. Notification will be given to the business entity recommended for award upon which the business entity will be required to submit the completed form prior to award.

A copy of this law is available at <http://www.statutes.legis.state.tx.us/Docs/GV/htm/GV.2252.htm>. The on-line form is available at https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm. *The Definitions are included in Chapter 46, Ethics Commission Rules: <https://www.ethics.state.tx.us/tec/1295-Info.htm>.*

1.18 PROHIBITION OF CONTRACT WITH CERTAIN COMPANIES:

- A. Vendors/Contractors/Providers must be in compliance with the provisions of §2252.152 and §2252.153 of the Texas Government Code, which states in part, contracts with companies engaged in business with Iran, Sudan, or Foreign Terrorist Organizations are prohibited. A governmental entity may not enter into a contract with any company listed on the Comptroller of the State of Texas website identified under Section 806.051 or Section 2253.253, which do business with Iran, Sudan or any Foreign Terrorist Organization. By submitting a response to this solicitation, contractor verified to Denton County that it is not on any such list.

1.19 CHAPTER 2270 VERIFICATION:

- A. Denton County is legally prohibited from contracting for goods and services unless the contract contains written verification from the contractor that it does not, and will not during the term of the contract boycott Israel as described in Texas Government Code §808.001(1). By submitting a response to this solicitation, the respondent is affirming compliance with Chapter 2270 of the Texas Government Code.

1.20 HISTORICALLY UNDERUTILIZED BUSINESS (HUB) CONTRACTING:

- A. The goal of Denton County is to ensure all HUBs, as described in the Texas Government Code, Title 10 Subtitle D, Chapter 2161, have maximum opportunities to participate in the County's procurement in awarding of contracts and subcontracts.
- B. Denton County will make a good faith effort to increase contract awards for the purchase of goods or services from the HUBs. HUB vendors are encouraged to participate in the county's purchasing and solicitation process. While the County is oriented to adhere to good faith efforts, nothing in this effort shall be construed to establish set-asides or mandatory quotas. The County and all prime contractors (if subcontracts are to be let) will take the affirmative steps listed below:
1. Placing qualified small and minority businesses and women's business enterprises on solicitation lists.
 2. Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources.
 3. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority business, and women's business.
 4. Establishing delivery schedules, where the requirements permit, which encourage participation by small and minority business, and women's business enterprises.
- C. Using the services and assistance of the Small Business Administration, the Minority Business Development Agency of the Department of Commerce and the Texas Procurement and Support Services (TPASS) Centralized Master Bidders List HUB Directory

1.21 PREVAILING WAGE RATES

- A. The following information from Chapter 2258 Texas Government Code Title 10 requires state agencies, cities, counties, independent school districts, and all other political subdivisions that engage in construction projects using public funds to include prevailing wage rate in the project proposal documents and the construction contract.

2258.021 Duty of Governmental Entity to Pay Prevailing Wage Rates

(a) The state or any political subdivision of the state shall pay a worker employed by it or on behalf of it:

- (1) not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed; and
- (2) not less than the general prevailing rate of per diem wages for legal holiday and overtime work

(b) Subsection (a) does not apply to maintenance work.

(c) A worker is employed on a public work for the purposes of this section if the worker is employed by a contractor or subcontractor in the execution of a contract for the public work with the state, a political subdivision of the state, or any officer or public body of the state or a political subdivision of the state.

2258.023 Prevailing Wage Rates to be Paid by Contractor and Subcontractor; Penalty

(a) The contractor who is awarded a contract by a public body or a subcontractor of the contractor shall pay not less than the rates determined under Section 2258.022 to a worker employed by it in the execution of the contract.

(b) A contractor or subcontractor who violates this section shall pay to the state or a political subdivision of the state on whose behalf the contract is made, \$60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body awarding a contract shall specify this penalty in the contract.

(c) A contractor or subcontractor does not violate this section if a public body awarding a contract does not determine the prevailing wage rates and specify the rates in the contract as provided by Section 2258.022.

(d) The public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.

(e) A municipality is entitled to collect a penalty under this section only if the municipality has a population of more than 10,000.

2258.051 Duty of Public Body to Hear Complaints and Withhold Payment

A public body awarding a contract,, and an agent or officer of the public body, shall:

- (1) take cognizance of complaints of all violations of this chapter committed in the execution of the contract; and
- (2) withhold money forfeited or required to be withheld under this chapter from the payments to the contractor under the contract, except that the public body may not withhold money from other than the final payment without determination by the public body that there is good cause to believe that the contractor has violated this chapter.

B. Current prevailing wage rates are incorporated in the contract documents as attached.

1.22 INSURANCE

A. Insurance requirements are incorporated in the Agreement for Construction, Article 11.

1.23 PAYMENT AND PERFORMANCE BONDS

A. Payment and Performance Bonds will be required in the amount of 100% of the contract amount by the successful proposer. Bonds must be completed on the forms included herein and incorporated in the contract documents. Not later than ten (10) days from and after date on which the award of the solicitation is made by the Owner; Contractor shall execute, as Principal, bonds joined in by a Surety Company, of the Contractor's choice, on form satisfactory to Owner, generally referred to as a "Performance Bond" and a "Labor and Material Payment Bond", each in a penal sum equal to 100% of the Contract Sum. Bond form shall be compatible with provisions of governing authorities. Contractor shall file bonds with the Owner. Surety Company executing bonds shall be acceptable to Owner and shall be authorized to do business in the State of Texas. Surety Company shall list the address and phone number of the home office of its' principal place of business. Surety shall also provide the name, address and phone number of the local Agent issuing the bonds.

1.24 DEBARMENT

- A. Contractor certifies that at the time of submission of its proposal, Contractor was not on the federal government's list of suspended, ineligible or debarred contractors and that Contractor has not been placed on this list between the time of its proposal submission and the time of execution of the Contract. If Contractor is placed on this list during the term of the Contract, Contractor shall notify the Denton County Director of Purchasing. False certification or failure to notify may result in termination of the Contract for default.

PRODUCTS - NOT USED

PART 2 - EXECUTION - NOT USED

END OF SECTION

SECTION 00 21 16.1
PREVAILING WAGE RATES
JAIL KITCHEN/LAUNDRY
RFP#19-2534

General Decision Number: TX190243 02/08/2019 TX243

Superseded General Decision Number: TX20180293

State: Texas

Construction Type: Building

County: Denton County in Texas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.60 for calendar year 2019 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.60 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2019. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

HDR Project No. 10105890

Denton County
Kitchen & Laundry Addition
PREVAILING WAGE RATES

June 14, 2019
Bidding Documents

JAIL KITCHEN/LAUNDRY
RFP#19-2534

Modification Number Publication Date

0 01/04/2019
 1 02/08/2019

ASBE0021-011 06/01/2016

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Duct, Pipe and Mechanical System Insulation)....	\$ 24.32	7.52

 BOIL0074-003 01/01/2017

	Rates	Fringes
BOILERMAKER.....	\$ 28.00	22.35

 CARP1421-002 04/01/2016

	Rates	Fringes
MILLWRIGHT.....	\$ 26.60	8.65

 * ELEV0021-006 01/01/2019

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 41.24	33.705

FOOTNOTES:

A. 6% under 5 years based on regular hourly rate for all hours worked. 8% over 5 years based on regular hourly rate for all hours worked.

B. New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and Veterans Day.

 ENGI0178-005 06/01/2014

	Rates	Fringes
--	-------	---------

POWER EQUIPMENT OPERATOR

(1) Tower Crane.....	\$ 29.00	10.60
(2) Cranes with Pile Driving or Caisson Attachment and Hydraulic Crane 60 tons and above.....	\$ 28.75	10.60
(3) Hydraulic cranes 59 Tons and under.....	\$ 27.50	10.60

IRON0263-005 06/01/2017

Rates Fringes

IRONWORKER (ORNAMENTAL AND STRUCTURAL).....	\$ 23.25	7.32
--	----------	------

PLUM0100-008 11/01/2017

Rates Fringes

HVAC MECHANIC (HVAC Unit Installation Only).....	\$ 30.84	11.51
---	----------	-------

SUTX2014-019 07/21/2014

Rates Fringes

BRICKLAYER.....	\$ 19.89	0.00
CARPENTER, Excludes Drywall Hanging, Form Work, and Metal Stud Installation.....	\$ 19.25	0.00
CAULKER.....	\$ 16.63	0.00
CEMENT MASON/CONCRETE FINISHER...	\$ 12.93	0.00
DRYWALL HANGER AND METAL STUD INSTALLER.....	\$ 15.42	0.00
ELECTRICIAN (Alarm Installation Only).....	\$ 18.83	3.32
ELECTRICIAN (Communication Technician Only).....	\$ 19.98	3.64

HDR Project No. 10105890

Denton County
Kitchen & Laundry Addition
PREVAILING WAGE RATES

June 14, 2019
Bidding Documents

JAIL KITCHENLAUNDRY
RFP#19-2534

ELECTRICIAN (Low Voltage Wiring Only).....	\$ 15.80	2.18
ELECTRICIAN, Excludes Low Voltage Wiring and Installation of Alarms/Sound and Communication Systems.....	\$ 18.82	0.83
FORM WORKER.....	\$ 12.13	0.00
GLAZIER.....	\$ 16.55	3.13
HIGHWAY/PARKING LOT STRIPING: Operator (Striping Machine).....	\$ 10.04	2.31
INSTALLER - SIDING (METAL/ALUMINUM/VINYL).....	\$ 14.74	0.00
INSTALLER - SIGN.....	\$ 15.61	0.00
INSULATOR - BATT.....	\$ 13.00	0.00
IRONWORKER, REINFORCING.....	\$ 14.02	0.00
LABORER: Common or General.....	\$ 11.76	0.00
LABORER: Mason Tender - Brick...	\$ 10.54	0.00
LABORER: Mason Tender - Cement/Concrete.....	\$ 10.75	0.00
LABORER: Pipelayer.....	\$ 13.00	0.35
LABORER: Plaster Tender.....	\$ 12.22	0.00
LABORER: Roof Tearoff.....	\$ 11.28	0.00
LABORER: Landscape and Irrigation.....	\$ 12.50	0.48
LATHER.....	\$ 16.00	0.00
OPERATOR: Backhoe/Excavator/Trackhoe.....	\$ 12.83	0.00

HDR Project No. 10105890

Denton County
Kitchen & Laundry Addition
PREVAILING WAGE RATES

June 14, 2019
Bidding Documents

JAIL KITCHENLAUNDRY
RFP#19-2534

OPERATOR: Bobcat/Skid Steer/Skid Loader.....	\$ 13.93	0.00
OPERATOR: Bulldozer.....	\$ 18.29	1.31
OPERATOR: Drill.....	\$ 15.69	0.50
OPERATOR: Forklift.....	\$ 13.21	0.81
OPERATOR: Grader/Blade.....	\$ 12.48	0.00
OPERATOR: Loader.....	\$ 13.46	0.85
OPERATOR: Mechanic.....	\$ 17.52	3.33
OPERATOR: Paver (Asphalt, Aggregate, and Concrete).....	\$ 18.44	0.00
OPERATOR: Roller.....	\$ 15.04	0.00
PAINTER (Brush, Roller and Spray), Excludes Drywall Finishing/Taping.....	\$ 13.21	2.33
PAINTER: Drywall Finishing/Taping Only.....	\$ 13.76	2.84
PIPEFITTER, Excludes HVAC Pipe Installation.....	\$ 22.98	6.35
PLASTERER.....	\$ 15.75	0.00
PLUMBER (HVAC Pipe Installation Only).....	\$ 22.16	5.46
PLUMBER, Excludes HVAC Pipe Installation.....	\$ 20.84	4.74
ROOFER.....	\$ 17.19	0.00
SHEET METAL WORKER (HVAC Duct Installation Only).....	\$ 20.88	5.19

SHEET METAL WORKER, Excludes

HDR Project No. 10105890

Denton County
Kitchen & Laundry Addition
PREVAILING WAGE RATES

June 14, 2019
Bidding Documents

JAIL KITCHENLAUNDRY
RFP#19-2534

HVAC Duct Installation.....	\$ 24.88	5.97
SPRINKLER FITTER (Fire Sprinklers).....	\$ 22.94	0.00
TILE FINISHER.....	\$ 11.22	0.00
TILE SETTER.....	\$ 14.25	0.00
TRUCK DRIVER: 1/Single Axle Truck.....	\$ 16.40	0.81
TRUCK DRIVER: Dump Truck.....	\$ 12.39	1.18
TRUCK DRIVER: Flatbed Truck.....	\$ 19.65	8.57
TRUCK DRIVER: Semi-Trailer Truck.....	\$ 12.50	0.00
TRUCK DRIVER: Water Truck.....	\$ 12.00	4.11

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

=====

=

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that

classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests

for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

=====

=

END OF GENERAL DECISION
END OF SECTION

HDR Project No. 10105890

JAIL KITCHENLAUNDRY
RFP#19-2534

Denton County
Kitchen & Laundry Addition
PREVAILING WAGE RATES

June 14, 2019
Bidding Documents

SECTION 00 26 00
SUBSTITUTIONS PRIOR TO PROPOSAL SUBMISSION
JAIL KITCHEN/LAUNDRY
RFP #19-2534

PART 1 - GENERAL

1.1 DEFINITION

- A. Acceptable Manufacturers and Products: See Section 01 61 00.
- B. This Section includes administrative and procedural requirements for handling requests for substitutions made prior to submission of proposal.
- C. Any product proposed by Contractor which does not meet requirements of the Contract Documents, whether in product characteristics, performance, quality, or manufacturer or brand names, is considered a substitution.
- D. In case of non-availability of materials contact Architect for review and action.
- E. For proposal purposes; base all offers on materials, equipment and procedures specified or approved by Addenda.

1.2 SUBSTITUTION PRIOR TO SUBMISSION OF PROPOSAL REQUEST

- A. Submit complete data substantiating compliance of proposed substitution with Contract Documents.
- B. For products and systems:
 - 1. Product identification, including manufacturer's name.
 - 2. Manufacturer's literature, marked to indicate specific model, type, size, and options to be considered:
 - a. Product description.
 - b. Performance and test data.
 - c. Reference standards.
 - d. Difference in power demand, air quantities, etc.
 - e. Dimensional differences from specified unit.
 - 3. Samples:
 - a. Architect reserves right to retain sample until physical units are installed on project for comparison purposes.
 - b. Requester pay all costs of furnishing and return of samples.
 - c. Architect is not responsible for loss of or damage to samples.
 - 4. Name and address of at least five similar projects that proposed product has been in use for at least four years, and name and phone number of owner's and architect's or engineer's representative, which Owner or Architect can contact to discuss; product, installation, and field performance data.
 - 5. Environmental Criteria: Provide the following additional information where environmental requirements are specified and when they apply to proposed substitutions, or where Contractor is proposing alternative products or systems which due to environmental aspects will improve project.
 - a. VOC Content: Comply with specified requirements for VOCs and indicate VOC content. Owner, in consultation with Architect reserve right to reject proposed substitutions where data for VOCs is not provided or where emissions of individual VOCs are higher than for specified materials.

- b. Recycled Content: Indicate recycled content for specified product and proposed substitution.
 - c. Local/Regional: Indicate final point of manufacture for specified product and proposed substitution.
 - d. Energy Efficiency: Indicate energy efficiency for specified equipment and proposed substitution.
 - e. Life-Cycle Cost: Include life cycle cost savings by product, system or assembly recommended if applicable.
- C. For construction methods:
 - 1. Detailed description of proposed method.
 - 2. Illustrate with drawings.
 - D. Itemized comparison of proposed substitute to specified item; indicate variations.
 - E. Effect and changes required on other trades, subcontractors or contracts.
 - F. Data related to change in construction time.
 - G. Cost of proposed substitution in comparison with product, system or method specified.
 - H. Availability of maintenance and repair services, and sources of repair or replacement items.
 - I. Warranty comparison with specified product or system.

1.3 PRODUCT SELECTION – GENERAL

- A. Certain types of products are described in Project Manual by means of trade names, catalog numbers and/or manufacturer's names. This is not intended to exclude from consideration other products which may be capable of accomplishing purpose indicated.
- B. Other types of products may be considered acceptable to Owner and Architect in place of those specified.
- C. Listing of a manufacturer implies acceptance of them only as supplier of a product which complies with specified item.
 - 1. See Section 01 61 00 for definition of Base and Optional manufacturers.
- D. No substitution permitted after execution of contract, unless allowed by Contract Documents.
- E. Conditional offers and voluntary alternates will not be considered unless allowed by Instructions to Proposers.

1.4 SUBSTITUTION REQUESTS

- A. Only written requests with complete data for evaluation will be considered.
 - 1. Request must be received at least 10 calendar days prior to proposal submission deadline.
 - 2. Requests received late will not be considered.
 - 3. Submit evaluation data with attached form to Architect.
- B. In making request for substitution, Suppliers represent:
 - 1. has personally investigated proposed product, system or method, and has determined that it is equal or superior in all respects to that specified, and that it will perform intended function;
 - 2. is in full compliance with applicable code;
 - 3. will provide same warranty for substitute item as for product, system or method specified;
 - 4. if a finish product, complies color wise and pattern wise with base specified items;
 - 5. will coordinate installation of accepted substitution into Work, to include building modifications if necessary, and be responsible for such modifications as may be required for Work to be complete and functional in all respects;

6. certifies cost data presented is complete and includes all related costs, excluding Architect's review and redesign cost;
 7. waive all claims for additional costs or time extensions related to substitution which subsequently become apparent or are caused by substitution;
 8. will pay additional costs to other trades, subcontractors or contracts caused by substitution;
 9. will pay all Architect's review and redesign cost, special inspections, and other costs caused by substitutions or revisions made necessary by the acts or omissions of Contractor, due to product submittal or product not being ordered in a timely manner, due to ease of construction progress or Work, or which are in interest of or are for convenience of supplier, subcontractor or Contractor;
 10. Acknowledge acceptance of these provisions.
- C. Supplier sign substitution request in space provided on form acknowledging acceptance of terms.

1.5 APPROVAL OF SUBSTITUTION REQUEST

- A. No verbal or written approvals other than by Addenda will be valid.
1. Addendum listing approved substitutions will be published prior to proposal submission deadline.

1.6 REJECTION OF SUBSTITUTION REQUESTS

- A. Substitutions may not be considered if:
1. Submitted after stipulated date or time period.
 2. Not submitted in accord with this Section.
 3. Acceptance will require substantial revision of Contract Documents, building or system.
 4. Substitution request does not indicate specific item for which request is submitted.
 5. Substitution Request form is not properly executed and signed.
 6. Substitution request for manufacturer acceptance only.
 7. Insufficient information submitted.
 8. Substitution color or pattern wise does not comply with base specified item.
 9. Substitution does not appear to comply with requirements of specifications for base item.

END OF SECTION

SUBSTITUTION REQUEST

PROJECT: Denton County Kitchen/Laundry Addition
PROJECT NUMBER: RFP#19-2534

TO: Office of Architect: HDR Architecture
8750 N. Central Expressway
Dallas, TX 75231
Attention: John Hultberg

SPECIFIED PRODUCT:

Substitution request for: _____
Specification Section number: _____
Article(s)/paragraph(s): _____

REASON FOR SUBSTITUTION REQUEST:

- | | |
|--|---|
| <input type="checkbox"/> Fails to comply with building code requirements | <input type="checkbox"/> Not available |
| <input type="checkbox"/> Unavailable to meet Project schedule | <input type="checkbox"/> Reduce Project construction time |
| <input type="checkbox"/> No qualified installer for specified item | <input type="checkbox"/> Project cost savings |
| <input type="checkbox"/> Supplier refuses to warrant item or installation | <input type="checkbox"/> Unsuitable for application |
| <input type="checkbox"/> Supplier, Subcontractor or Contractor convenience | <input type="checkbox"/> Constructability issue |
| <input type="checkbox"/> Other: | |

Explanation in Detail: See attached: _____

SUPPORTING DATA:

Attach product description, specifications, drawings, photographs, performance data, test data, environmental criteria, and any additional data or information for evaluation of the proposed substitution in accord with requirements of Section 02 25 13

Sample is included:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Sample will be sent if requested:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Maintenance Service Available:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>

If yes, location: _____

Spare Parts Source: _____

REFERENCES:

LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

EFFECT OF SUBSTITUTION:

Substitution affects other parts of Work: No Yes (If yes, explain below)
Substitution requires dimensional revision or redesign of structure or mechanical and electrical Work: No Yes (If yes, explain below)
Same warrantee provided as specified base product: No Yes (If yes, explain below)
Explanation: _____

Cost difference: \$ _____ (add / deduct).
Total cost implications of substitution on Project: \$ _____ (add / deduct).
Total time implications: \$ _____ (add / deduct) calendar days.

STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS:

Supplier, Subcontractor and Contractor in making substitution request or in using an approved substitution represent:

- Has personally investigated the proposed substitution and determined it is equal or superior in all respects to specified product or system and will perform intended function, except as stated above.
- Is in full compliance with applicable code requirements.
- Will provide same warranty for substitute item as for product, system or method specified.
- Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
- Waive all claims for additional costs or time extensions related to substitution that subsequently become apparent or are caused by substitution.
- If a finish product, color wise and pattern wise complies with base specified items.
- Certifies cost data presented is complete and includes all related costs under this Contract, excluding Architect's review and redesign cost.
- Will pay Architect's review and redesign cost, special inspections, and other costs caused by substitution.
- Will pay additional costs to other contractors caused by substitution.
- Will modify other parts of Work as may be needed, to make all parts of Work complete and functioning.
- Acknowledge acceptance of these provisions.

List of Attachments: _____

ACKNOWLEDGEMENTS:

FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF CONTRACT DOCUMENTS:

Supplier/Vender: _____
Acknowledged by (print & sign): _____ Date: _____
Position: _____ Phone _____

Subcontractor: _____
Acknowledged by (print & sign): _____ Date: _____
Position: _____ Phone _____

Contractor: _____
Acknowledged by (print & sign): _____ Date: _____

Position:

_____	Phon	_____
_____	e	_____

END OF SUBSTITUTION REQUEST

SECTION 00 31 32
SUBSURFACE DRILLING AND SAMPLING INFORMATION
JAIL KITCHEN/LAUNDRY
RFP #19-2534

PART 1 - GENERAL

1.1 SOILS REPORT

- A. Soils Report (a.k.a. Geotechnical Report) dated August 2, 2018 has been prepared by Alliance Geotechnical Group for Owner. Report was prepared to assist in design process. Copies are available upon request.
- B. No representation or warranty is made by Architect, Engineer, Owner or any other party regarding completeness, accuracy, adequacy, or contents of report or of the subsurface investigation upon which report is based.

1.2 AVAILABILITY

- A. Copies of report are on file and may be downloaded from Denton County's online portal [eBid DentonCounty](#).

1.3 BIDDER RESPONSIBILITY

- A. Bidders accept full responsibility for using soil information in preparing bids.
- B. Bidder is responsible to obtain, at its expense, any additional information necessary to bid and perform Work.
- C. Bidders agree they will make no claim, exceeding actual cost of work, if, in performing the Work, they find actual subsurface conditions encountered do not conform to those indicated by soil borings, test excavations, and other subsurface investigations.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 00 42 16
PROPOSAL FORM
JAIL KITCHEN/LAUNDRY
RFP #19-2534

DATE: _____

Offeror, _____, a * _____ organized and existing under the laws of the State of Texas, does business as ** _____.

* Insert corporation, partnership, or individual, as applicable.

** Insert trade or business name.

TO: Denton County Commissioners Court
Attn: Scott Arledge, Director of Purchasing
Denton County Purchasing
401 W. Hickory, Suite 324
Denton, TX 76201

(Hereinafter called "Owner")

The Offeror, in compliance with the request for competitive sealed proposals for construction of: Jail Kitchen/Laundry, having examined the Proposal Solicitation Documents prepared by HDR and other related documents and being familiar with site of proposed Work, and with all conditions surrounding construction of proposed Project including availability of materials and labor, hereby proposes to furnish all labor, materials, tools, equipment, machinery, equipment rental, transportation, superintendence, perform all Work, provide all services, and to construct all Work in accordance with Proposal Solicitation Documents, within time and amounts stated herein. These amounts are to cover all expenses incurred in performing Work required under Proposal Solicitation Documents, of which this Offer is a part.

One (1) original of your firm's proposal should be submitted. The original proposal should be submitted in a single unbound volume separated by and tabbed by section. The tabs should identify the sections by name rather than simply a number or alphabet.

Offeror, if awarded contract, hereby agrees to commence Work under this contract on or before a date to be specified in Contract Agreement or written "Notice to Proceed" from Owner and to obtain Substantial Completion of Project within _____ (Offeror to fill in) consecutive calendar days thereafter.

Offer amount shall be expressed in words and in figures. In case of discrepancy, amount shown in words will govern.

BASE OFFER - FOR CONTRACT: Offeror agrees to perform all Work as described in Proposal Solicitation Documents

for Lump Sum of _____ dollars (Offeror to fill

in) (\$_____).

Base Offer includes **Contingency Allowance in the sum of Two Hundred and Fifty Thousand Dollars (\$250,000.00)** as required and outlined by Section 01 21 16.

Offeror is required to include \$8,550.00 in the Total Base Offer for Submittal Exchanges Services.

Unit Prices – Unit prices are not required with submission of your firm’s proposal. Upon request, firms selected for the competitive range will be required to submit a complete list of unit prices as described in Division 01. See Division 01 for descriptions.

Offeror agrees that this Proposal shall be good and will not be withdrawn for period of 90 calendar days after date of receipt of proposals.

Offeror understands that Owner reserves right to reject any or all proposals and to waive any informalities or irregularities therein.

Within ten days of notice of award, Contractor will furnish Performance Bond and Labor and Material Payment Bond.

Use of Owner’s Contract Agreement and bond forms are hereby made a requirement of the Contract Documents.

Offeror acknowledges receipt of following addenda: _____.

Respectfully submitted,

Contractor License Number: _____

Expiration Date: _____

Name of Individual _____

Signature if an Individual: _____

Doing Business as: _____

Business Address: _____

If a Partnership: _____

By: _____ Member of Firm
Name Signature

_____ Member of Firm
Name Signature

Business Address: _____

If a Corporation _____

By: _____
Name Title

_____ Signature

Business Address: _____

Telephone Number: _____

Email: _____

END OF SECTION

Note to Proposers: These forms are available for electronic completion and may be downloaded from Denton County's online portal [eBid DentonCounty](#).

I. CONTRACTOR BACKGROUND AND QUALIFICATIONS

General Contractors Name: _____

A. GENERAL

1. Qualification information submitted shall be applicable only to the company entity or branch that will perform this Work.
2. Submit list of other fully staffed branch offices
3. Submit list of corporate officers, partnerships or owners of organization
4. Please specify:
 Corporation - State of Incorporation _____
 Partnership
 Sole Proprietorship
 Joint Venture
5. Specify: In continuous business since: _____
6. Specify:
 Large Business (100 or more employees)
 Small Business (fewer than 100 employees)
 Other _____

B. PROJECT SELF PERFORMED WORK

1. Normally performs _____% of work with own forces.
2. Proposing to perform _____% of work for this project with own forces.
 - i. List Trades to be performed with own forces:

C. CONTRACTOR LITIGATION, CLAIMS, REPUTATION & COMPLIANCE

1. Has your firm ever defaulted, been declared to be in default, or failed to complete any work awarded?

yes no

If yes, stipulate where and why: _____

2. Has your firm ever paid (or had withheld from payment) liquidated damages for failure to complete a contract on time?

yes no

If yes, stipulate where and why: _____

3. Has your organization ever been charged with or paid a fine for non-compliance of State and/or Federal statutes or regulations?

yes no

If yes, stipulate where and why: _____

4. List pending claims and/or litigation against or involving project owners at time of submitting Proposal. Show project name, owner and summary explanation.

II. CONTRACTOR'S SAFETY RECORD

A. List your organization's Workers Compensation Experience Modification Rate (EMR) for the last five years, as obtained from your insurance agent.

2018 _____
 2017 _____
 2016 _____
 2015 _____
 2014 _____

B. Complete the matrix below for the last five years, as obtained from OSHA No. 200 Log:

	2018	2017	2016	2015	2014
Number of injuries & illnesses					
Number of lost time accidents					
Number of recordable cases					
Number of fatalities					
Number of employee direct hire fixed hours (round to 1,000's)					

C. Are regular project safety meetings held for Field Supervisor(s)?

yes no
 If yes, frequency:
 weekly
 bi-monthly
 monthly
 as needed

- D. Are project safety inspections conducted?
 yes no
 If yes, who performs inspections? _____
 How often? _____
 Who is required to attend? _____
- E. Does your organization have a written safety program?
 yes no
Do not submit a copy of Safety Program with proposal. A copy will be required by the awarded contractor, and it will become a compliance document upon contract award.
- F. Does your organization have a safety orientation program for new employees?
 yes no
 For employees promoted to Field Supervisor?
 yes no
 If yes, does your Supervisor Safety Program include instructions on the following:
- | | | |
|--------------------------|------------------------------|-----------------------------|
| Safety work practices | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| Tool box safety meetings | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| First aid procedures | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| Accident investigation | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| Fire protection | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| New worker's orientation | <input type="checkbox"/> yes | <input type="checkbox"/> no |

III. CONTRACTOR'S QUALITY CONTROL PROGRAM

Summarize your firm's Quality Control Program (not to exceed 3 pages).

The program should address all aspects of quality control including responsibility for surveillance work, acceptance, rejection, documentation and resolution of deficiencies, trend analysis and corrective action and interface with Owner's inspectors.

Do not submit complete Quality Control Program with Proposal. The awarded contractor shall submit a complete Quality Control Program which will become a compliance document upon contract award.

IV. REFERENCES

Submit a list of 5 projects of similar work, giving owner's name, owner's representative's name, project architect's name, telephone numbers and emails for each. References must be provided for owners of similar size and scope as the proposed project.

V. CONTRACTOR'S FINANCIAL AND BONDING RESOURCES

A. FINANCIAL RESOURCES

Submit the Current Assets and Current Liabilities from your firm's most recent Audited Financial Statement Balance Sheet. Also include net income for the last 2 most recent Audited Financial Statements. **Do not submit the full Financial Statement with proposal.** Upon request, your firm will be required to submit the full Audited Financial Statement.

Fiscal/Calendar Year of most recent Audited Financial Statement: _____

Current Assets: \$ _____

Current Liabilities \$ _____

Net Income

\$ _____ Year _____

\$ _____ Year _____

B. BONDING CAPABILITY

Firm's Bonding Capacity _____

Firm's Bonding Committed _____

% of Bonding Capacity Available _____

Maximum Bonding Capacity per Project _____

VI. RELEVANT WORK EXPERIENCE

A. CURRENT WORK SCHEDULE

1. List construction projects your organization has in-progress of similar size and scope using the format below:

Name & Location of Project	Contract \$	% Complete	Projected Completion Date	Owner Contact And Phone

2. Total number and dollar amount of contracts currently in progress:

Number _____ \$ _____

3. Largest single contract amount currently in progress:

Project Name: _____

Projected Completion Date : _____

Dollar Amount \$ _____

B. PAST WORK RECORD

1. List construction projects of similar size and scope your organization has completed in the last 5 years with completion dates and references.

Name & Location of Project	Contract \$	Date Completed	Owner Contact and Phone

2. Volume of work completed over last 5 years:

2018 \$ _____
2017 \$ _____
2016 \$ _____
2015 \$ _____
2014 \$ _____

STAFFING PLAN

VII. ORGANIZATIONAL PLAN AND APPROACH

Submit proposed organizational chart identifying key personnel for this project. Submit a narrative description of the approach and/or methodology to be taken by your firm to represent the interests of Denton County during this project specifically identifying the roles and responsibilities of management, project management, superintendent, etc. Documentation should include overall management approach as well as the proposed methodology by identified tasks. Include specifics about all technologies and software programs that your firm is capable of providing to enhance the efficiency and quality of the project through completion.

VIII. PROVISIONS FOR REQUIRED DISCIPLINES AND SKILLS

- A. Resumes of key personnel shall also be included. Professional affiliations, memberships, certifications and number of years' experience in specific roles for each of the key personnel must be included and will be used to evaluate the proposed team and personnel.
- B. Provide key personnel's percentage of commitment to Denton County's project and a list of projects they have participated in and in what role they participated on that specific project.

Project Manager's commitment to this project: ____% Name: _____

Projects	Project Role

Superintendent's commitment to this project: ____% Name: _____

Projects	Project Role

STAFFING PLAN

Scheduler's commitment to this project: ____% Name: _____

Projects	Project Role

Quality Control's commitment to this project: ____% Name: _____

Projects	Project Role

LEED Coordinator's commitment to this project: ____% Name: _____

Projects	Project Role

STAFFING PLAN

_____ commitment to this project: _____% Name: _____

Projects	Project Role

_____ commitment to this project: _____% Name: _____

Projects	Project Role

_____ commitment to this project: _____% Name: _____

Projects	Project Role

IX. CONTRACTOR'S COST REDUCTION SUGGESTIONS

The Offeror is encouraged to suggest to the County possible cost reduction items to be taken into consideration prior to awarding a construction contract. Offeror may include this listing as a referenced attachment if additional space is needed. Please do not provide costs at this time, only suggestions for items to be taken into consideration.

END OF SECTION

00 52 13
AGREEMENT
FOR CONSTRUCTION OF
JAIL KITCHEN/LAUNDRY
RFP #19-2534
DENTON COUNTY, TEXAS

TABLE OF ARTICLES

1. General Provisions
2. Owner
3. Contractor
4. Administration of the Contract
5. Subcontractors
6. Construction by Owner or by Separate Contractors
7. Changes in the Work
8. Time
9. Payments and Completion
10. Protection of Persons and Property
11. Insurance and Bonds
12. Uncovering and Correction of Work
13. Miscellaneous Provisions
14. Termination or Suspension of the Contract
15. Access to the Work
16. Standards
17. Prohibition against personal interest in the Contract
18. Compliance Requirements
19. Prevailing Wage Rates
20. Authority to Contract

AGREEMENT FOR CONSTRUCTION OF DENTON COUNTY
(ADD PROJECT NAME HERE)

This Agreement for the construction of the _____, Denton County, Texas, in the amount of _____, is entered into this _____ day of _____, 20____ by and between **DENTON COUNTY, TEXAS** (hereafter referred to as "Owner"), 110 West Hickory, 2nd Floor, Denton, Texas 76201, and **(ADD CONTRACTOR NAME HERE)**, (hereinafter referred to as "Contractor"). The Denton County **JAIL KITCHEN/LAUNDRY** is hereinafter referred to as the "Project." The Architect/Engineer for the Project is the firm of **HDR** and is hereinafter referred to as "Architect."

ARTICLE 1
GENERAL PROVISIONS

1.1. BASIC DEFINITIONS

1.1.1 THE COMPLETE CONTRACT DOCUMENTS: The complete Contract Documents consist of the Agreement between Owner and Contractor (hereinafter the "Agreement"), Conditions of the Contract (General, Supplementary and other Conditions), all documents included in **RFP #19-2534** and the Drawings, Project Manual and Bid Specifications, as well as Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract.

A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order; (3) a Construction Change Directive or (4) a clarification, interpretation or written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include other documents such as bidding requirements (advertisement or invitation to bid, Instructions to Bidders, sample forms, or portions of addenda relating to bidding requirements). The Contract Documents executed in accordance with Sub-paragraph 1.5.1. shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

1.1.2 THE CONTRACT: The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind: (1) between the Contractor and Architect or Architect's consultants; (2) between the Owner and a Subcontractor or Sub-subcontractor, or (3) between any persons or entities other than the Owner and Contractor. The Architect shall, however, with the consent of Owner, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

1.1.3 THE WORK: The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project. Although not indicated, "Work" includes providing supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, complete and functional installation.

1.1.4 THE PROJECT: The Project is the construction of the **JAIL KITCHEN/LAUNDRY** in Denton County, Texas as specified in the Contract Documents. The Project may include construction by the Owner or by separate contractors.

1.1.5 THE DRAWINGS: The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

1.1.6 THE SPECIFICATIONS: The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.

1.1.7 THE PROJECT MANUAL: The Project Manual is the volume usually assembled for the Work that may include the bidding requirements, sample forms, this Agreement, Supplementary Conditions of the Contract and Specifications.

1.1.8 GENERAL DEFINITIONS: Construction industry technical terms not defined in the Contract Documents shall have the meanings given as listed in the latest edition of the AIA "Glossary of Construction Industry Terms." Those not specifically defined either place shall have the meanings commonly attributed to them by the particular trade involved.

- .1 **Provide:** shall be understood to mean: "Furnishing of all labor, materials, equipment, transportation and services referred to and installation of the materials, equipment and other items referred to, all in compliance with the requirement of the Contract Documents and applicable Federal, State and local laws and ordinances as well as requirements of Federal, State and local authorities having jurisdiction at the site of the Work."
- .2 **Required:** shall be understood to refer to the requirements of the contract Documents unless its use in a sentence clearly implies a different interpretation.
- .3 Where "**as shown,**" "**as indicated,**" "**as noted,**" and similar terms are used, it shall be understood that reference to the Contract Drawings is made, unless their use in a sentence clearly implies a different interpretation.
- .4 Where the terms "**Plans**" or "**Drawings**" are used, they shall be understood to include drawings, details and schedules as applicable.
- .5 **Construction Time:** Another term for "Contract Time" as defined in Paragraph 8.1.1 (the period of time set forth in Paragraph 8.1.2 for Substantial Completion of the Work).
- .6 **Day:** A calendar day beginning and ending at 12:00 midnight.
- .7 **Equal; approved equal; Architect approved; acceptable; approved; satisfactory; required; directed; instructed:** Such terms and related phrases shall relate to the opinions and interpretations of the Contract Documents by the Architect, unless otherwise stated, and shall be limited in authority and responsibility as defined under this Agreement and the contract between the Architect and Owner.
- .8 **Date of Final Completion:** The date when Architect and Owner find all the work of the Contract documents acceptable and the Contract fully performed.
- .9 **Occurrence:** Is defined as follows for purpose of insurance – An event which occurs during the policy period, or a continuous or repeated exposure to conditions which result, during the policy period in bodily injury, sickness or disease, or injury to or destruction of property, excluding injuries or deaths of one or more persons or organizations, including the loss of use thereof, resulting from a common cause or from exposure to substantially the same general condition existing at or emanating from each location shall be deemed to result from one occurrence.
- .10 **Not-In-Contract (N.I.C.):** Work not included in this Contract.
- .11 **And/or:** Shall mean both "**and**" and "**or**" and shall be enforceable by Owner when read in either manner.
- .12 **General Contractor:** Same as Contractor.

- .13 **Material Man; Material Supplier:** Anyone that supplies material only and does not perform any labor at the site of the work.
- .14 **Timely Change:** A change in the work that can be arranged before the particular item of work has required the expenditure of any non-recoverable costs by the Contractor and/or subcontractors.

- .15 **Late Change:** A change in the work that cannot be performed before the particular item of work that requires the expenditure of some non-recoverable cost after shop drawings, samples and/or schedules related to the change have been reviewed and found acceptable.
- .16 **Prompt:** Promptly and similar terms shall be held to refer to a time period of not less one week or more than two weeks.
- .17 **Addendum:** A change to the Construction Documents (General Documents, Specifications and Drawings) issued prior to the execution of the Agreement.
- .18 **Agreement/Contract:** Agreement/Contract means the same and are used interchangeably throughout this document. This Agreement/Contract is the signed agreement between Owner and Contractor for the performance of the Work.
- .19 **Critical Path:** The project's tasks that will cause the project end date to be delayed if they are delayed. The word "critical" does not imply how important a task is; a task is critical solely because it must occur as scheduled for the project to finish on time.
- .20 **Furnish:** Unless specifically limited in context, the word “furnish” and any derivatives thereof mean: deliver indicated items, materials, equipment, apparatus, appurtenances and all items necessary for a complete and proper installation to Project site and stored in secure locations.
- .21 **Install:** “Install” and any derivatives thereof mean; incorporated indicated items, materials, equipment, apparatus, appurtenances and all items necessary for the Work including all necessary labor, materials and connections to perform a properly and complete installation ready for operation of use, including but not limited to unpacking and assembly, if necessary.
- .22 **The Contractor Shall:** In the interest of conciseness; sentences, statements and clauses may be verb phrases with expressed verbs such as “furnish,” “install,” “provide,” “construct,” “erect,” “comply,” “apply,” “submit,” etc. Any such sentences, statements and clauses are to be interpreted to include the applicable form of the phrase “the Contract shall” preceding the expressed verb, with the requirements described interpreted as mandatory elements of the Contract.
- .23 **Evaluation:** “Evaluation” and any derivative thereof, as used in reference to Architect mean; to become generally familiar with the progress and quality of the portion of Work completed to determine in general if it is being performed in a manner indicating that the Work when completed may be occupied or utilized by the Owner for its intended use. Such evaluations shall be based on what is plainly visible at the construction site during periodic visits to the Project, and without the removal of material or other Work that is in place.
- .24 **Inspect:** “Inspect” and any derivative thereof, as used in reference to the Architect shall mean; Type of evaluation that a reasonably prudent architect, in the exercise of ordinary care, would make to determine if the Work is in general accordance with the Contract Documents; they are not “inspections” as would necessarily disclose a defect.
- .25 **See:** In the interest of conciseness, references to specification sections and details are preceded by the word “see.” Any such references are to be interpreted to include applicable form of phrase “...and comply with.”

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary and what is

required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them.

1.2.2. Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed, nor limit the scope of work performed by any trade or by any Sub-contractor or supplier.

1.2.3. Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.2.4. General Conditions and Supplementary Condition and General Requirements apply to all of the Contract Documents.

1.2.5 Precedence of the Contract Documents: The most recently issued Document takes precedence over previous issues of the same Document. The order of precedence is as follows with the highest authority listed as "A."

- A. Modifications, Change Orders or a Change Proposal Request
- B. This Agreement, including the General Conditions stated herein.
- C. Addenda
- D. Supplementary Conditions
- E. Specifications and Drawings. In the case of an inconsistency between Drawing and specifications or within either document, the better quality and the greater quantity of work shall be provided unless otherwise directed by Architect.

1.2.6 Current Editions: When any work is governed by reference to standard, codes, manufacturer's instructions or other reference documents, the latest issue in effect on the original issue date of the Construction Documents shall apply whether or not the proper edition is noted.

1.2.7 Enumeration of Items: Lists of "work included," "work excluded" and "description of the work" and similar groupings are not intended to enumerate each and every item of work or appurtenance required therein, but shall be used in conjunction with all other portions of the Contract Documents to establish the requirements for completion of the Work or any portions thereof.

1.2.8 Reference Guarantees: When reference standards are made a part of the requirements, the warranties and guarantees they contain shall apply, except for the portions that are less stringent than those required by the Contract Documents or imply or state exclusions, limitations or waivers that are inconsistent with the requirements of the Contract Documents.

1.3 CAPITALIZATION

1.3.1 Terms capitalized in these General Conditions include those which are: (1) specifically defined; (2) the titles of numbered articles and identified references to Paragraphs, Subparagraphs and Clauses in the document, or (3) the titles of other documents published by the American Institute of Architects.

1.4 INTERPRETATION

1.4.1 In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

1.5 EXECUTION OF CONTRACT DOCUMENTS

1.5.1 The Contract Documents shall be enumerated on attachment(s) to the Agreement and attachments(s) shall be signed by the Owner and Contractor as provided in the Agreement.

1.5.2 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become familiar with local conditions under which the work is to be performed and correlated personal

observations with requirements of the Contract Documents. Contractor shall verify the location of all easements before beginning the project.

1.6 OWNERSHIP AND USE OF ARCHITECT'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS:

1.6.1. The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect and/or Architect's consultants are Instruments of the Architect's service through which the Work to be executed by the Contractor is described. The Contractor may retain one contract record set. Neither the Contractor, nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect or the Architect's consultants, and unless otherwise indicated the Architect or the Architect's consultants shall be deemed the author of them and will retain all common law, statutory and other reserved rights, in addition to the copyright, unless indicated differently in the Owner – Architect Agreement. The Drawings, Specifications and other documents prepared by the Architect, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the work without the specific written consent of the Owner, Architect and/or Architect's consultants. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and/or Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect and/or the Architect's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's copyright or other reserved rights.

1.6.2 CONTRACTOR'S USE OF INSTRUMENTS OF SERVICE IN ELECTRONIC FORM

1.6.2.1 Architect may furnish or sell, at an agreed upon cost, to Contractor, Subcontractor, Sub-subcontractor, and material and equipment supplier, or others versions of Instruments of Service in electronic form for use solely with respect to this Project. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic means involving computers.

1.6.2.2 If required to be furnished, or if furnished, Architect or Architect's Consultants will furnish electronic data in software format in use by Architect at the time Architect's services are performed. Contractor, any Subcontractors or Sub-subcontractors, material or equipment suppliers, or others shall be responsible for proper storage, maintenance and conversions necessary to prevent degradation or obsolescence of data. Any change or modification in electronic data by Contractor, any Subcontractors or Sub-subcontractors, material or equipment suppliers, or others shall be at their sole risk and without liability or legal exposure to Architect, Architect's consultants or Owner, and to fullest extent permitted by law, the Contractor, any Subcontractors or Sub-subcontractors, material or equipment suppliers agrees to hold harmless and indemnify Architect, Architect's consultants and Owner from and against all claims, liabilities, losses, damages and costs, including but not limited to reasonable attorney's fees, arising there from or in connection therewith.

1.6.2.3 The Contractor, any Subcontractors or Sub-subcontractors, material or equipment suppliers, and others understand that the conversion of electronic information and data supplied by the Architect or Architect's consultants from the system and format used by the Architect or Architect's consultants to an alternative or upgraded system or format, whether performed by Architect, Architect's consultants or others, cannot be accomplished without the introduction of inexactitudes, anomalies, omissions and errors. In the event the electronic data furnished to the Contractor, any Subcontractors or Sub-subcontractors, material or equipment suppliers, is converted, they agree to assume all risks associated with such conversion. If Architect and/or Architect's consultants furnish electronic data, the Contractor, any Subcontractors or Sub-subcontractors, material or equipment suppliers, and others agrees to hold Architect, Architect's consultants and Owner harmless and to waive any and all claims, liabilities, losses, damages and costs arising out of, or

in any way connected with, the conversion of electronic data supplied by the Architect or Architect's consultants.

1.6.2.4 If documents, including those in electronic form, are modified, revised or changed in any way by the Contractor, Subcontractor, Sub-subcontractor, and material and equipment supplier, or others, any reference to the Architect and Architect's consultant and any professional seals and signatures shall be removed from the documents.

1.6.2.5 In consideration for the use of the Drawings, Specifications and other documents, including those in electronic form, Contractor, Subcontractor, Sub-subcontractor, material and equipment supplier and others agree to indemnify, defend and hold harmless the Architect, Architect's consultants and Owner from and against, any claim or liabilities arising out of such use.

ARTICLE 2 **OWNER**

2.1 DEFINITION

2.1.1 The Owner is Denton County, Texas. Unless otherwise stated herein, wherever the terms of this Agreement refer to some action, consent, or approval to be provided by "Owner" or some notice, report or document to be provided to "Owner," such reference to "Owner" shall mean, to the extent that such person has been expressly designated and authorized by Owner to act on its behalf, Owner's representative. However, in no event shall Owner's representative be authorized to approve on Owner's behalf any amendment to this Agreement, or any Change Order or Construction Change Directive that involves an increase or decrease in cost of \$50,000 or more or in increase in the number of days to complete the project.

2.1.2 The Owner upon reasonable written request shall furnish to the Contractor in writing information which is necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein at the time of execution of the Agreement and within five (5) days after any change, information of such change in title, recorded or unrecorded.

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.1 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

2.2.2 Except for permits and fees, including those required under Paragraph 3.7, which are the responsibility of the Contractor under the Contract Documents, Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

2.2.3 Information or services required of the Owner by the Contract Documents shall be furnished by the Owner with reasonable promptness and complete and accurate to the best of the Owner's information and belief. Any other information or services relevant to the Contractor's performance of the Work under the Owner's control shall be furnished by the Owner after receipt from the Contractor of a written request for such information or services.

2.2.4 Contractor will be furnished, free of charge, one set of Contract Documents in Adobe "PDF" file format suitable for plotting or printing. Contractor may use for limited purpose of making prints thereof required for use in performance of Work, in accordance with Paragraph 1.6.

2.2.5 The foregoing are in addition to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Article 6 (Construction by Owner or by Separate Contractors), Article 9 (Payments and Completion) and Article 11 (Insurance and Bonds).

2.3 OWNER'S RIGHT TO STOP THE WORK: If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Paragraph 12.2 or fails, more than once, to carry out Work in accordance with the Contract Documents, the Owner by written order may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Subparagraph 6.1.3. Owner does not waive the right to stop the work in any future situation if Owner waives this right in any one situation.

2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

2.4.1 If the Contractor defaults or neglects to carry out the Work, or any portion thereof, in accordance with the Contract Documents or fails to complete, within the time period stipulated, any items of work scheduled (punch listed) to be done subsequent to the Date of Substantial Completion or fails to complete or correct any items of work disclosed subsequent to the Date of Substantial Completion and fails within a seven day period after receipt of written notice from Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then, or thereafter, due the Contractor the cost of correcting such deficiencies, including compensation for the Architect's additional services and expenses made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor shall be done after consultation with the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

2.4.2 Neither Owner nor its officers, agents, or employees are in any way liable or accountable to Contractor or its Surety, if any, for method by which completion of said Work, or any portion thereof, is accomplished or for price paid therefore, unless Surety is required to pay cost to complete the Project, in excess of the amount contained in the Owner-Contractor Agreement, as a direct result of the Architect's negligent issuance of Certificate(s) for Payment. Contractor and Surety are responsible for all costs for completing the Work including cost in excess of original Contract Sum. Owner does not forfeit right to recover damages from Contractor or Surety for failure to complete Contract by taking over the Work or by declaring Contract in default. Maintenance of the Work remains Contractor's and Surety's responsibility as provided for in Performance Bond and guarantee of Contractor.

2.4.3 The Owner reserves the right to:

- .1 observe the work, at any time, whenever it is in preparation or progress;
- .2 make emergency repairs to the work during the guarantee period, to prevent further damages and the Contractor shall pay for such repairs when necessitated by defects in the Contractor's work;
- .3 make changes to the work.

2.4.4 The Owner shall not be required to accept from the Contractor (unless specifically agreed upon):

- .1 Partial Substantial Completion;
- .2 Substantial Completion when it occurs prior to the expiration of the Contract Time.

ARTICLE 3
CONTRACTOR

3.1 GENERAL

3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative.

3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the

Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS

3.2.1 Because the Contract Documents are complementary, before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Subparagraph 2.2.1, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating construction by the Contractor and are not for the purpose of discovering errors, omissions or inconsistencies in the Contract Documents; however, any errors, inconsistencies or omissions discovered by the Contractor shall be reported promptly to the Architect as a properly prepared, timely Request For Information (RFI) in such form as the Architect may require.

3.2.2 Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes and rules and regulations, unless they bear upon construction means, methods, techniques or safety and health precautions, but the Contractor shall promptly report to Architect any nonconformity discovered by or made known to the Contractor as a Request For Information (RFI) in such form as the Architect may require.

3.2.3 If the Contractor believes that additional cost or time is involved because of clarifications, interpretations or instructions issued by the Architect in response to the Contractor's notices or requests for information pursuant to Subparagraphs 3.2.1 and 3.2.2, the Contractor shall make Claims as provided in Subparagraphs 4.3.6 and 4.3.7. If the Contractor fails to perform the obligations of Subparagraphs 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. The Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents or for differences between field measurements or conditions and the Contract Documents unless the Contractor recognized such error, inconsistency, omission or difference and knowingly failed to report it to the Architect.

3.2.3 The Contractor shall verify the location of all easements before beginning the Project.

3.2.4 The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved pursuant to Paragraph 3.12.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall review, substantiate, and comply with current industry execution standards and manufacturer's current execution instructions and evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures.

If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage.

3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor.

3.3.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.3.4 The Contractor shall be responsible for inspection of portions of Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work.

3.3.5 Contractor is solely responsible for coordination of scope of Work for its own forces, and of Subcontractors and suppliers, and to complete all Work, whether performed by the Contractor or a Subcontractor.

3.3.6 The Contractor shall provide a full-time Project Superintendent with a minimum of five years of similar construction experience. Superintendent shall be approved by Architect and permanently assigned to project until full completion of project.

3.3.7 The Contractor shall employ Licensed Surveyor to locate and stake out the Work and establish necessary reference and bench marks. Work from established bench marks and reference points, layout and correctly establish all lines, levels, grades and locations of all parts of their own Work and be responsible for their accuracy and proper correlation with Work and established data.

3.4 LABOR AND MATERIALS

3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent, and whether or not incorporated or to be incorporated in the Work.

3.4.2 The Contractor may make substitutions only if allowed by Contract Documents and with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order, or by Owner's approval of a Substitution Request.

3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

3.5 WARRANTY

3.5.1 The Contractor warrants to the Owner and Architect that all materials and equipment furnished under this Contract will be of good quality and new unless otherwise specified and that all Work will be provided in accordance with the requirements of the Contract Documents and will be of good quality, free of faults and defects. All Work not conforming to the requirements of the Contract Documents, including substitutions or changes made by the Contractor or any subcontractor, material supplier or equipment supplier that have not been specifically identified (PRIOR to Contract award) by means of a Letter of Notice to Architect and properly accepted and authorized by Architect, shall be considered defective and not in agreement with the requirements of the Contract Documents, and shall be promptly corrected in accordance with the requirements of Article 12 of this Agreement and amendments thereto as set forth in Supplementary Conditions or Modifications. Notation or listing of such substitutions or changes on shop drawings or other types of submittal will not be considered acceptable to Architect whether or not such submittal has been reviewed or stamped by Architect. Notice must be specific and transmitted in letter form. If required by Owner or Architect, Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment actually provided. This warranty is not limited by the provisions of Paragraph 12.2.

3.5.2 Immediately prior to Date of Substantial Completion, Contractor shall execute and deliver to Architect, a written warranty in approved form, stating that all materials and equipment provided and all

work performed are in accordance with the requirements of the Contract Documents and authorized modifications and additions thereto; and further stating that Contractor guarantees, should any condition arise or be disclosed during the time of Contract warranty, which conditions are due to incomplete, or improper or defective materials, or due to incomplete or improper or defective workmanship or arrangement, such condition, together with all work affected in correcting such condition, shall be (upon written notice from Owner) promptly and satisfactorily corrected by Contractor at no additional cost to Owner. Contractor shall be fully responsible for the prompt, satisfactory completion of all warranty work whether performed by his own or subcontract personnel.

3.5.3 Work Covered by Warranty: Contractor's warranty shall cover all work under the Contract, whether or not any portion or trade has been assigned or sub-let. In the event any portion of the Work is performed by an assignee or subcontractor, Contractor shall obtain from such assignee and/or subcontractor a written warranty to Contractor and Owner covering their respective portion of the Work for the period required. Contractor shall deliver them, together with his own warranty, to Owner prior to final payment. Assigns' and subcontractors' warranties shall expressly provide that the same shall be enforceable directly by Owner, if he so elects, and shall run concurrently with Contractor's warranty. Warranty shall be secured by Contractor's Performance Bond as directed by Owner.

3.5.4 Time of Warranty: Contractor's warranty shall be for a period of one year from Date of Substantial Completion of the Work. Should a warranty required under any Section of the Specifications or of this Contract be for a period of more than one year, Contractor's and subcontractor's warranty, with respect to such work, shall be for such longer period. Warranty for work done subsequent to Date of Substantial Completion shall be for a period of one year from date of Final Completion or such longer period, if so specified.

3.5.5 Partial Occupancy: Should Owner occupy a portion of the Work before the date of Substantial Completion, the warranty period for that portion so occupied shall begin on the date of such occupancy as agreed in writing with Owner.

3.5.6 Objectionable Process: Where any material, process, or method or operation or application procedure is required, which in the opinion of the Contractor, would render the finished work unsuitable for the required warranty, then, before a bid is submitted, such unsuitable material, process, or application method shall be objected to in writing to Architect, stating reasons therefore and recommending other alternate materials or methods so that the Work, when completed, will be suitable for the required warranty. In the event the Contractor's recommendations are approved, the work shall be installed in accordance therewith, and all changes in cost resulting there from shall be included in the Contract bid amount.

3.5.7 Under the requirements of this Paragraph 3.5, Contractor shall be responsible for:

- .1 Damages to the building contents and/or building utilities or services when damages result from use of faulty materials or negligent workmanship.
- .2 Warranting modifications accepted under subparagraph 3.5.6 above will give satisfactory results.
- .3 Warranting substitutions will be equal or superior to the specified item or method unless he specifically lists shortcomings in his request for making substitution.
- .4 Obtaining and enforcing all subcontract warranties with particular attention being directed to enforcement of warranty work by mechanical, electrical and plumbing subcontractors.

3.6 TAXES

3.6.1 Although Owner is a tax-exempt unit of local government, the Contractor shall pay all sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor which may not be within Owner's exemption that are legally enacted when Contractor's bids were received or negotiations between Owner and Contractor were concluded, whether or not yet effective or merely scheduled to go into effect.

3.6.2 Contractor requires all Subcontractors, Sub-subcontractors and suppliers to bill Contractor for all sales and use taxes on all materials and equipment incorporated into Project as clearly discernible separate item to facilitate Contractor's keeping tax as separate item of expense on records. Furnish this information to Owner to enable Owner to meet state reporting requirements

3.7 PERMITS, FEES AND NOTICES

3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received or negotiations concluded.

3.7.1.1 Owner shall secure and pay for health and environmental impact fees, water and sewer connections and impact fees, and zoning regulation fees and permits. The Contractor shall secure and pay for all other permits and governmental fees, licenses and inspections necessary for proper execution of and completion of Work which are customarily secured after execution of Contract and which are legally required when bids are received or Contract is executed.

3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules, regulations and lawful orders of public authorities bearing on performance of the Work.

3.7.3 It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, unless they bear upon construction means, methods, techniques or safety and health precautions. However, if the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing and necessary changes shall be accomplished by appropriate Modification.

3.7.4 If the Contractor performs Work, knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume full responsibility for such Work and shall bear all the costs attributable for any and all repairs required for conformance, including but not limited to, any penalties, fines or other damages realized..

3.8 ALLOWANCES

3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities against which the Contractor makes reasonable objection.

3.8.2 Unless otherwise provided in the Contract Documents:

- .1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the allowances, and
- .3** whenever actual costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect: (1) the difference between actual costs and the allowances under Article 3.8.2.1, and (2) changes in Contractor's costs under Article 3.8.2.2.

3.8.3 Contingency Allowance is established in the Specifications and shall be processed pursuant to Section 01 21 16 of the Specifications.

3.9 SUPERINTENDENT

3.9.1 The Contractor shall employ a competent superintendent with a minimum of five years of similar construction experience and necessary assistants who shall be in attendance at the Project site during performance of the Work. The Superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner and Architect the name and qualifications of a proposed superintendent. The Owner or Architect may reply within fourteen (14) days to the Contractor in writing stating: (1) whether the Owner or Architect has reasonable objection to the proposed superintendent, or (2) that the Owner or Architect requires additional time to review. Failure of the Owner or Architect to reply within the fourteen (14) day period shall constitute notice of no reasonable objection.

3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

3.10.1 The Contractor, promptly (within thirty 30 days) after notification of contract award, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised monthly or at appropriate intervals as required by the conditions of the Work and Project whichever is less, shall be related to the entire Project to the extent required by the Contract Documents and shall provide for expeditious and practicable execution of the Work.

3.10.1.1 Owner may authorize construction activities to commence prior to completion of Drawings and Specifications. If Drawings and Specifications require further development at the time the initial construction schedule is prepared, Contractor shall: 1) allow time in the schedule for further development of Drawings and Specifications by Architect, including time for review by Owner and Contractor and for Contractor's coordination of Subcontractors' Work, and 2) furnish to Owner, in a timely manner, information regarding anticipated market conditions and construction cost, availability of labor, materials and equipment, and proposed methods, sequences and time schedules for construction of Work.

3.10.2 The Contractor shall prepare and keep current, for the Architect's approval, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows the Architect reasonable time, as defined by the Architect to review submittals. If the Contractor fails to submit a schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

3.10.4 Owner shall not be bound by any early completion deadline submitted in any schedule.

3.10.5 Owner does not approve or accept any schedule, but reserves the right to review, comment and reject.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

3.11.1 The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record changes and selections made during construction, and in addition approved Shop Drawings, Product Data, Samples and similar required submittal. These shall be available to the Architect and shall be delivered to the Owner upon completion of the Work.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

3.12.3 Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Architect is subject to the limitations of Subparagraph 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Architect without action.

3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect; Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect without action.

3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor and Sub-contractor represent to the Owner and Architect that the Contractor and Sub-contractor have (1) reviewed and approved them, (2) have reviewed for compliance with the Contract Documents, (3) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (4) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents, and have approved the submittal.

3.12.7 The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect. Such Work shall be in accordance with approved submittals.

3.12.7.1 The Contractor shall make all revisions as noted by Architect and shall re-submit the required number of corrected copies of Shop Drawings, product data or samples until no exceptions are taken. The Contractor shall direct specific attention, by cover letter accompanying resubmitted Shop Drawings, to all revisions made in addition to those requested by Architect on previous submissions, if any.

3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In absence of such written notice the Architect's approval of a re-submission shall not apply to such revisions.

3.12.10 The Contractor shall not be required to provide professional services which constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided the Owner and Architect have specified to the Contractor appropriate performance and design criteria that such services must satisfy. Pursuant to this Subparagraph 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

3.12.11 When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

3.13 USE OF SITE

3.13.1 The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, policies, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

3.13.2 Contractor shall assume full responsibility for protection and safekeeping of materials stored on premises.

3.13.3 Contractor shall provide all necessary precautions to protect public, visitors and tenants from activities of Contractor or his agents on project.

3.14 CUTTING AND PATCHING

3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

3.14.2 The Contractor shall not damage or endanger a portion of the Work, or fully or partially completed construction, by the Owner, or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner, or a separate contractor, except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner, or a separate contractor, the Contractor's consent to cutting or otherwise altering the Work.

3.15 CLEANING UP

3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

3.15.2 If the contractor fails to clean up as provided in the Contract Documents after reasonable notice from Owner of such failure, the Owner may do so and the cost thereof shall be charged to the Contractor.

3.16 ACCESS TO WORK

3.16.1 The Contractor shall provide governmental authorities who lawfully request access to the work, the Owner and Architect proper facilities and equipment for access to the Work in preparation and progress wherever located.

3.17 ROYALTIES AND PATENTS

3.17.1 The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of patent rights and shall hold the Owner and Architect harmless from loss (including but not limited to attorney's fees, court cost, and other cost of defense), on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright, trademark, trade name, or similar property right or interest, or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

3.18 INDEMNIFICATION

3.18.1 TO THE FULLEST EXTENT PERMITTED BY LAW, THE CONTRACTOR SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS THE OWNER, ITS ELECTED OFFICIALS, APPOINTED OFFICIALS, OFFICERS, DIRECTORS, EMPLOYEES, AGENTS AND REPRESENTATIVES, ARCHITECT, ARCHITECT'S CONSULTANTS (COLLECTIVELY REFERRED TO AS THE "INDEMNITEES") FROM AND AGAINST ANY AND ALL CLAIMS, LIABILITIES, DAMAGES, LOSSES, COSTS, AND EXPENSES, INCLUDING, BUT NOT LIMITED TO, ATTORNEY'S FEES, ARISING OUT OF, RESULTING FROM, OR OCCURRING IN CONNECTION WITH THE PERFORMANCE OF THE WORK PROVIDED THAT SUCH CLAIM, LIABILITY, DAMAGES, LOSS, COSTS OR EXPENSE IS ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE, OR DEATH OR TO INJURY TO, OR DESTRUCTION OF, TANGIBLE PROPERTY (OTHER THAN THE WORK ITSELF), INCLUDING THE LOSS OF USE THEREOF IN ANY WAY OCCURRING, INCIDENT TO, ARISING OUT OF OR IN CONNECTION WITH: (A) A BREACH OF THE WARRANTIES PROVIDED BY THE CONTRACTOR; (B) THE WORK PERFORMED OR TO BE PERFORMED BY THE CONTRACTOR, ITS CONTRACTORS, SUB-CONTRACTORS, SUB-SUB-CONTRACTORS, AND SUPPLIERS, AND THEIR EMPLOYEES AND AGENTS; (C) ANY NEGLIGENT ACTION AND/OR OMISSION OF THE INDEMNITEES RELATED IN ANY WAY TO THE PROJECT WHETHER THE INDEMNITEES ARE NEGLIGENT IN WHOLE OR IN PART, AND EVEN WHEN THE LOSS IS CAUSED BY THE SOLE FAULT OR NEGLIGENCE (INCLUDING ACTS OR OMISSIONS THAT ARE CHARACTERIZED AS NEGLIGENCE PER SE, NEGLIGENCE PREMISED ON STRICT LIABILITY, OR ANY OTHER TYPE OF NEGLIGENCE) OF THE INDEMNITEES; OR (D) ANY FINES, PENALTIES, DAMAGES (INCLUDING PUNITIVE), LIABILITIES, COSTS AND EXPENSES IN CONNECTION WITH: (1) A VIOLATION OF ANY LAW, STATUTE, RULE, ORDINANCE, CODE OR OTHER REQUIREMENT OF PUBLIC AUTHORITIES; (2) MEANS, METHODS, PROCEDURES OR SEQUENCES OF EXECUTION OR PERFORMANCE OF THE WORK; AND (3) FAILURE TO SECURE AND PAY FOR PERMITS, FEES, APPROVALS, LICENSES AND INSPECTIONS FOR WHICH THE CONTRACTOR IS RESPONSIBLE UNDER THE CONTRACT DOCUMENTS. THE CONTRACTOR'S INDEMNITY OBLIGATION HEREIN SHALL NOT BE CONSTRUED TO NEGATE, ABRIDGE OR REDUCE OTHER RIGHTS OR OBLIGATIONS OF INDEMNITY THAT WOULD OTHERWISE EXIST AS TO A PARTY OR PERSON DESCRIBED IN THIS SECTION 3.18. THE SCOPE AND EXTENT OF THIS INDEMNITY SHALL NOT BE LIMITED BY THE AVAILABILITY OF COVERAGE UNDER THE CONTRACTOR'S INSURANCE AND SHALL NOT LIMIT INDEMNITEES' OTHER LEGAL REMEDIES AGAINST CONTRACTOR OR ANY OTHER PERSON OR ENTITY. THIS INDEMNIFICATION PROVISION SHALL SURVIVE TERMINATION OF THE CONTRACT.

3.18.2 In claims against any person or entity indemnified under Paragraph 3.18 by an employee of the Contractor, a Subcontractor, Sub-Sub-contractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Paragraph 3.18 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or

a Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

3.18.3 The obligations of the Contractor under Paragraph 3.18 shall not extend to the liability of the Architect, the Architect's consultants and agents and employees of any of them arising out of: (1) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications; or (2) the giving of, or the failure to give, directions or instructions by the Architect, the Architect's consultants and agents and employees of any of them, provided such giving, or failure to give, is the primary cause of the injury or damage. The indemnity for the Architect, the Architect's Consultants, agents and employees does not extend to any indemnity prohibited by Section 130.003 of the Texas Civil Practice and Remedies Code.

3.19 ADDITIONAL REQUIREMENTS

3.19.1 Contractor shall submit to Architect, in writing, all substitutions proposed PRIOR TO the bid opening date. Contractor shall furnish sufficient data for evaluation. To be acceptable for project use, substitutions must be approved in writing by Architect or by appropriate addendum.

3.19.2 Contractor shall follow manufacturer instructions. Where such instructions are in conflict with the Contract Documents, Contractor shall notify Architect for clarification before proceeding. A copy of the manufacturer's instructions shall be kept at job site and made available to Architect.

3.19.3 Contractor shall stop the Work affected when notified of a proposed change and when unsatisfactory results are anticipated. Contractor shall proceed only after receiving additional instructions from Architect.

3.19.4 Contractor shall establish and maintain bench marks, and all other grades, lines, and levels necessary for the Work, report errors and inconsistencies to Architect, in writing, before commencing work affected. Contractor shall be responsible for placement of Project Work and shall make all corrections necessary to achieve an accurate layout of Project Work.

3.19.5 Contractor shall provide acceptable access facilities to the Work for the Owner, Architect, and all local, State and Federal authorities having jurisdiction. All access facilities shall be made safe and reasonably convenient.

3.19.6 Contractor shall prepare quotations, for proposed changes in the Work. Quotations shall be in a "break-down" form giving the number of units, unit cost of materials, tool costs, taxes, overhead, profit, etc. Quotations shall reflect credits as well as extras.

3.19.7 Contractor shall furnish written warranties using the form directed by Owner or Architect.

3.19.8 Contractor shall secure required inspection certificates and transmit them to Architect and Owner.

ARTICLE 4
ADMINISTRATION OF THE CONTRACT

4.1 ARCHITECT

4.1.1 The Architect is the person lawfully licensed to practice architecture, or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Architect's authorized representative or such representative as the architect may designate, who may be employed by the Architect as a consultant.

4.1.1.1 Each of these terms; "Architect," "Engineer," "Architect/Engineer," "A/E," or "Engineer/Architect" shall mean Architect, or an affiliate as otherwise provided in the Contract Documents, or duly authorized

representatives, such representatives acting severally within scope of particular duties entrusted to them, unless otherwise provided in Contract Documents.

4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

4.1.3 In case of termination of employment of the Architect, the Owner shall appoint a new Architect whose status under the Contract Documents shall be that of the former architect.

4.2 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

4.2.1 The Architect, acting in consultation with Owner, will provide administration of the Contract as described in the Contract Documents: (1) during construction; (2) until final payment is due, and (3) with the Owner's concurrence, from time to time during the correction period described in Paragraph 12.2. The Architect will advise and consult with the Owner. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified by written instrument in accordance with other provisions of the Contract; however, such authority shall not be considered or construed as creating a fiduciary relationship between the Architect and Owner.

4.2.2 The Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations, or as otherwise agreed by Owner and Architect, and as Architect deems necessary: (1) to become generally familiar with and to keep the Owner informed about the progress and aesthetic quality of the portion of the Work completed; (2) to endeavor to guard the Owner against defects and deficiencies in the Work, and (3) to determine in general if the Work observed is being performed in a manner indicating that the Work, when completed, will be in general accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site evaluations or inspections to check the quality or quantity of the Work. The Architect will neither have control over or charge of, nor be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety or health precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Subparagraph 3.3.1.

4.2.2.1 Contractor shall reimburse Owner for compensation paid to Architect for additional site visits made necessary by fault, neglect or request of Contractor.

4.2.3 The Architect will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided in Paragraph 3.3. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the Contract Documents or failure to complete Work on schedule. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

4.2.4 Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate through the Architect. Communications by and with the consultants shall be through the Architect, unless otherwise approved by the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner. The Architect's presence at the Project Site shall not imply concurrence or approval of the work. Contractor shall call specific items to the Architect's attention in writing if he wishes to obtain Architect's opinion.

4.2.5 Based on the Architect's observations and evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

4.2.6 The Architect has authority to reject Work which does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable for implementation of the intent of the Contract Documents, the Architect will have authority to require additional inspection or testing of the Work in accordance with Subparagraphs 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, materials and equipment suppliers, their agents or employees, or other persons performing portions of the Work. All costs made necessary by such failure, including those of repeated procedures shall be at Contractor's sole expense, including compensation for Architect's services and expenses.

4.2.7 The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Such review and action on the part of the Architect is limited to only those submittals required by the Contract Documents. The Architect's action will be taken with such reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or separate contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review by the Architect, Architect's consultants and Owner, if needed. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Paragraphs 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety or health precautions or, unless otherwise specifically stated by Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's review or approval of a specific item shall not indicate approval of an assembly of which the item is a component.

4.2.8 The Architect will prepare Change Orders and Construction Change Directives, or other change documents for changes in the Work for the Owner's approval and execution, and the Architect may authorize minor changes in the Work as provided in Paragraph 7.4.

4.2.9 The Architect and Owner will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion. The Architect may receive and forward to the Owner for the Owner's review and records written warranties and related documents as required by the Contract Documents and assembled by the Contractor, and will issue a final Certificate for Payment based upon final inspection indicating the Work complies with the requirements of the Contract Documents.

4.2.10 If the Owner and Architect agree, Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Paragraph 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until twenty (21) days after written request is received.

4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings.

4.2.13 The Owner's and Architect's decisions on matters relating to aesthetic effect will be final, if consistent with the intent expressed in the Contract Documents.

4.3 CLAIMS AND DISPUTES

4.3.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money and extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of, or relating to, the Contract. Claims must be made by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

4.3.1.1 Claims must contain following:

- .1 Date of the event giving rise to such Claim and, if applicable, date when the event ceased;
- .2 Nature of occurrence or condition giving rise to the Claim;
- .3 Identification of contractual provisions affected and a detailed explanation of how the Claim is contrary to those provisions;
- .4 An estimate of effect upon the Contract Sum, including an itemized breakdown of additional cost, if any;
- .5 An estimate of the effect upon the Project Schedule, including a comparison of Project Construction Schedule and schedules prepared in connection with the Claim. If required by Owner or Architect, this shall include showing in CPM format, both critical and non-critical path activities affected and showing Project Construction Schedule and Claim sequences, durations and float substantiating delay claimed.

4.3.2 Decision of Architect. Claims, including those alleging an error or omission by the Architect, shall be referred initially to the Architect for action as provided in Paragraph 4.4. A decision by the Architect and Owner, as provided in Subparagraph 4.4.4, shall be required as a condition precedent to litigation of a Claim between the Contractor and Owner as to all such matters arising prior to the date final payment is due, regardless of: (1) whether such matters relate to execution and progress of the Work, or (2) the extent to which the Work has been completed.

4.3.3 Time Limits on Claims initiated prior to Final Payment. Claims by either party must be initiated and submitted within **twenty-one (21)** days after occurrence of the event giving rise to such Claim or within **twenty-one (21)** days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be initiated and submitted by written notice to the Architect and the other party. An additional Claim made after the initial Claim has been implemented by Change Order will not be considered unless submitted in a timely manner.

4.3.4 Continuing Contract Performance. Pending final resolution of a Claim, unless otherwise agreed in writing or as provided in Sub-paragraph 9.7.1 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

4.3.5 Waiver of Claims: Final Payment. The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

4.3.6 Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are: (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated

in the Contract Documents, or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed. The Architect will promptly investigate and evaluate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made and submitted within **twenty-one (21)** days after the Architect has given notice of the decision. If the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect for initial determination, subject to further proceedings pursuant to Paragraph 4.4.

4.3.7 Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Paragraph 10.4. If the Contractor believes additional cost is involved for reasons including but not limited to: (1) a written interpretation from the Architect; (2) an order by the Owner to stop the Work where the Contractor was not at fault; (3) a written order for a minor change in the Work issued by the Architect; (4) failure of payment by the Owner; (5) termination of the Contract by the Owner; (6) Owner's suspension, or (7) other reasonable grounds, Claim shall be filed in accordance with this Paragraph 4.3.

4.3.8 Claims for Additional Time

4.3.8.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall demonstrate that the task is on the critical path and identify the new completion date. In the case of a continuing delay, only one Claim is necessary.

4.3.8.1.1 The Contractor's request for an increase in the time shall be submitted with pay applications. The delay impacting the critical path shall be addressed no later than the pay application for the month following the month in which the time was lost.

4.3.8.1.2 Only delay impacting the critical path of the Work shall be considered when determining if Contractor is entitled to additional time.

4.3.8.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, that weather conditions had an adverse effect on the scheduled construction and that the activities delayed by weather were on the critical path.

4.3.8.2.1 Acceptable data for substantiating a claim for additional time due to abnormal weather conditions will be the records of the National Oceanographic and Atmospheric Administration (NOAA) for the prior ten (10) years. In the absence of NOAA records for a specific Project site, upon mutual agreement, local official records will be the basis. Furthermore, the effect of such abnormal weather must be demonstrated.

4.3.8.3 Claims for increase in Contract Time shall set forth in detail the circumstances that form the basis of the Claim, date upon which each cause of delay began to affect progress of Work, date upon which each cause of delay ceased to affect progress of Work and the number of days' increase in Contract Time claimed as a consequence of each such cause of delay. Contractor shall provide such supporting documentation as Owner or Architect may require including, where appropriate, a revised construction schedule indicating all activities affected by circumstances forming the basis of the Claim.

4.3.8.4 Contractor shall not be entitled to a separate increase in Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on progress of Work or for concurrent delays due to fault of Contractor.

4.3.9 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding **twenty-one (21)** days after first observance. The notice shall provide sufficient detail to enable the other party to investigate and evaluate the matter.

4.3.10 If unit prices are stated in the Contract Documents, or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive, so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

4.3.11 Owner reserves the right to audit the Contractor's costs and bid documents if Contractor files a claim against Owner.

4.3.12 Contractor, not owner, shall handle any disputes which may arise between subcontractor and owner.

4.4 RESOLUTION OF CLAIMS AND DISPUTES

4.4.1 Decision of Architect:

Claims, including those alleging an error or omission by the Architect but excluding those arising under Paragraphs 10.3 through 10.4, shall be referred initially to the Architect for decision. An initial decision by the Architect shall be required as a condition precedent to mediation, arbitration (if allowed) or litigation of all Claims between the Contractor and Owner arising prior to the date final payment is due, unless thirty (30) days have passed after the Claim has been referred to the Architect with no decision having been rendered by the Architect. The Architect will not decide disputes between the Contractor and persons or entities other than the Owner.

4.4.2 The Architect will review Claims and within **twenty-one (21)** days of the receipt of the Claim take one or more of the following preliminary actions within ten (10) days of receipt of a Claim: (1) request additional supporting data from the claimant or a response with supporting data from the other party; (2) reject the Claim in whole or in part; (3) recommend approval of the Claim by the other party; (4) suggest a compromise, or (5) advise the parties that the Architect is unable to resolve the Claim, if the Architect lacks sufficient information to evaluate the merits of the Claim or if the Architect concludes that, in the Architect's sole discretion, it would be inappropriate for the Architect to resolve the Claim.

4.4.3 In evaluating Claims, the Architect may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Architect in rendering a decision. The Architect may request the Owner to authorize retention of such persons at the Owner's expense.

4.4.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten (10) days after receipt of such request and shall either, provide a response on the requested supporting data, advise the Architect when the response or supporting data will be furnished, or advise the Architect that no supporting data will be furnished. Within **twenty-one (21)** days of receipt of the response or supporting data, if any, the Architect will either reject or approve the Claim in whole or in part.

4.4.5 If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Architect, the Architect will notify the parties in writing that the Architect's decision will be made within seven (7) days. Upon expiration of such time period, the Architect will render to the parties the Architect's written decision relative to the Claim. If any change in the Contract Sum or Contract Time or both is included as part of the Architect's decision, Architect will be required to submit his decision to the Denton County Commissioners Court for final approval. If there is a surety and there appears to be a possibility of a Contractor's default, the Architect may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

ARTICLE 5
SUBCONTRACTORS

5.1 DEFINITIONS

5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

5.1.3 Architect and Architect's consultants may, but are not required to, communicate directly with any Subcontractor, Sub-subcontractor, or materials supplier when it is necessary to obtain information necessary for the Architect or Architect's consultants to complete its services on the Project. The Architect shall endeavor to keep Contractor informed of conversations. Requests for information, interpretation or clarification, and correspondence must all be in writing and must be routed through Contractor.

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, within fourteen (14) days after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the work. The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Architect to reply promptly shall constitute notice of no reasonable objection.

5.2.2 The Contractor shall not contract with a proposed person or entity to which the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. The Contract Sum shall be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued. However, no increase in the Contract Sum shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

5.2.4 The Contractor shall not change a Subcontractor, person or entity previously selected, if the Owner or Architect makes reasonable objection to such change. Acceptance of the substitute Subcontractor after previous acceptance of a Subcontractor for any portion of the work shall not constitute reason for an increase in the Contract amount.

5.3 SUBCONTRACTUAL RELATIONS.

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontractor agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors.

The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors shall similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

5.3.2 Contractor is fully responsible for acts and omissions of Subcontractors, and persons either, directly or indirectly, employed by them or under their control, as Contractor is for their own employees.

5.3.3 Nothing in Contract Documents creates any contractual relationship between any Subcontractor or Sub-subcontractor, or other tiers, and Owner or Architect, except for provisions in paragraph 5.4.

5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:

- .1** Assignment is effective only after termination of the Contract by the Owner for cause pursuant to Paragraph 14.2 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor in writing, and
- .2** Assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

5.4.2 Upon such Assignment, if the Work has been suspended for more than thirty (30) days, the Subcontractor's compensation shall be equitably adjusted.

5.4.3 Contractor will provide copies of its subcontracts, agreements and current information on status of its accounts, upon demand by Owner.

ARTICLE 6

CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces and to award separate contracts in connection with other portions of the Project or other construction of operations on the site under Conditions of the Contract identical, or substantially similar, to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Paragraph 4.3.

6.1.2 When separate contracts are awarded for different portions of the Project or other construction of operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule and Contract Sum deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights which apply to the Contractor under the Conditions of the

Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles, 10, 11 and 12.

6.2 MUTUAL RESPONSIBILITY

6.2.1 The Contractor shall afford the Owner and separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor to report shall constitute an acknowledgment that the Owner's or separate contractors' completed, or partially completed construction, is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

6.2.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, and damage to the Work or defective construction of a separate contractor.

6.2.4 The Contractor shall promptly remedy damage caused by the Contractor to completed or partially completed construction or to property of the Owner or separate contractors as provided in Subparagraph 10.2.5.

6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Paragraph 3.14.

6.3 OWNER'S RIGHT TO CLEAN UP

6.3.1 If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up after reasonable written notice and the cost will be paid by those responsible.

ARTICLE 7 **CHANGES IN THE WORK**

7.1 CHANGES

7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, by Construction Change Directive, or by order for a minor change in the Work issued by Architect, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect. A Construction Change Directive requires agreement by the Owner and Architect. An order for a minor change in the Work may be issued by the Architect alone.

7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

7.1.4 If unit prices are stated in the Contract Documents, or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order or Construction Change Directive that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

7.1.5 Wherever mutual agreement or acceptance is provided for in this Article 7, Owner's acceptance/agreement may be given by Owner's representative only where the change involves an increase or decrease in cost of less than \$50,000.

7.2 CHANGE ORDERS

7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect, stating their agreement upon all of the following:

- .1** a change in the Work;
- .2** the amount of the adjustment in the Contract Sum, if any; and
- .3** the extent of the adjustment in the Contract Time, if any.

A Contingency Allowance Authorization, or "CAA" is a Change Order that is within the approved Contingency Allowance described in Article 3.8.3. Throughout this entire Agreement, as well as in this Article 7, the term "Change Order" includes both change orders and Contingency Allowance Authorizations.

7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Article 7.3.5.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both. If the parties are unable to agree on the terms of a Change Order, Owner may by Construction Change Directive order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

7.3.2 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1** mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2** unit prices stated in the Contract Documents or subsequently agreed upon;
- .3** cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4** as provided in Subparagraph 7.3.5.
- .5** If the CCD is within the requirements of the contingency allowance refer to Contingency Allowance Section 01-21-16 in the specifications.

7.3.3 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

7.3.4 A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and constitutes a Change Order.

7.3.5 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit. In such case, and also under Article 7.3.2, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized

accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Subparagraph 7.3.5 shall be limited to the following:

- .1 costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' or workmen's compensation insurance;
- .2 costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work;
- .5 additional costs of supervision and field office personnel directly attributable to the change; and
- .6 the maximum allowance for overhead and profit combined included in the total cost to Owner shall be based on the following schedule:
 - A. for Contractor, for any work performed by his own forces, 15% of the cost;
 - B. for each subcontractor involved, work performed by his own forces, 10% of the cost;
 - C. for Contractor, for work performed by his subcontractor, 5% of the amount due the subcontractor.

7.3.6 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect, plus overhead and profit. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change. If the net value of a change results in a credit from Contractor or subcontractor, the credit given shall be the net cost, plus overhead and profit.

7.3.7 Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by a Change Order indicating the parties' agreement with part or all of such costs. For any portion of such cost that remains in dispute, the Architect will make an interim determination for purposes of monthly certification for payment for those costs. That determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a claim in accordance with Article 4.

7.3.8 When the Owner and Contractor agree with the determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

7.4 MINOR CHANGES IN THE WORK

7.4.1 To the extent allowed by law, the Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 **TIME**

8.1 DEFINITIONS

8.1.1 The "Contract Time" is the period of time set forth in Paragraph 8.1.2 for Substantial Completion of the Work. Substantial Completion shall be considered "achieved" on the date that Substantial Completion is certified to by the Architect as described in 9.8.4.

8.1.2 The Contractor shall achieve Substantial Completion of the Work not later than _____ days from the date of commencement of Work, subject to adjustments of the time for Substantial Completion as provided in this Agreement.

8.1.3 Work shall commence upon the date of permit acquisition following the final approval of the Agreement and receipt by the Contractor of written notice to proceed from either the Owner or the Architect. The Contractor must submit application for permits within 5 days of the date of the notice to proceed. If the Contractor fails to submit application within the 5 days, or if no permit is required, work shall commence on the date of notice to proceed.

8.1.4 The term "free slack time" as used in the Contract Documents shall mean the amount of time a task can be delayed without delaying another task.

8.1.5 The term "total slack time" as used in the Contract Documents shall mean the amount of time a task can be delayed without delaying the finish date of the project.

8.2 PROGRESS AND COMPLETION

8.2.1 Time limits stated in this Agreement are of the essence of the contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

8.2.2 The Contractor shall not, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere or store materials or equipment on site prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by the Contract Documents and a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five (5) days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

8.2.4 Contractor and their Subcontractors shall complete and coordinate Work in accordance with established schedule.

8.2.5 Contractor is responsible for expediting Work, identifying potential conflicts and coordination problems, and proposing measures to avoid such problems

8.2.6 Whenever it becomes apparent that any activity completion date may not be met, unless delay is related to an approved extension of time, Contractor shall take some or all of following actions and submit supplementary schedule indicating effect of action on progress and completion of Work, all without additional costs to Owner;

- .1** increase number of working hours per shift, shifts per working days, working days per week, or amount of construction equipment, or any combination of foregoing which will substantially eliminate backlog of Work, and put Project back on schedule, and/or,
- .2** increase construction manpower in such quantity as will substantially eliminate backlog of Work, and put Project back on schedule, and/or,
- .3** reschedule activities to achieve maximum practical concurrency of accomplishment of activities, and put Project back on schedule.

8.2.7 If Contractor fails to take any of actions indicated in subparagraph 8.2.6 within three (3) days after receiving written notice, Owner may take action to attempt to put Project back on schedule, and deduct cost of such actions from money due or to become due Contractor, or shall be grounds for determination by Owner

that Contractor is not prosecuting Work with such diligence as will insure completion within Contract Time. Upon such determination, Owner may terminate Contractor's right to proceed with Work, or any separable part thereof, in accordance with provisions of Article 14.

8.2.8 Contractor shall bear cost of any services of Architect made necessary by delays in completion of Work due to actions or inactions of Contractor or any Subcontractors. Contractor shall promptly pay any such cost upon demand by Owner. At Owner's option, these costs may be deducted from any amounts otherwise due Contractor.

8.3 DELAYS AND EXTENSION OF TIME

8.3.1 Except as otherwise provided in the Contract Documents, if the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate Contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, adverse conditions as provided for in 4.3.8.2, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control, or by delay authorized by the Owner, or by other causes which the Owner determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect and Owner may determine.

- .1 If at least seven (7) hours of work time are available out of the working day, no extensions of time will be allowed;
- .2 No extension of time will be allowed for Saturdays, Sundays, or holidays unless the Contract requires and stipulates overtime work and it has been approved in writing by Owner; and
- .3 Time extensions will not be allowed for drying of materials when it is possible for the Contractor to enclose area and materials or use an acceptable drying process.

8.3.2 There will be no delay claims by Contractor if the Contractor finishes the Project early, even if owner delays the work.

8.3.3 Claims relating to time shall be made in accordance with applicable provision of Paragraph 4.3.

8.3.4 If Contract Time is extended pursuant to paragraph 8.3, such extension shall be the exclusive remedy of Contractor and said Contractor shall not be entitled to recover damages from Owner or Architect.

8.3.4 Owner's exercise of any of its rights under "ARTICLE 7 - CHANGES IN THE WORK," regardless of the extent of number of such changes, or requirement of correction or re-execution of defective work, or extent of number of Architect's interpretations or clarifications of the Contract Documents, shall not, under any circumstances, be construed as neglect or intentional interference with Contractor's performance of the Work.

ARTICLE 9 **PAYMENTS AND COMPLETION**

9.1 CONTRACT SUM

9.1.1 The Contract Sum is _____ and, subject to authorized adjustments as provided in this Agreement, is the total amount payable by the Owner to the Contractor for performance of the Work.

9.2 SCHEDULE OF VALUES

9.2.1 Unless otherwise provided in the Contract documents, before the first application for Payment, the Contractor shall submit to the Architect a schedule of values allocated to various portions of the Work prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

9.2.2 The Architect will provide to the Contractor a list of the portions or sections of work for which he wishes to have separate values included and those items for which he will require material quantities to be shown.

9.3 APPLICATIONS FOR PAYMENT

9.3.1 Unless otherwise provided in the Contract Documents; at least twenty (20) days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be notarized and supported by such data substantiating the contractor's right to payment including the most current Contractors Construction Schedule and/or copies of requisitions from Subcontractors and material providers as the Owner or Architect may require, and reflecting retainage if provided for elsewhere in the Contract documents.

9.3.1.2 Such applications may not include requests for payment of amounts the Contractor does not intend to pay to a Subcontractor or material supplier because of a dispute or other reason.

9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

9.3.4 The Contractor shall submit his Application for Payment, amounting to 95% of the cost of the work performed and 95% of the materials on hand in accordance with paragraph 9.3.2 above, as of the last day of each month.

9.4 CERTIFICATES FOR PAYMENT

9.4.1 The Architect will, within seven (7) days after receipt of the Contractor's Application for Payment and the Architect's site visit, either, issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Subparagraph 9.5.1.

9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's observations at the site and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Architect's knowledge, information and belief, the observed aesthetic quality of the Work is in accordance with the Contract Documents. The Architect's Certificate for Payment shall be based, in part, on the recommendation of the Contractor. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract documents upon Substantial Completion, to results of subsequent tests and inspections, to minor deviations from the Contract Documents correctable prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has: (1) made exhaustive or continuous on-site evaluations and/or inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences or procedures; (3) reviewed copies of

requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the contractor has used money previously paid on account of the Contract Sum.

9.5 DECISIONS TO WITHHOLD CERTIFICATION

9.5.1 The Architect may decide not to certify payment and may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner if, in the Architect's opinion, the representations to the Owner required by Subparagraph 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Subparagraph 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also decide not to certify payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss because of:

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or another contractor;
- .6 reasonable evidence that the Work will not be completed within the contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
- .7 persistent failure to carry out the Work in accordance with the Contract Documents;
- .8 failure to comply with the approved Project Construction Schedule;
- .9 erroneous estimates by the Contractor or a Sub-contractor of values of Work performed,

or

- .10 the existence of any event of default under the Contract Documents.

9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

9.6 PROGRESS PAYMENTS

9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

9.6.1.1 Owner will make monthly partial payments to Contractor within fifteen (15) days after receipt of Certificate for Payment from Architect.

9.6.1.2 Owner may withhold payment to Contractor notwithstanding Architect's certification, if it is necessary, in Owner's opinion, to do so to protect Owner from loss due to any of the reasons set forth in Subparagraphs 9.5.1.1 through 9.5.1.10, inclusive.

9.6.2 The Contractor shall pay each Sub-contractor no later than seven (7) days after receipt of payment from the Owner, the amount to which the Sub-contractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Sub-contractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in similar manner.

9.6.3 The Architect will, on request, furnish to a Sub-contractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect on account of portions of the Work done by such Sub-contractor.

9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven (7) days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money, to a Subcontractor except as may otherwise be required by law.

9.6.5 Contractor's payment to material suppliers and equipment suppliers shall be treated in a manner similar to that provided in Subparagraphs 9.6.2, 9.6.3 and 9.6.4.

9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the contract Documents.

9.7 FAILURE OF PAYMENT

9.7.1. If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven (7) days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the contractor within seven (7) days after the date established in the Contract Documents the amount certified by the Architect, then the Contractor may, upon seven (7) additional days' written notice to the Owner or Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, as provided for in the Contract Documents.

9.8 SUBSTANTIAL COMPLETION

9.8.1 Substantial Completion is the stage in the progress of the Work when the Work is complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use.

9.8.2 Unless otherwise provided in the Contract Documents, when the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall thoroughly inspect the Work and prepare and submit to the Architect a comprehensive list of items to be completed or corrected, Contractor's Notice of Substantial Completion, and a written request for Architect's review of the Work. The Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Upon approval of Substantial Completion by Denton County, Contractor has thirty (30) days to reach Final Completion of the Work. If the Contractor does not achieve Final Completion within thirty (30) days after Substantial Completion, Contractor shall be subject to additional Liquidated Damages as set forth under paragraph 9.11.2 herein.

9.8.3 Unless otherwise provided in the Contract Documents, after receipt of the Contractor's Notice of Substantial Completion and the Contractor's list, the Architect and Owner will make inspections to determine whether the Work or designated portion thereof is substantially complete. If the Architect's and Owner's inspections disclose any item, whether or not included on the Contractor's list, which is not in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit another Contractor's Notice of Substantial Completion and a request for another inspection by the Architect and Owner to determine Substantial Completion.

9.8.4 When the Work is substantially complete, the Architect will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance or responsibilities assigned to them in such Certificate.

9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

9.9 PARTIAL OCCUPANCY OR USE

9.9.1 The Owner may occupy, or use, any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Subparagraph 11.3.1.2 and authorized by public authorities having jurisdiction over the Work. Such partial occupancy, or use, may commence whether or not the portion is substantially complete provided that the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, or the Owner notifies the Contractor of intent to occupy or use a portion of the Work prior to substantial completion, the Contractor shall prepare and submit a list to the Architect as provided under Subparagraph 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

9.9.2 Immediately prior to such partial occupancy, or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.1 Unless otherwise provided in the Contract Documents; the Contractor shall inspect the Work to determine that it is sufficiently complete in accordance with the Contract Documents and the Contract is fully performed. Upon receipt of Contractor's Notice of Final Completion written notice certifying that the Work is sufficiently complete in accordance with the Contract Documents, that the Contract is fully performed, that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect and Owner will in a reasonable time, make such inspection and when the Architect and Owner finds the Work acceptable under the Contract Documents and the Contract sufficiently performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's and Owner's on-site visits and inspections, the Work has been sufficiently completed in accordance with terms and conditions of the Contract Documents. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Subparagraph 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. However, 95% of the contract amount will be due and payable to Contractor as noted in said final Certificate, with the remaining 5% retainage due and payable to the Contractor within thirty (30) days after acceptance of the Work by the Owner.

9.10.2 Unless otherwise provided in the Contract Documents, neither final payment nor any remaining retained percentage shall become due until the Contractors submits to the Architect: (1) an affidavit that payrolls, bills for materials and equipment and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied; (2) a certificate evidencing that insurance required by the Contract Document to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to the Owner; (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents; (4) consent of surety, if any, to final payment, and (5) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the

extent and in such form as may be designated by the Owner, for Owner's review and approval. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

9.10.3 If, after Substantial Completion of the Work, Final Completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents and if bonds have been furnished the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

9.10.3.1 Final payment constituting entire unpaid balance of Contract Amount will be paid by Owner to Contractor within thirty (30) days after final Certificate for Payment has been issued by Architect.

9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents, or
- .4 non-conforming, faulty or defective Work appearing at or after final payment.

9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

9.11 LIQUIDATED DAMAGES

9.11.1 Owner will suffer financial loss if the Project is not Substantially Complete on the date set forth in the Contract. Contractor and Contractor's Surety shall be liable for and shall pay Owner stipulated and fixed sums, hereinafter agreed to as liquidated damages, for each calendar day of delay after the date established for Substantial Completion until the Work is Substantially Complete: Five Hundred dollars (\$500.00). It is understood that said sum shall be considered as liquidated damages and shall not be considered as a penalty against the Contractor

9.11.2 If thirty (30) days after Substantial Completion of the Work the Contractor is unable to achieve Final Completion of the Project as determined by Denton County, Denton County will suffer further loss. Contractor and Contractor's Surety shall be liable for and shall pay Owner stipulated and fixed sums, hereinafter agreed to as liquidated damages, for each additional calendar day of delay past thirty (30) days after Substantial Completion until Final Completion is achieved: One Thousand Dollars (\$1,000.00). It is understood that said sum shall be considered as liquidated damages and shall not be considered as a penalty against the Contractor.

ARTICLE 10 **PROTECTION OF PERSONS AND PROPERTY**

10.1 SAFETY AND HEALTH PRECAUTIONS AND PROGRAMS

10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety and health precautions and programs in connection with the performance of the Contract. This requirement applies continuously and is not limited to normal Working hours.

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.1 The Contractor shall at all times conduct all operations under this Agreement in a manner to avoid the risk of bodily injury or risk of damage to the following:

- .1** employees on the Work and other persons who may be affected thereby, to include but not limited to the Owner and Architect and their consultants and employees;
- .2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- .3** other property at the site or adjacent thereto, such as trees, shrubs, lawns walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, standards, rules, regulations, policies and lawful orders of public authorities (including reference standards issued under the Occupation Safety Act and the Occupancy Safety and Health Administration) bearing on safety and health of persons or property or their protection from damage, injury or loss.

10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

10.2.4 When use or storage of hazardous materials or equipment or unusual methods are necessary for execution of the Work, such as driving or removal of piles, wrecking, demolition, excavation or other similar potentially dangerous work is necessary, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel, and shall give Owner reasonable advance notice. Contractor is fully responsible for any and all damages, claims, and for the defense of all actions against Owner and Architect, and their consultants and employees resulting from the prosecution of such work.

10.2.4.1 Use or storage of explosives is prohibited.

10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Paragraphs 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them or by anyone for whose acts they may be liable and for which the Contractor is responsible under Paragraphs 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.18.

10.2.6 The Contractor shall designate a responsible, properly trained and qualified member or members of the Contractor's organization at the site whose duties shall be the prevention of accidents, damage to property and to supervise and train personnel in the use of dangerous and hazardous equipment, materials and substances necessary for the execution of the Work. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

10.2.7 The Contractor shall not permit any part of the construction or site, including new construction or existing facilities to be loaded with weights that will exceed design loads or so as to endanger safety of persons or property or cause damage or create an unsafe condition.

10.2.8 Contractor shall give notice in writing at least forty-eight (48) hours or longer if required by affected parties before breaking ground, to all persons having interests on or near site, Public Utility Companies, owners of property having structures or improvements in proximity to site of the Work, agencies, authorities, inspectors, or those otherwise in charge of property, streets, water pipes, gas pipes, sewer pipes, telephone cables, electric cables, railroads or otherwise who may be affected by Contractor's operation, in order that they may remove any obstruction for which they are responsible and have representative on site to see that their property is properly protected. Such notice does not relieve Contractor of responsibility for any damages, claims, and defense of all actions against Owner and Architect resulting from performance of such Work in connection with or arising out of Contract.

10.2.9 All parts of Work shall be braced to resist wind or other loads. Contractor shall perform Work with the explicit understanding that the design of the Project is based on all parts of Work having been completed and as such, the methods of performance of each part of Work shall be done accordingly.

10.2.10 Temporary items such as, but not limited to: scaffolding, staging, lifting and hoisting devices, shoring, excavation, barricades, and safety and construction procedures necessary in completion of Project shall be the responsibility of the Contractor and its Subcontractors and shall comply with all applicable codes and regulations. It shall not be responsibility of Owner, Architect or their representatives to determine if Contractor, Subcontractors or their representatives are in compliance with the aforementioned regulations.

10.2.11 The Contractor shall comply with all Federal Occupational Safety and Health Administration Hazard Communications Act (HAZCOM) requirements, including properly maintaining Materials Safety Data Sheets (MSDS) at the Project site. The Contractor shall ensure that all MSDS are compiled in a single location at the Project site, and are available to the regulating agencies. The Contractor shall indemnify and hold harmless the Owner and Architect for their respective failure to comply with this provision.

10.2.12 The Contractor shall be responsible for any fines, penalties or charges by any regulatory body by reason of any violation of safety or health regulations. Contractor shall also be responsible for reimbursement of any OSHA fines incurred by the Architect for Project site safety conditions created or controlled by the Contractor that result in the Architect receiving a citation under the OSHA multi-employer citation provision.

10.2.13 The Contractor shall notify Owner's and Architect's personnel upon arrival to the Project site of any known safety or health hazards at the Project and the precautions they should take.

10.2.14 The Contractor shall provide safety and health equipment (excluding boots) for the Owner and Architect to protect them from safety and health risks during the performance of their services during the construction of the Project.

10.2.15 The Architect's review of Contractor's performance does not include review of adequacy of Contractor's safety or health measures.

10.3 HAZARDOUS MATERIALS OR SUBSTANCES

10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a hazardous material or substance, including but not limited to, asbestos or polychlorinated biphenyl (PCB) encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner, in writing, with a copy to the Architect.

10.3.1.1 The term "hazardous materials or substance" also includes, but is not limited to, asbestos, asbestos products, polychlorinated biphenyl (PCB), radon gas, industrial waste, acids, lead, alkaline, irritants,

contaminants or other pollutants, excluding mild chemicals used in the cleaning of finished building materials.

10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If the Contractor has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor has no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Subparagraph 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) except to the extent that such damage, loss or expense is to the fault or negligence of the party seeking indemnity.

10.3.4 The Architect and Architect's consultants and employees shall have no responsibility for the discovery, presence, handling, removal or disposal of, or exposure of persons, to hazardous materials or toxic substances in any form at the Project site.

10.3.5 The Owner and Architect shall not be responsible under Paragraph 10.3 for hazardous materials and substances brought to the Project site by the Contractor unless such materials or substances were required by the Contract Documents and the Contractor so notified the Owner and Architect. The Contractor shall notify the Owner and Architect prior to bringing any hazardous material or substance onto the Project site.

10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

10.4 EMERGENCIES

10.4.1 In an emergency affecting safety or health of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Paragraph 4.3. and Article 7.

10.4.2 The Contractor shall promptly report in writing to Owner and Architect all accidents arising out of, or in connection with, the performance of the Work, whether on or off the site, which caused death, personal injury or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to Owner and Architect.

ARTICLE 11 **INSURANCE AND BONDS**

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the State of Texas such insurance as will protect the Contractor from claims set forth below which may arise out of, or result from, the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by Contractor or by a Subcontractor or by anyone directly, or indirectly, employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 claims under workers' or workmen's compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;
- .2 claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 claims for damages because of bodily injury, sickness, disease or death of any person other than the Contractor's employees or persons or entities excluded by statute from requirements of Subparagraph 11.1.1.1, but required by Contract Documents to provide insurance required by that Subparagraph;
- .4 claims for damages insured by usual personal injury liability coverage which are sustained by: (1) by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor; or (2) by another person;
- .5 claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting there from;
- .6 claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 claims for bodily injury or property damage arising out of completed operations;
- .8 claims involving contractual liability insurance applicable to the Contractor's obligations under Paragraph 3.18.
- .9 Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including:
 - (1) Premises Operations (including X, C and U coverages as applicable).
 - (2) Independent Contractors' Protective.
 - (3) Products and Completed Operations.
 - (4) Personal Injury Liability with Employment Exclusion deleted.
 - (5) Contractual, including specified provision for Contractor's obligations under Paragraph 3.18.
 - (6) Owned, non-owned and hired motor vehicles.
 - (7) Broad Form Property Damage including Completed Operations.
- .10 If General Liability coverages are provided by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2.

11.1.2 The insurance required by Subparagraph 11.1.1 shall be written for not less than the limits of liability specified in the Bid documents or as required by law, whichever coverage is greater. Coverage shall be written on an occurrence basis and shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment.

11.1.2.1 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits, or greater if required by law:

1. Workers' Compensation:
 - (a) State: **Texas** Statutory
 - (b) Applicable Federal (e.g., Longshoremen harbor work, Work at or outside U.S. Boundaries):
Statutory: **Not Applicable**
 - (c) Maritime: **Not Applicable**
 - (d) Employer's Liability: **\$ 500,000** each accident
\$ 500,000 disease, policy limit

\$ 500,000 disease, each employee

(e) Benefits required by union labor contracts: **As Applicable**

2. Comprehensive or Commercial General Liability (including Premises-Operations; Independent Contractors' Protective: Products and Completed Operations; Broad Form Property Damage):

(a) Bodily Injury: \$ 1,000,000 each occurrence
\$ 1,000,000 aggregate

(b) Property Damage: \$ 1,000,000 each occurrence
\$ 1,000,000 aggregate

(c) Products and Completed Operations Insurance to be maintained for a minimum period of **five (5)** year(s) after final payment:

(d) Property Damage Liability Insurance shall include coverage for the following

hazards:

1) X (Explosion).

2) C (Collapse).

3) U (Underground).

(e) Broad Form Property Coverage shall include Completed Operations.

3. Contractual Liability:

(a) Bodily Injury: \$ 2,000,000 each occurrence

(b) Property Damage: \$ 2,000,000 each occurrence
\$ 4,000,000 aggregate

4. Personal Injury with Employment Exclusion deleted: \$ 1,000,000 aggregate

5. If the General Liability coverages are provided by a Commercial Liability policy, the:

(a) General Aggregate shall be not less than \$ 2,000,000 and it shall apply, in total, to this Project only.

(b) Fire Damage Limit shall be not less than \$ 100,000 on any one Fire.

(c) Medical Expense Limit shall be not less than \$ 10,000 on any one person.

6. Umbrella Excess Liability: \$ 2,000,000 over primary insurance
\$ 10,000 retention for self-insured hazards each occurrence

7. Business Auto Liability (including owned, non-owned and hired vehicles):

(a) Bodily Injury: \$ 500,000 each person
\$ 1,000,000 each accident

(b) Property Damage: \$ 500,000 each occurrence

Note: The State of **Texas** has a no fault automobile insurance requirement. Contractor shall be certain coverage is provided which conforms to any specific stipulation in the law.

11.1.3 Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These Certificates and the insurance policies required by this Paragraph 11.1 shall contain a provision that coverage afforded under the policies will not be canceled, or allowed to expire, until at least thirty (30) days prior written notice has been given to the Owner. If any of the foregoing insurance coverage are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Subparagraph 9.10.2. Information concerning reduction of coverage shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief. Not later than ten (10) days from award of bid, Contractor shall deliver to the Owner, copies of the insurance certificate in accordance with the above requirements naming Owner as additional insured.

11.2 OWNER'S LIABILITY INSURANCE:

11.2.1 The Owner reserves the right to be self insured for any and all insurance of any kind, type, or nature required by the Contract Documents.

11.2.1.1 Contractor shall purchase and maintain insurance covering Owner's contingent liability for claims which may arise from operations under the Contract.

- .1 Bodily Injury:
 - \$ 1,000,000 each occurrence
 - \$ 1,000,000 aggregate
- .2 Property Damage:
 - \$ 1,000,000 each occurrence
 - \$ 1,000,000 aggregate

11.3 PROPERTY INSURANCE

11.3.1 The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus architect fees, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Paragraph 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Paragraph 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project. The form of policy for this coverage shall be Completed Value, in the names of the Owner, Contractor, Subcontractors and Sub-subcontractors as their interests may appear in amount equal to contract sum for the Work. If Owner is damaged by failure of Contractor to maintain such insurance, then Contractor shall bear all reasonable costs properly attributable thereto.

11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

11.3.1.2 Partial occupancy or use in accordance with paragraph 9.9 shall not commence until the insurance company or companies providing such property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and Contractor shall take reasonable steps to obtain consent of the insurance company and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

11.3.2 Loss of Use Insurance. The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused.

11.3.3 If the Contractor requests in writing that insurance for risks other than those described herein or for other special hazards be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

11.4 PERFORMANCE BOND AND PAYMENT BOND

11.4.1 Not later than ten (10) days from and after the date on which the award of the bid is made by the Owner, Contractor shall execute, as Principal, bonds joined in by a Surety Company of the Contractor's choice, generally referred to as a "Performance Bond" and a "Payment Bond," each in a penal sum equal to 100% of the Contract Sum. The Bonds shall be on the form provided by Owner and shall be compatible with provisions of governing authorities. Contractor shall file bonds with the Owner.

11.4.2 Surety Company executing bonds shall be acceptable to Owner and shall be authorized to do business in the State of Texas.

11.4.3 Surety Company shall list the address and phone number of the home office of its' principal place of business. Surety shall also provide the name, address and phone number of the local Agent issuing the bonds.

11.4.4 Contractor shall require attorney-in-fact who executes required bonds on behalf of surety to affix thereto a certified and current copy of power of attorney.

11.4.5 Contractor shall deliver required bonds to Owner not later than three (3) days following the date the Agreement is entered into, or if Work is to be commenced prior thereto in response to a letter of intent, Contractor shall, prior to commencement of Work, submit evidence satisfactory to Owner that such bonds will be furnished.

11.4.6 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

11.4.7 Contractor shall keep surety informed of progress of Work and where necessary, obtain surety's consent to, or waiver of: (1) notice of changes in the Work; (2) request for reduction or release of retention; (3) request for final payment; and (4) any other information required by surety.

ARTICLE 12 **UNCOVERING AND CORRECTION OF WORK**

12.1 UNCOVERING OF WORK

12.1.1 If a portion of the Work is covered contrary to the Architect's, Owner's or governing authority's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's, Owner's or governing authority's examination and be replaced at the Contractor's expense without change in the Contract Time.

12.1.2 If a portion of the Work has been covered which the Architect, Owner or governing authority has not specifically requested to examine prior to its being covered, the Architect, Owner or governing authority may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such cost and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

12.2 CORRECTION OF WORK

12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

12.2.1.1 The Contractor shall promptly correct Work rejected by the Architect, Owner or governing authority or failing to conform to the requirements of the Contract Documents, whether observed before, or after, Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear costs of correcting such rejected Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby.

12.2.2 AFTER SUBSTANTIAL COMPLETION

12.2.2.1 In addition to the Contractor's obligation under Paragraph 3.5, if, within one (1) year after the date of Substantial Completion of the Work, or designated portion thereof, or after the date for commencement of warranties established under Subparagraph 9.9.1, or by terms of an applicable special warranty required by the Contract Document, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This

period of one (1) year shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation under this paragraph 12.2.2 shall survive acceptance of the Work under the Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

12.2.2.2 The one (1) year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

12.2.2.3 The one (1) year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Paragraph 12.2.

12.2.2.4 Upon request of Owner and prior to expiration of one (1) year from date of Substantial Completion, Architect may conduct, and Contractor shall attend, a meeting with Owner to review facility operations and performance.

12.2.3 The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

12.2.5 Nothing contained in this Paragraph 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one (1) year period for correction of Work as described in Subparagraph 12.2.2 relates only to the specific obligation of the Contractor to correct the Work and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

12.3 ACCEPTANCE OF NONCONFORMING WORK

12.3.1 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Contractor shall bear all direct, indirect and consequential costs attributable to Owner's evaluation of and determination to accept such defective or nonconforming Work (such costs to include but not limited to fees and charges of architects, engineers, testing agencies, consultants, attorneys and other professionals). Such adjustment shall be effected whether or not final payment has been made. If any such acceptance occurs prior to final payment, Owner shall be entitled to an appropriate decrease in the Contract Sum. If the acceptance occurs after final payment, an appropriate amount will be paid by the Contractor to the Owner.

ARTICLE 13 **MISCELLANEOUS PROVISIONS**

13.1 GOVERNING LAW: The Contract shall be governed by the laws of the State of Texas.

13.2 SUCCESSORS AND ASSIGNS

13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

13.2.2 The Owner may, without consent of the Contractor, assign the Contract to lender providing construction financing for the Project. If the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

13.2.3 Contractor shall not assign any monies due or to become due hereunder without written consent of Owner and of Contractor's Surety. The Contractor shall file a copy of such consent of Surety, together with copy of assignment with Owner and Architect. In case Contractor assigns all or any part of any monies due or to become due under this Contract, instrument of assignment must contain a clause substantially to effect that it is agreed that right of assignees in and to any monies due or to become due to Contractor shall be subject to prior liens and claims of all persons, firms and corporations for services rendered; for payment of all laborers and mechanics for labor performed; for payment for all materials and equipment furnished and payment for all materials and equipment used or rented in performance of the Work called for in Contract; and for payment of any liens, claims, or amounts due to governments or any of their funds.

13.3 WRITTEN NOTICE: Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered or sent by registered or certified mail or by courier service providing proof of delivery to the last business address known to the party giving notice.

13.4 RIGHTS AND REMEDIES

13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available there under shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

13.5 TESTS AND INSPECTIONS

13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the testing agency, Project inspector (if any), public authorities and (if requested), Architect timely notice of when and where tests and inspections are to be made so that they may observe such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

13.5.2 If the Architect, Owner, Project inspector (if any), or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Subparagraph 13.5.1, the Project inspector (if any), or Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the testing agency, project inspector (if any), governing agency, and (if requested), Architect of when and where tests and inspections are to be made so they may observe such procedures. The Owner shall bear such costs except as provided in Subparagraph 13.5.3.

13.5.3 If procedures for testing, inspection or approval under Subparagraphs 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, laws, statutes, ordinances, codes, rules or regulations, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect and Project inspector (if any).

13.5.5 If the Architect, Owner or Project inspector (if any), is to observe tests, inspections or approvals required by the Contract Documents, they will do so promptly and where practicable, at the normal place of testing.

13.5.6 Test or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

13.6 INTEREST

13.6.1 Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the legal rate prevailing for public entities under the laws of the State of Texas.

13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

13.7.1 As between the Owner and Contractor:

- .1 Before Substantial Completion.** Before Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;
- .2 Between Substantial Completion and Final Certificate for Payment.** As to acts or failures to acts occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and
- .3 After Final Certificate for Payment.** As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any warranty provided under Paragraph 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under paragraph 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

13.8 EQUAL OPPORTUNITY

13.8.1 Contractor shall maintain policies of employment as follows:

- .1** Contractor and Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. Contractor shall take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth policies of nondiscrimination.
- .2** Contractor and Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

13.9 NON-DISCRIMINATION

13.9.1 In performance of Work, Contractor and Subcontractors agree not to discriminate against any employee or applicant for employment because of age, race, religion, color, handicap, sex, physical condition, developmental disability, sexual orientation or national origin. This provision shall include, but

not be limited to the following: employment, upgrading, demotion, promotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeships.

ARTICLE 14

TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1 The Contractor may terminate the Contract if the work is stopped for a period of thirty (30) days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons performing portions of the Work under the Contract with the Contractor, for any of the following reasons:

- .1 issuance of an order of a court or other public authority having jurisdiction;
- .2 an act of government, such as a declaration of national emergency, making material unavailable;
- .3 because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Subparagraph 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 if repeated suspensions, delays or interruptions by the Owner as described in Paragraph 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or one hundred twenty (120) days in any three hundred sixty-five (365) day period, whichever is less.

14.1.2 If one of the above reasons exists, the Contractor may, upon seven (7) additional days written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools and construction equipment and machinery, including reasonable overhead, profit and damages.

14.1.3 If the Work is stopped for a period of sixty (60) days through no act or fault of the Contractor or a Subcontractor or their agents, employees or any other persons performing portions of the Work under the Contract with the Contractor because the Owner has persistently failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven (7) additional days written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Subparagraph 14.1.2.

14.2 TERMINATION BY THE OWNER FOR CAUSE

14.2.1 The Owner may terminate the Contract if the Contractor:

- .1 persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make prompt payment to Subcontractors for materials or labor in accordance with the respective agreement between the Contractor and the Subcontractors;
- .3 persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

14.2.2 When any of the above reasons exist and the Owner believes that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety seven (7) days written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 take possession of the site and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor;
- .2 accept assignment of subcontracts pursuant to Paragraph 5.4; and
- .3 finish the Work by whatever reasonable method the Owner may deem expedient.

14.2.3 When the Owner terminates the Contract for one of the reasons stated in Subparagraph 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the Owner. This obligation for payment shall survive termination of the Contract.

14.3 SUSPENSION BY OWNER FOR CONVENIENCE

14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Subparagraph 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

.1 that performance is, was or would have been so suspended, delayed or interrupted by

another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 15 **ACCESS TO THE WORK**

15.1 Architect, the Owner, and their authorized representatives, shall have access at all times to the work for inspection wherever it is in preparation or progress and the Contractor shall provide proper facilities for such access and inspection.

ARTICLE 16 **STANDARDS**

16.1 Any material specified by reference to the number, symbol or title of a specific standard, such as a Commercial Standard, a Federal specification, a trade association standard or other similar standard, shall comply with the requirements in the latest revision thereof and any amendment or supplement thereto in

effect on the date of these Specifications, except as limited to type, class or grade, or modified in such reference.

16.2 The Standards referred to, except as modified in the Specifications, shall have full force and effect as though printed in the Specifications. These Standards are not furnished to bidders for the reason that the manufacturers and trade involved are assumed to be familiar with their requirements. The Architect will furnish, upon request, information as to how copies of the standards referred to may be obtained.

16.3 It is not the intent of the Specifications to limit materials to the product of any particular manufacturer. Where definite materials, equipment and/or fixtures have been specified by name, manufacturer or catalog number, it has been done to set a definite standard and a reference for comparison of quality, application, physical conformity and other characteristics. It is not the intention to discriminate against, or prevent, any dealer, jobber or manufacturer from furnishing materials, equipment and fixtures which, in the judgment of the Architect, expressed in writing, meet or exceed the characteristics of the specified items.

ARTICLE 17
PROHIBITION AGAINST PERSONAL INTEREST IN CONTRACTS

17.1 No officer or employee of Denton County, Texas, shall have a financial interest, direct or indirect, in this Agreement or shall be financially interested, directly or indirectly, in the sale of any materials, supplies or services, except on behalf of the County as an officer or employee. Any willful violation of this Article shall constitute malfeasance in office and any officer or employee guilty thereof shall be subject to removal from his office or position. Any violation of this Article with the knowledge, express or implied, of the Contractor or Subcontractors shall render this Agreement voidable by Denton County.

ARTICLE 18
COMPLIANCE REQUIREMENTS

18.1 PROHIBITION AGAINST BOYCOTTING OF ISRAEL

18.1.1 By its execution of this Agreement, Contractor verifies that it does not and will not during the term of this Agreement boycott Israel as described in Texas Government Code §808.001(1).

18.2 PROHIBITION OF CONTRACTS WITH CERTAIN COMPANIES

18.2.1 By its execution of this Agreement, Contractor verifies that it is not on a list prepared and maintained by the State Comptroller of Texas under Texas Government Code §2252.153 or §2270.0201.

ARTICLE 19
PREVAILING WAGE RATES

19.1 PREVAILING WAGE RATE DETERMINATION

19.1.1 Chapter 2258, Texas Government Code, Title 10, requires state agencies, cities, counties, independent school districts and all other political subdivisions that engage in construction projects using public funds to include prevailing wage rates in the project bid documents and the construction contract.

ARTICLE 20
AUTHORITY TO CONTRACT

The County Judge is authorized to execute this Agreement upon the Commissioners Court's approval of the Agreement as set forth in the minutes of the Court's _____ meeting.

This Agreement is entered into in as of the day and year first written above and is executed in at least three (3) original copies of which one (1) is to be delivered to the Contractor, one (1) to the Architect for use in the administration of the Contract, and the remainder to the Owner.

**OWNER:
DENTON COUNTY, TEXAS**

**CONTRACTOR:
(ADD NAME)**

Denton County Judge
110 West Hickory Street, 2nd Floor
Denton, Texas 76201

By: _____
Title: _____
Address: _____

APPROVED AS TO FORM:

Assistant District Attorney

AUDITOR'S CERTIFICATE

I hereby certify that funds are available in the amount of \$ _____ to accomplish and pay the obligation of Denton County under this Contract.

By: _____
James Wells, Denton County Auditor



DIVISION 01

GENERAL REQUIREMENTS



SECTION 01 14 16
COORDINATION WITH OCCUPANTS AND WORK RESTRICTIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Contractor use of site and premises.
- B. Working days and hours
- C. Directed premium time
- D. Future work.
- E. Work sequence.
- F. Owner occupancy.
- G. Disruption of existing services.

1.2 NO INTERRUPTION OF OCCUPANCY

- A. Work is required to be performed within an existing detention facility. Each Contractor will have access to areas in which this work occurs, subject to rights of Owner, security being of the utmost importance.
- B. Owner will occupy existing building during life of this contract. Schedule all work at such time and in such a manner to minimize interference and inconvenience to public, staff and Owner's operations. Contractor must obtain approval of Owner before starting any work within any existing area of building.
 - 1. Contractor's personnel will not be allowed access to areas of the Law Enforcement Jail Building outside of the Limits of Construction without specific permission. Contractor must obtain approval of Owner for work outside the Limits of Construction and must arrange with Owner for escort detail.
- C. Area immediately surrounding all areas of Work shall be protected from danger of materials being dropped or dislodged.
- D. Work shall be carried out in a manner that will not impose avoidable hardship, danger, or inconvenience to public or staff.
- E. Prior to commencement of Work, Contractor and Owner shall jointly survey construction site and surrounding areas, making permanent record of such existing damage as cracks, malfunctioning utility equipment and fixtures, or other similar damage. This record shall serve as a basis for determination of subsequent damage to these structures and adjacent areas due to Contractor's operations. Any damage of any nature to these structures and adjacent areas not noted in original survey but subsequently noted shall be reported immediately to Owner.

1.3 CONTRACTOR USE OF SITE AND PREMISES

- A. Limit operations and use of site to "Limits of Construction," and as required to perform Work.
- B. Secure written approval of Owner to disturb portions of site beyond area of required Work.
 - 1. Obtain written approval from Owner at least seven (7) calendar days in advance when scheduling Work outside limits of construction.
 - 2. Provide Owner an estimate of time needed to perform Work outside limits of construction.
 - 3. Cutting, capping, and reconnecting utility systems outside limits of construction shall be performed by Contractor, unless otherwise noted.
 - 4. Conform to laws, ordinances, permits and regulations affecting Work on site.
 - 5. Maintain existing roads, streets, drives, parking lots, entrances and required fire exit ways clear and available at all times for their intended use.

- a. Do not use these areas for parking, staging or storage without Owner's written approval.
 - b. Coordinate with Owner, and provide alternate routes for public and Owner access if normal routes are affected.
- 6. Do not encumber site with equipment, materials or vehicles.
 - 7. Return improvements on, or about, site and adjacent property which are not shown to be altered, removed or otherwise changed; to conditions which existed previous to starting performance under Contract.
- C. Use of Facilities:
- 1. Limit use and operation within existing facilities to areas indicated for construction Work and as required to perform Work.
 - 2. Areas within facility shall not be disturbed or disrupted.
 - 3. Do not to interfere or inconvenience public, staff and Owner's operation.
 - 4. Maintain and keep clear required fire exit ways throughout facility within and in vicinity of construction areas.
 - 5. Coordinate alternate temporary egress routes with Owner and Local Fire Authority.
 - 6. Do not load structure with weights that will endanger structure.
 - 7. Smoking is prohibited within facilities and on Owner's property.
 - 8. Audio devices and radios are prohibited, except two-way radios needed for Contractor's operations.
 - 9. Limit use of two-way radios within occupied facilities, so not to disrupt occupants.
 - 10. Use of toilet facilities, washrooms, and telephones within existing facility or occupied areas is not allowed without Owner's written approval.
 - 11. Elevators in existing facility or within occupied areas of addition may not be used by construction personnel without Owner's written approval and such use shall meet following conditions:
 - a. Protect and maintain system and finishes during use.
 - b. Repair or replace any damaged components of system and finishes.
 - c. Clean finishes.
 - 12. Cafeteria and dining areas may not be used by construction personnel without Owner's consent.
 - 13. Clothing with derogatory depictions, language, or slogans which are racial or sexual in nature, shall not be worn on premises.
 - 14. Clothing with depictions, language, or slogans regarding alcohol or drugs shall not be worn on premises.
 - 15. Derogatory language or graphic display of artifacts which are racial, sexual or religious in nature, shall not be used on premises.
 - 16. Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 17. Maintain existing building in weather tight condition throughout construction period.
 - 18. Repair damage and leaks caused by construction operations.
 - 19. Protect building and its occupants during construction period.
 - 20. Keep noise to a minimum in construction operation.
 - 21. Jack hammer will not be permitted to use within existing building without Owner's consent.
- D. Limit Use of Site and Premises to Allow:
- 1. Owner occupancy.
 - 2. Work by Others.
 - 3. Use of site and premises by public.

1.4 WORKING DAYS AND HOURS

- A. Days: Monday through Friday
- B. Hours: 6 AM to 7 PM.
- C. Work performed during Holidays or other than normal working days or hours shall be scheduled in advance with, and approved by Owner.

1.5 DIRECTED PREMIUM TIME

- A. Actual premium wages paid for original contract Work directed by Owner to be performed other than normal working hours, including; social security taxes, unemployment insurance, and union fringe benefits if required by union agreements; to be without overhead and profit mark-ups.
 - 1. Owner approved scheduled utility line tie-in or shutdown affecting building operation that is not allowed to be completed during normal working hours shall be completed on premium time basis.

1.6 WORK SEQUENCE

- A. Coordinate operations and construct Work in stages to accommodate Owner's occupancy requirements during construction period:
 - 1. [Stage] [Phase] 1: ____.
 - 2. [Stage] [Phase] 2: ____.
 - 3. [Stage] [Phase] 3: ____.

1.7 OWNER OCCUPANCY

- A. Perform Work within existing building. Each Contractor will have access to areas in which work occurs, subject to rights of Owner.
- B. Owner will occupy existing building during life of this contract.
- C. Schedule work at such time and in such a manner to minimize interference and inconvenience to public, staff and Owner's operations.
- D. Obtain approval of Owner prior to commencement of work within existing area of building.
- E. Area immediately surrounding all areas of Work shall be protected from danger of materials being dropped or dislodged.
- F. Carry out Work in a manner that does not impose hardship, danger, or inconvenience to public or staff.
- G. Prior to commencement of Work, Contractor and Owner shall jointly survey construction site and surrounding areas, making permanent record of such existing damage as cracks, malfunctioning utility equipment and fixtures, or other similar damage.
 - 1. This record shall serve as a basis for determination of subsequent damage to these structures and adjacent areas due to Contractor's operations.
- H. Report damage to structures and adjacent areas not noted in original survey to Owner.
- I. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- J. Schedule work to accommodate this requirement.

1.8 DISRUPTION OF EXISTING SERVICES

- A. Plan Work to minimize shutdown time of service.
 - 1. Request approval of a utility or equipment shutdown in writing to Owner not less than seven (7) working days before time shutdown is desired.
 - 2. Provide Owner an estimate of duration of shutdown and how facility is going to be affected.
 - 3. Coordinate with Owner's building engineering staff in advance of any shut down.
 - 4. Begin work only after engineering staff is fully informed and has agreed to schedule of shut offs.
 - 5. Do not cut into existing services without first verifying with Owner that service has been correctly identified and shut off.
 - 6. Operation of existing valves, switches, etc., to affect service shutdown will be completed by Owner, unless arranged otherwise.
- B. Limit duration of each such disruption of service to maximum of 4 HRS or as approved by Owner.

- C. Fabricate and install interconnecting portions of these systems prior to shut down for final connections.
- D. Maintain utilities or other service, indicated to be abandoned, in service or provide alternate means of service until new facilities are provided, tested, and put in operation.
- E. Maintain fire protection and fire alarm systems operational within existing facilities.
- F. Review existing conditions, drawings and other documents for proper coordination between new and existing construction.
- G. Active utilities whose locations are unknown to Owner but suspected to exist.
 - 1. Exercise caution of their existence. If encountered report to Owner for direction.
- H. Repair or replace to original conditions damage to existing structures, utilities and other items caused by Contractor's operations at Contractor's expense.

END OF SECTION

SECTION 01 21 13
CONTINGENCY ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Contingency Allowance is established to account for portions of Work that were not fully coordinated, incorporated, or documented in the Contract Documents prior to the award of contract. In some cases, items may have been deferred to a later date when additional information is available.
- B. Contingency Allowance is for exclusive use of Owner and Architect for changes as a result of design refinements, clarifications, inconsistencies, errors, omissions, and unanticipated design issues.
 - 1. Not for Contractor's unknown or unanticipated conditions or Owner's scope changes.
 - 2. Not for use by Contractor as Contractor's construction contingency.
 - 3. Not for Owner scope changes.
 - 4. Owner and Architect approval of contingency adjustment required prior to withdrawing funds from Contingency Allowance.
 - 5. Contingency adjustments will include Sub Contractor's related costs, and reasonable overhead and profit as stipulated in Contract Documents.

1.2 ALLOWANCE

- A. Contingency Allowance:
 - 1. Contractor shall include in Contract Sum the Contingency Allowance, inclusive of all General Condition costs to cover work to be performed through the Contingency Allowance, including but not limited to: Insurance, bond, trailer rental, copy fees, office supplies, temporary power, equipment, accounting, On Site Staff, dumpsters, layout, safety, etc.
 - a. Allowance shall cover cost to Contractor of materials and equipment delivered at site and all required taxes, less applicable trade discounts.
 - b. Contractor's costs for unloading and handling at site, labor, installation costs and other expenses may be included in the allowance.
 - c. In the event that the General Contractor is either self performing a portion of the work or procuring material directly related to said work, costs may be submitted for the tradesman and/or material needed. No General Contractor General Condition costs, including but not limited to: Insurance, bond, trailer rental, copy fees, office supplies, temporary power, equipment, accounting, On Site Staff, dumpsters, layout, safety, etc., will be allowed to be billed
 - 2. The Contractor shall submit a Contingency Allowance Authorization form for costs associated with work not required by the contract documents.
 - a. The authorization to deduct funds from the allowance must be approved by the Owner and Architect by signature of the Contingency Allowance Authorization form.
 - b. Once approved, the Contractor may request payment in the Monthly Application for Payment for specific items approved.
 - c. Subcontractor overhead costs will be allowed in the Contingency Allowance Authorization. General contractor costs are not allowed since the amount of the allowance is already included in the contract sum as noted in Paragraph 1.2.A.
 - d. Any unused amount from the contract sum will be deducted from the contract sum prior to final payment, along with the percentages of over head, profit, and general conditions.

3. Allowance Amount
 - a. Include in the contract sum \$250,000.00 for minor changes in the work authorized by the Owner.

END OF SECTION

CONTINGENCY ALLOWANCE AUTHORIZATION FORM

CAA No.: _____

The Contractor shall furnish all labor and materials for the revision clarifications to the contract documents as follows:

Amount requested by this authorization (Attach back-up documentation)	\$ _____
Original Allowance Total	\$ 135,000.00
Plus/Less previous Authorization Requests approved for payment	\$ _____
Plus/Less this Authorization	\$ _____
Remaining in Contingency Allowance	\$ _____

The Contingency Allowance Authorization referenced above is approved to be funded from the allowance included in the contract sum.

Owner Signature: Construction Manager Agent

Architect:

Owner Signature: Purchasing.

Contractor

cc: Beth Fleming, DeWayne Snider, Jack Adger

END OF FORM

SECTION 01 22 00
UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Unit Price is an amount proposed by bidders, stated on Bid Form, as a price per unit of measurement for materials or services added to or deducted from Contract Sum by appropriate modification, if estimated quantities of Work required by Contract Documents are increased or decreased.
- C. Contractor to take all measurements and compute quantities.
 - 1. Assist by providing necessary equipment, workers, and survey personnel as required.
 - 2. Owner will confirm in field the Contractor's measurement of work-in-place that involves use of established unit prices.
 - 3. If disputes arise, Owner reserves the right to have this work measured, at Owner's expense, by independent surveyor acceptable to Contractor.

1.2 UNIT QUANTITIES SPECIFIED

- A. Quantities indicated in Bid Form are for bidding and contract purposes only.
- B. If actual work requires more or fewer quantities than those quantities indicated, provide required quantities at unit sum/prices contracted.
- C. If quantities originally contemplated are materially changed in a proposed change so that application of such unit prices to quantities of Work proposed will cause substantial inequity to Owner or Contractor, the applicable unit prices shall be equitably adjusted.

1.3 MEASUREMENT OF QUANTITIES

- A. Measurement of Weight:
 - 1. Concrete reinforcing steel, rolled or formed steel or other metal shapes shall be measured by handbook weights.
 - 2. Welded assemblies shall be measured by handbook or scale weight.
- B. Measurement by Volume:
 - 1. Measured by cubic dimension using mean length, width and height or thickness.
- C. Measurement by Area:
 - 1. Measured by square dimension using mean length and width or radius.
- D. Linear Measurement:
 - 1. Measured by linear dimension, at item centerline or mean chord.
- E. Stipulated Sum/Price Measurement:
 - 1. Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of work.

1.4 PAYMENT

- A. Payment Includes:
 - 1. Full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection application or installation of an item of work; overhead and profit.
- B. Final payment for work governed by unit prices will be made on basis of approved measurements and quantities, multiplied by unit sum/price for work which is incorporated in or made necessary by the work.

1.5 UNIT PRICES

- A. Unit Price No.1: Additive or deductive cost per lineal foot for providing and installing additional or less piling, in place, in accord with Section 31 63 16.
- B. Unit Price No.2: Additive or deductive cost per cubic yard for providing additional caisson volume, in place, in accord with Section 31 63 29.
- C. Unit Price No.3: Additive cost per cubic yard for removal of unsuitable subgrade material and replacement with suitable compacted backfill in accord with Section 31 23 00.
- D. Unit Price No.4: Additive and deductive cost to install or delete data drops including all conduit, faceplates, up to 295 FT of cable, CAT6 inserts, F-connectors, labeling and testing.
 - 1. Type 1: Work Area Outlet - three CAT6 data cables (white or blue CAT6 cabling).
 - 2. Type 2: Work Area Outlet – two CAT6 cables (white or blue CAT6 cabling)
 - 3. Type 3: Work Area Outlet / Telephone Outlet – one CAT6 data cable (white or blue CAT6 cabling)
 - 4. Type 4: Work Area Outlet / Coax Cable Outlet – one CAT6 data cable and one RG6 Quadshield coax cable (blue CAT6 cable, blue coax cable)
- E.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 23 04
CHANGES IN WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section defines administrative and procedural requirements for handling and processing Changes in Work.
- B. Provisions within this section take precedence over provisions in General Conditions governing Changes in Work.
- C. Provisions followed by an asterisk (*) include some or all provision as obtained from AIA Document A201- General Conditions of the Contract for Construction.

1.2 DESCRIPTION

- A. Changes in Work may be accomplished after execution of Contract, and without invalidating Contract, by Change Order (CO), Change Proposal Request (CPR), Construction Change Directive (CCD), Contingency Allowance Authorization (CAA) (see specification section 01 21 13) or order for a minor change in Work, subject to the limitations stated in this Section and elsewhere in Contract Documents. *
 - 1. A Change Order or Change Proposal Request shall be based upon agreement among Owner, Contractor and Architect.*
 - 2. A Construction Change Directive requires agreement by Owner and Architect and may or may not be agreed to by Contractor.*
 - 3. A Contingency Allowance Authorization requires agreement among Owner, Contractor and Architect.
 - 4. An order for a minor change in Work may be issued by Architect alone. *
- B. Changes in Work shall be performed under this Section and other applicable provisions of Contract Documents, and Contractor shall proceed promptly, unless otherwise provided in a Change Order, Change Proposal Request, Construction Change Directive, Contingency Allowance Authorization, or order for a minor change in Work. *
- C. Contractor may anticipate a minimum of Forty (40) change documents being issued during Project duration: however such quantities shall not guarantee nor limit total quantity of changes.
- D. Manage changes issued so as not to adversely affect Project Schedule.
- E. Neither Owner nor Architect recognize “reservation of rights” or similar language from Contractor that would state or purport to preserve ability to make additional claims or demands related to a change, not in conformance with terms and provisions provided by Contract Documents.
 - 1. Claims or other demands for changes, compensation or an extension of time must be made in strict conformance with the provisions of Contract Documents.
 - 2. Agreement on any Change Order, Construction Change Directive or Change Proposal Request shall constitute a final settlement of the event and all matters related thereto.
 - 3. Contractor waives and releases Owner and Architect of direct material costs, labor costs, equipment costs, overhead and profit, costs or losses due to productivity loss, morale, attitude, staffing changes, supervision, acceleration, delay, interference, logistics, fatigue, ripple effect, overtime, time extensions related to costs, and other costs related to any change that are not expressly included in an agreement on any Change Order, Change Proposal Request, Contingency Allowance authorization, or Construction Change Directive.
- F. Verbal or other informal orders provided by Owner or Architect should be considered as temporary or emergency instructions.

1. Verbal or other informal orders shall be formally documented, using one of procedures indicated in this Section. This includes email which is considered to be Informal instruction.
 2. Should Contractor choose to proceed with any verbal or informal instructions, Contractor does so at their own risk.
 3. Should Contractor not receive written verification of verbal or informal instructions in a timely manner, Contractor should request verification using Request for Information (RFI) process.
 4. Contractor shall not proceed with verbal or informal instructions which may result in a change to Contract Sum or Contract Time, until an approved Change Order or Change Proposal Request is received.
- G. Incorporate approved changes in Project Record Documents and Construction Schedules for Project.
1. Submit revised schedules for Project to Owner and Architect.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CHANGE ORDERS*

- A. A Change Order (CO) is a written instrument prepared by Architect and signed by Owner, Contractor and Architect, stating their agreement upon following:
1. Change in Work,
 2. amount of adjustment, if any, in Contract Sum, and
 3. extent of adjustment, if any, in Contract Time.

3.2 CHANGE PROPOSAL REQUEST

- A. Change Proposal Request (CPR) is prepared and initiated by Architect at Owner's request or may be issued in response to an Request for Information which has a cost or time impact, or some other required or desired change in the Work that may require an adjustment to Contract Sum or Contract Time.
1. Change Proposal Requests will include a description of proposed change and may include supplemental or revised Drawings and Specifications, or written instruments prepared by Architect.
 2. Initiation and issuance of a Change Proposal Request is not direction to either stop Work in progress or to proceed with change.
 3. Upon receipt, Contractor and Subcontractors shall review and evaluate scope of change, and potential impact on Project.
 - a. If potential impact to schedule, Contractor shall immediately initiate and forward Change Proposal Impact Evaluation to Owner for processing.
 - b. If potential impact, Owner may direct Contractor to stop Work in area affected by change to minimize cost impact, or may issue a Construction Change Directive directing Contractor to proceed with change.
 4. Evaluate Subcontractor's cost proposals, make recommendations and submit proposal to Architect on CPR form issued by Architect within twenty-one (21) days of receipt so not to delay progress of Project.
 - a. Proposals shall include Contractor's Cost Summary form from Contractor and each Subcontractor with complete itemized accounting, together with appropriate supporting data to substantiate adjustments in Contract Sum and Contract Time, including labor, materials and equipment.
- B. Method used to determine an adjustment in Contract Sum shall be limited to following:
1. Labor Wages:
 - a. Itemized by each craft involved, indicating hourly rate for each and hours required, excluding premium pay, paid to employees directly engaged in Work.

- b. Rates shall be actual rate paid the workman in accordance with established management labor agreements.
 - c. Labor rates indicated in Contractor Agreement or Subcontractor Agreements are not applicable if they cannot be substantiated in writing as direct labor burden when requested by Owner or Architect.
2. Labor Burden:
 - a. Percent of actual wages for each craft including:
 - 1) Mandatory fringe benefits required by established agreements.
 - 2) Health and Welfare.
 - 3) Pension.
 - 4) Apprenticeship and other required programs.
 - 5) Social Security.
 - 6) Unemployment Insurance.
 3. Subsistence, Mileage, or both:
 - a. If in union agreements.
 4. Materials and Equipment: Materials incorporated in Work at Contractor's actual invoice cost, including freight.
 5. Amount of credit allowed for a deletion or change which results in net decrease in Contract Sum shall be net cost.
 - a. When both additions and credits covering related Work or substitutions are involved in a change, allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.
 6. Overhead and Profit:
 - a. Fifteen percent (15 PCT) of net increase of labor and material for work performed by own forces including, but not limited to:
 - 1) Project Manager.
 - 2) Estimating.
 - 3) Field supervision above foremen level superintendents.
 - 4) Assistant superintendents.
 - 5) General foremen.
 - 6) Engineers.
 - 7) Accountants.
 - 8) Timekeepers.
 - 9) Office managers and others on staff.
 - 10) Office supplies.
 - 11) Computers and software.
 - 12) Drinking water.
 - 13) Temporary heat.
 - 14) Temporary cooling.
 - 15) Light and power.
 - 16) Sanitation facilities.
 - 17) Small tools valued at \$500 or less.
 - 18) Record documents; and other
 - 19) Cost of materials, equipment or both not incorporated in Work or directly associated with Work, including home office and on site office costs.
 7. Directed Premium Time on Contract Work:
 - a. Actual premium portion of wages for original contract Work which was directed by Owner to be performed other than normal working hours, including:
 - 1) Social Security Taxes.
 - 2) Unemployment Insurance.
 - 3) Union Fringe Benefits if required by Union Agreements.
 8. Major Construction Equipment:
 - a. Owned:
 - 1) Cost not to exceed eighty-five percent (85 PCT) of current prevailing rates or blue book rates for rental of appropriate equipment for job and time period of use.
 - b. Leased:

- 1) Contractor's reasonable invoiced cost, except lease-purchase equipment which is considered "Contractor owned".
9. Contractor's overhead and profit on Subcontractor's Work:
 - a. Contractor's overhead and profit on Subcontractor's Work shall not exceed five percent (5 PCT) on net increase of Work performed by Subcontractor.
10. Subcontractor overhead and profit markup is not allowed on their Sub-subcontractor's Work.
11. Subcontractor Cost:
 - a. Quote in same manner as prescribed herein for "Contractor".
12. Bond and Insurance:
 - a. Actual amount based on net increase or deduct to be paid to surety and insurance carrier.
- C. Only delay impacting critical path of Work shall be considered when determining if Contractor is entitled to additional time.
 1. If proposals include a change in time, Contractor shall substantiate number of days proposed.
 - a. An estimate of cost and of probable effect of delay of the Work progress and Project schedule shall be included to substantiate potential delay, including a comparison of Project Construction Schedule and schedules prepared to substantiate a change in time.
 - b. Indicate in CPM format both critical and non-critical path activities affected, and show Project Construction Schedule and change sequences, durations and float.
- D. Owner shall have right within its sole discretion to require Contractor to commence performance of changes to Work prior to submission by Contractor of proposal, or Owner's approval of proposal.
 1. Proceed with Work upon receipt of a Construction Change Directive from Owner, and thereafter submit to Owner and Architect as soon as possible any cost proposal required for approval.
- E. Change Proposal Request signed by Contractor and Owner indicates agreement therewith, and shall be considered a Change Order.
 1. Contractor is authorized to proceed with the change after Owner approval thereof.
- F. Construction Change Directive may be prepared if Contractor's proposal is not acceptable or change need be expedited to reduce or eliminate impact on project.

3.3 CONSTRUCTION CHANGE DIRECTIVES

- A. Written order prepared by Architect or Owner and signed by Owner, directing a change in Work prior to agreement on adjustment, if any, in Contract Sum, Contract Time, or both.
- B. Owner may by Construction Change Directive, without invalidating Contract, order changes in Work within general scope of Contract consisting of additions, deletions or other revisions, Contract Sum and Contract Time being adjusted accordingly.*
- C. Construction Change Directive may be used in absence of total agreement on terms of a Change Order or Change Proposal Request.*
- D. If Construction Change Directive provides for an adjustment to Contract Sum, the adjustment shall be based on one of following methods: *
 1. Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation, *
 2. Unit prices stated in Contract Documents or subsequently agreed upon, *
 3. cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee,
 4. or as provided in Paragraph 3.2 B and C.
- E. Upon receipt of a Construction Change Directive, proceed with change in Work involved and advise Owner and Architect of Contractor's agreement or disagreement with method, if any,

provided in Construction Change Directive for determining proposed adjustment in Contract Sum or Contract Time.*

- F. Failure of Contractor and Owner to agree on an adjustment of Contract Sum or Contract Time shall not excuse Contractor from proceeding with prosecution and performance of Work. Contractor and Subcontractors, Sub-subcontractors and Suppliers shall administer all disputes in a manner that will permit Work to proceed on schedule while matter in dispute is being resolved.
- G. Construction Change Directive signed by Contractor indicates agreement of Contractor therewith, including adjustment in Contract Sum and Contract Time or method for determining them.
 - 1. Such agreement shall be effective immediately and shall be recorded as a Change Order.*
- H. The amount of credit allowed by Contractor to Owner for a deletion or change which results in a net decrease in Contract Sum shall be actual net cost.*
 - 1. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on basis of net increase, if any, with respect to that change.*
- I. Present an itemized accounting together with appropriate supporting data in accordance with Paragraph 3.2 B and C.
- J. When Owner and Contractor reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.*
- K. For any portion of such cost that remains in dispute, Owner shall hire independent professional estimator to make determination. Resulting determination of cost shall adjust Contract Sum, subject to right of either party to disagree and assert a claim.*
- L. When Owner and Contractor agree with determination made by independent professional estimator concerning the adjustments in Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.*

3.4 MINOR CHANGES IN WORK

- A. Architect has authority to order minor changes in Work not involving adjustment in Contract Sum or extension of Contract Time and not inconsistent with the intent of Contract Documents.*
- B. Such changes shall be effected by written order and shall be binding on Owner and Contractor.*
- C. Following may be used as a written order to order minor change in the Work:
 - 1. Clarification-Interpretation (C-I) or Architect's Supplemental Instruction (ASI) issued by Architect.
 - 2. Response to a Request for Information by Architect.
 - 3. Architect's comments or direction on a Contractor's Submittal.
 - 4. Minor changes indicated in Architect's project visit report.
- D. Contractor shall carry out such written orders promptly. *
- E. If Contractor perceives direction in a written order requires adjustment to Contract Time or Contract Sum, Contractor shall not execute such direction, and shall submit a claim to Architect along with substantiation within twenty-one (21) working days of receipt of such written order.

3.5 CONTRACTOR'S PROPOSED CHANGES TO WORK

- A. Architect and Owner may consider properly prepared, timely Contractor Proposed Changes (CPC) to Work, if requested by Owner or Architect, or at any time Contractor believes unforeseen conditions may require modifications to the Contract Sum or Contract time.
 - 1. A Contractor Proposed Change shall be properly prepared, accompanied by proposed cost, sufficient supporting data and information to permit Architect to make a reasonable

determination without extensive investigation to determine if change may be considered warranted.

- a. Include a statement outlining reasons for change and effect of change on Work.
 - b. Provide a complete description of proposed change.
 - c. Indicate effect of proposed change on Contract Sum and the Contract Time.
 - d. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made.
 - 1) Indicate separately any credit due Owner for products eliminated.
 - 2) If requested, furnish survey data to substantiate quantities.
 - e. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - f. Include costs of labor and supervision directly attributable to change and identify separately any credit for work previously bid but would be eliminated.
 - g. In event proposed change effects construction schedule, include an updated Contractor's Construction Schedule indicating effect of change, including, but not limited to:
 - 1) Changes in activity duration.
 - 2) Start and finish times.
 - 3) Activity relationship.
 - 4) Use available total float before requesting an extension of Contract Time.
 - 5) Document use of float or proposed alternate methods to maintain original schedule or both.
2. Contractor Proposed Change shall be submitted to Architect in such format and on such form included herein or as Architect may require.
- B. Architect will take appropriate action on Contractor Proposed Changes.
1. Architect may issue an order for a minor change in Work if it is determined that proposed change is not materially different from requirements of Contract Documents.
 2. Architect may incorporate proposed change into a change document and issue for Owner's consideration.
 3. If Architect determines that implementation of proposed change would result in a material change to Contract that may cause an adjustment in Contract Time or Contract Sum, Architect may make a recommendation to Owner who may authorize further evaluation of proposed change or may authorize issuance of such change.
 4. Architect may reject such proposed change if it will require substantial revisions to Contract Documents, building or systems or if Architect determines they are not appropriate or substantiated.

END OF SECTION

CONSTRUCTION CHANGE DIRECTIVE

TO CONTRACTOR: _____

You are hereby directed to:

- Stop work in area affected by above referenced change until it has been processed and appropriate action taken.
- Proceed with above referenced change immediately.

When signed by Owner and received by CM/Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and CM/Contractor shall proceed based per above.

FROM OWNER: _____
BY: _____ DATE: _____

DISTRIBUTION: CONTRACTOR ARCHITECT _____

CONTRACTOR'S COST SUMMARY

PROJECT:

CHANGE DOCUMENT:

PROJECT NO.:

DATE:

CONTRACTOR:

DATE:

SUBCONTRACTOR:

This form, itemized accountings and appropriate supporting data must be attached to any change documents or claim.

(Only fill in applicable line items)

- | | | | |
|----|--|----------|--|
| 1. | Labor * (including benefits) | \$ _____ | (Attach Cost Summaries and breakdowns) |
| 2. | Materials and Products * | \$ _____ | (Attach Cost Summaries and breakdowns) |
| 3. | (Subtotal of lines 1 and 2) | \$ _____ | |
| 4. | Overhead and Profit (see Article 7 if agreement) | \$ _____ | |
| 5. | Premium Time on Contract Work | \$ _____ | |
| 6. | Major Construction Equipment Rental * | \$ _____ | (Shall not exceed A.E.D. Schedules) |
| 7. | Subcontractor's name and cost: | | |

(Attach Cost Summaries and breakdowns)

Work Category:

a	_____	\$ _____	_____
b	_____	\$ _____	_____
c	_____	\$ _____	_____
d	_____	\$ _____	_____
e	_____	\$ _____	_____
f	_____	\$ _____	_____
g	_____	\$ _____	_____
h	_____	\$ _____	_____
i	_____	\$ _____	_____
j	_____	\$ _____	_____
k	_____	\$ _____	_____
l	_____	\$ _____	_____
m	_____	\$ _____	_____
n	_____	\$ _____	_____
o	_____	\$ _____	_____
p	_____	\$ _____	_____
q	_____	\$ _____	_____

- | | | | |
|-----|---|----------|--|
| 8. | Total Subcontractor cost (total of lines 7a through 7q) | \$ _____ | |
| 9. | Contractor's O & P on Sub's. Work (5 PCT of line 8) | \$ _____ | |
| 10. | (Subtotal of lines 3, 4, 5, 6, 8 and 9) | \$ _____ | |
| 11. | Bond ____% and Insurance ____% (if required) = ____% of line 10 | \$ _____ | |

12. **TOTAL PROPOSED COST ADJUSTMENT** (total of lines 10 and 11): \$ _____

13. **PROPOSED CONTRACT TIME ADJUSTMENT :** _____ ADD DEDUCT (calendar days)
 (Provide supportive data substantiating claim for additional days in accordance with Contract Documents)

* Attach complete breakdown of itemized accounting and supporting data, sufficient to permit evaluation.

SECTION 01 25 13
SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT

PART 1 - GENERAL

1.1 DEFINITION

- A. Acceptable Manufacturers and Products: See Section 01 61 00.
- B. Products proposed by Contractor that do not meet requirements of Contract Documents, whether in product characteristics, performance, quality, or manufacturer or brand names, is considered a substitution.
- C. No substitutions will be considered:
 - 1. In case of non-availability of materials contact Architect for review and action.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SUBSTITUTION REQUEST

PROJECT: _____

PROJECT NUMBER: _____ REQUEST NO.: _____

TO: Office of the Architect:
HDR Architecture, Inc.

Attention: _____

SPECIFIED PRODUCT:

Substitution request for: _____

Specification Section number: _____

Article(s)/paragraph(s): _____

REASON FOR SUBSTITUTION: Non-availability due to:

- Strike
- Lockout
- Bankruptcy
- Discontinuation of Production
- Proven Shortage (Explain)
- Similar Occurrence (Explain)
- Fails to comply with building code requirements
- Unavailable to meet Project schedule
- No qualified installer for specified item
- Supplier refuses to warrant item or installation
- Supplier, Subcontractor or Contractor convenience
- Other:
- Not available
- Reduce Project construction time
- Project cost savings
- Unsuitable for application
- Constructability issue

Explanation in Detail: See attached: _____

REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS: See attached:

SUPPORTING DATA:

Attach product description, Specifications, Drawings, photographs, performance data, test data, environmental criteria, and any additional data or information for evaluation of the proposed substitution in accord with requirements of Section 01 25 13.

Sample is attached: Yes No

Sample will be sent if requested: Yes No

Maintenance Service Available: Yes No

 If yes, location: _____

 Spare Parts Source: _____

PRODUCT / SYSTEM COMPARISON:

Provide a one-to-one comparison of proposed substitution with ALL specified attributes and qualities of specified item(s)

	SPECIFIED PRODUCT	PROPOSED SUBSTITUTION
Manufacturer:		
Name, brand:		
Catalog No.:		
Unit Cost:		
Attributes /		
Qualities /		
Variations /		
Warrantee /		
etc:		

REFERENCES:

LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

REFERENCES:

LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

EFFECT OF SUBSTITUTION:

Substitution affects other parts of Work: No Yes (If yes, explain below)
Substitution requires dimensional revision or redesign of structure or mechanical and electrical Work: No Yes (If yes, explain below)
Same warrantee provided as specified base product: No Yes (If no, explain below)

Explanation: _____

Cost difference: \$ _____ (add / deduct).
Total cost implications of substitution on Project: \$ _____ (add / deduct).
Total time implications: \$ _____ (add / deduct) calendar days.

STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS:

Supplier, Subcontractor and Contractor in making substitution request or in using an approved substitution represent:

- Has personally investigated the proposed substitution and determined it is equal or superior in all respects to specified product or system and will perform intended function, except as stated above.
- Is in full compliance with applicable code requirements.
- Will provide same warranty for substitute item as for product, system or method specified.
- Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
- Waive all claims for additional costs or time extensions related to substitution that subsequently become apparent or are caused by substitution.
- If a finish product, color wise and pattern wise complies with base specified items.
- Certifies cost data presented is complete and includes all related costs under this Contract, excluding Architect’s review and redesign cost.
- Will pay Architect’s review and redesign cost, special inspections, and other costs caused by substitution.
- Will pay additional costs to other contractors caused by substitution.
- Will modify other parts of Work as may be needed, to make all parts of Work complete and functioning.
- Acknowledge acceptance of these provisions.

List of Attachments: _____

ACKNOWLEDGEMENTS:

FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF CONTRACT DOCUMENTS:

Requested by (firm): _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____ Phone _____

Subcontractor: _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____ Phone _____

Contractor: _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____ Phone _____

CONSTRUCTION MANAGER'S ACKNOWLEDGMENT AND RECOMMENDATION:

- Recommend approval for following reasons:
- Do not recommend approval for following reasons:
- Returned to requester - Need more information:

Comments: _____

Construction Manager: _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____

Distribution: Architect file

ARCHITECT'S ACTION / RECOMMENDATION:

- Recommend Owner's approval.
- Submitted to Owner for authorization for Architect's as Change in service to further evaluate and make recommendation.
- Do not recommend (see comments below).
- Rejected:
 - Submitted after stipulated time period.
 - Not submitted in accordance with Section 01 25 13.
 - Acceptance will require substantial revision of Contract Documents, building or systems.
 - Request does not indicate specific item which is being requested.
 - Requested for manufacturer acceptance only.
 - Request form is not properly executed and signed.
 - Subcontractor or supplier requested directly.
 - Insufficient information submitted.
 - Does not comply color wise or pattern wise with base specified items.
 - Insufficient information submitted to evaluate.
 - Does not appear to comply with requirements of specifications for base product.
 - Other:
- Additional information needed - Returned to CM/Contractor for providing following:

Comments:

Architect:

By (print & sign):

Date:

Position:

Distribution: Owner CM/Contractor file

OWNER ACTION:

- Reject - Do not want to consider.
- Approved - Contractor may proceed with request as submitted.
- Approved – Architect directed as Change in Services to issue change document to incorporate substitution into contract Documents, adjust Contract Sum and/or Project time.
- Architect authorized as Change in Services to further evaluate and make recommendation.
- Additional information needed - Returned for providing following:

Comments:

Owner:

By: (print & sign) _____ Date: _____

Position: _____

Distribution: Architect CM/Contractor

ARCHITECT FURTHER ACTION / RECOMMENDATION (if needed):

- Incorporating into change document _____ as directed by Owner.
- Recommend Owner’s approval.
- Do not recommend.

Comments:

Architect:

By: (print & sign) _____ Date: _____

Position: _____

Distribution: Owner CM/Contractor file

OWNER FURTHER ACTION (if needed):

- Reject - Do not want to consider.
- Approved - Contractor may proceed with request as submitted.
- Approved – Architect directed as Change in Services to issue change document to incorporate substitution into contract Documents, adjust Contract Sum and/or Project time.
- Additional information needed - Returned for providing following:

Comments: _____

Owner: _____

By: (print & sign) _____ Date: _____

Position: _____

Distribution: Architect CM/Contractor file

END OF SUBSTITUTION REQUEST

SECTION 01 26 13
REQUESTS FOR INFORMATION (RFI)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section specifies administrative and procedural requirements for handling and processing Requests for Information (RFI).
- B. RFI is intended for requesting clarifications and interpretations of Contract Documents due to inconsistencies, errors or omissions in Contract Documents, and unanticipated existing conditions.
- C. RFI is not intended for general communication, requesting substitutions, Contractor's proposed changes, resolution of nonconforming work, and coordination between contractors or for general questions not related to Contract Documents.
- D. RFI process is a cooperative enterprise between Architect and Contractor to expedite RFI response and maintain progress of Work.
- E. Architect shall evaluate alternate proposed methods of processing RFI's to that indicated within this Section for potential impact on Architect's services.
 - 1. If Architect agrees to utilize another proposed method, Architect will be reimbursed for any special training, usage fees, extra time required to implement, maintain, utilize and administer such a system.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 REQUESTS FOR INFORMATION

- A. Review of Contract Documents and Field Conditions:
 - 1. Contract Documents are complementary. Before starting each portion of Work, Contractor shall carefully study and compare various Drawings, Specifications and other Contract Documents, coordination drawings, shop drawings, prior correspondence or documentation relative to that portion of Work, as well as information furnished by Owner.
 - 2. Contractor and Subcontractors shall evaluate and take field measurements of conditions related to that portion of Work and shall observe any conditions at site affecting it.
 - 3. These obligations are for purpose of facilitating coordination and construction by Contractor and are not for purpose of discovering errors, omissions, or inconsistencies in Contract Documents.
 - 4. Contractor and subcontractors acknowledge that all documents pertaining to Work has been examined, have examined character of site and any existing conditions, and are satisfied with nature of Work, and other matters which can affect Work.
 - 5. In event of inconsistency between portions of Contract Documents or within Contract Documents; provide better quality or greater quantity of Work, and comply with more stringent requirement, either or both in accordance with Architect's interpretation.
 - 6. Report errors, inconsistencies or omissions discovered in Contract Documents promptly to Architect as a properly prepared and timely RFI.
 - 7. Contractor and Subcontractors are not required to ascertain Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, and rules and regulations, unless they bear upon construction means, methods, techniques or safety and health precautions, but the Contractor shall promptly report to Architect any nonconformity discovered by or made known to Contractor as a RFI.

8. On condition that Contractor or Subcontractor fail to give such notice, and knowingly proceeds with Work affected by errors or omissions in Contract Documents, Contractor shall correct any such errors, inconsistencies, or omissions at no additional cost.
 9. Prior to bid, Contractor shall review existing facilities related to this contract and shall be familiar with utility requirements and construction.
 - a. Existing facility documents may be available through Owner for review.
 - b. Perform preliminary investigations as required to ascertain extent of Work.
 - c. Conditions which would be apparent by such investigation will not be allowed as cause for claims for extra costs.
- B. Contractor's and Subcontractor's Responsibilities:
1. Process request through Contractor when interpretation, clarification or explanation of portion of Construction Documents is needed by Contractor, Subcontractor, Vendor or Supplier.
 - a. Review request for completeness, quality, proper referencing to drawing or specification section and reason submitted.
 - b. In event request is not acceptable return to submitter with comments regarding reason for being returned.
 - c. Make every attempt to validate, resolve or respond to RFI by thoroughly researching and reviewing Contract Documents and field conditions.
 - d. Respond to RFI accordingly if review of RFI discloses a response or is related to coordination of construction or other issue not related to Contract Documents.
 - e. If request is unclear, rewrite and state in clear, concise, correct, complete and easily understood manner.
 - 1) Include additional information if necessary, and submit to Architect for response.
 2. Submit request for interpretation, clarification or explanation of Contract Documents to Architect through Contractor.
 - a. List specific Contract Documents researched when seeking information being requested.
 - b. Reference applicable Contract Drawings by sheet number, section, detail, room number, door number, etc., Specifications by section and paragraph number, and reference other relevant documents.
 - c. The field titled "Regarding" on attached RFI form must be clear for future reference in reports or correspondence.
 - d. Clearly state request and provide Contract Document references and any additional information needed so request can be fully understood, including sketches, photos or other reference material.
 - e. Fully assess issues, suggest any reasonable solutions and include various factors, including potential costs, schedule impacts, if any, and recommendations which will aid in determining a solution or response.
 - 1) In event a reasonable solution cannot be suggested, a statement to that effect should be so stated.
 - f. Indicate reason request is being submitted.
 - g. Clearly indicate critical RFI's requiring a rapid response with an explanation as to why RFI is critical.
 - h. Indicate priority for responses when multiple RFI's are submitted within short period of time.
 3. Distribute copies of responses to RFI's to all parties affected.
 4. Response to RFI shall not be considered a notice to proceed with a change that may revise the Contract Sum or Contract Time, unless authorized by Owner in writing.
 5. In event response to RFI is determined incomplete, resubmit with explanation for unacceptability of response and necessary additional information within five (5) days of receipt to RFI response.
 6. On condition Contractor determines or believes additional cost or time is involved due to clarifications, interpretations or instructions issued by Architect in response to a RFI,

resubmit RFI within five (5) days of receipt of response with reason and alternate solution or suggestion for performing work at no additional cost.

- a. In event no other solution is possible or desirable, submit Claim in accordance with Contract Documents within twenty-one (21) days of receipt of response to RFI.

C. RFI Submittal Process:

D. RFI Submittal Format:

1. Submit request for information to Architect on RFI form provided at end of this section, form provided by Architect in electronic text file format, or in similar format acceptable to Architect.
 - a. Electronically complete and email RFI form to Architect's designated representative in text file format.
 - b. Attachments shall be in electronic text or PDF file format.
 - c. Photo attachments may be in JPG format.

E. Architect's Response to Request for Information (RFI):

1. Clarifications, interpretations and decisions of Architect in response to RFI will be consistent with intent of and reasonably inferable from Contract Documents, in writing, and may be provided in form of drawings and other attachments, or both.
2. When making such interpretations and decisions, Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.
3. Architect's decisions on matters related to aesthetic effects will be final if consistent with intent expressed in Contract Documents.
4. Architect will not undertake to settle differences between Contractor, Subcontractors, trades suppliers, fabricator or manufacturer, or act as arbiter as to which Subcontractor, trade, supplier or manufacturer is to furnish or install various items indicated or required.
5. Architect shall provide responses to RFI's with reasonable promptness, but will endeavor to respond within twenty-one (21) days from date of receipt.
 - a. If multiple RFI's are submitted on same day or within a five (5) day period, review time may be extended by mutual agreement of parties.
 - b. Architect will provide a written response to RFI if Architect believes response only involves an interpretation, clarification, supplemental information or orders a minor change in Work not involving an adjustment in Contract Sum or extension of Contract Time, and is not inconsistent with intent of Contract Documents, and shall be binding.
 - c. If Architect believes response may result in a change to Contract Sum or Contract Time, response will indicate that a change document will be issued for the response, and appropriate change document will be issued indicating changes to Contract Documents.
 - d. Architect will provide any additional or supplemental drawings, specifications or other information as Architect may deem necessary to facilitate response.
6. Architect may return RFI without response for following reasons:
 - a. Is considered a "Contractor Proposed Change".
 - b. Response is consistent with the intent of the Contract Drawings.
 - c. Request is unclear or incomplete.
 - d. Is due to Contractor's lack of adequate coordination.
 - e. Is related to construction means, methods or techniques.
 - f. Response is required by another party.
 - g. Is considered a "Substitution Request."

- F. If requested information is available from careful study and comparison of Contract Documents, field conditions, other Owner-provided information, coordination drawings, or prior Project correspondence or documentation, Architect may invoice Owner as a change in services for costs involved in Architect's review, analysis, responding and processing of such RFI.

1. Contractor shall reimburse Owner for such costs.

- G. Contractor and Subcontractors may anticipate receiving ninety (90) clarifications, interpretations, orders for Minor Changes in Work or responses to valid requests for interpretations or clarifications of Contract Documents.
- H. Construction Manager may anticipate receiving _____ () clarifications, interpretations, orders for Minor Changes in Work or responses to valid requests for interpretations or clarifications of Contract Documents.

END OF SECTION

REQUEST FOR INFORMATION

Project: _____ RFI Number: _____
Project No.: _____

To: (Architect) Action Info Pages _____
 (consultant?) Action Info Pages _____
 (other?) Action Info Pages _____

Regarding: _____
References: (List specific Contract Documents researched when seeking the information being requested) _____

Spec. No.: _____ Dwg. No.: _____

Request: (Provide complete description of request with document references and sketches or photos if necessary, and present status of work)

Requester's Recommended Solution: (If RFI concerns a site or construction condition, provide a recommended solution, including cost & schedule considerations)

Response Priority: Normal Rush (Work in progress)
Reason For Request: Existing Condition Non-conformance Clarification / Interpretation Agency Generated Other

Subcontractor: _____ Date: _____

CM/Contractor: _____

By: _____ Date: _____

Response:

END OF FORM

SECTION 01 29 00

APPLICATIONS FOR PAYMENT AND SCHEDULE OF VALUES (GC)

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Project Information:
 - 1. Submittals, prior to first application for payment:
 - a. Copy of Executed Contract.
 - b. Copy of Performance and Payment Bonds.
 - c. Schedule of Values.
 - d. Copy of Owner's Notice to Proceed.
- B. Contract Closeout Information:
 - 1. See Section 01 77 00.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SCHEDULE OF VALUES

- A. Prior to first Application for Payment, submit to Architect a Schedule of Values allocated to various portions of Work, prepared in such form and supported by such data to substantiate its accuracy as Owner and Architect may require.
- B. Subdivide into following allocated items:
 - 1. Bond.
 - 2. Insurance.
 - 3. General condition items including but not limited to:
 - a. Mobilization.
 - b. Temporary facilities.
 - c. Temporary utilities.
 - d. Submittals.
 - e. Demobilization.
 - f. Other similar general condition items.
 - 4. Phases or areas or both of building.
 - 5. Specification Sections.
 - 6. Individual components of Work, and major pieces of equipment.
 - 7. Labor amount and material or equipment amount, listed separately.
 - 8. Contract closeout items including but not limited to:
 - a. Manuals.
 - b. Spare parts.
 - c. Maintenance material.
 - d. System demonstrations.
 - e. Record documents.
 - f. Operation and maintenance data.
 - g. Other similar contract closeout items.
 - 9. Individually approved changes.
- C. Labor amount shall include all on site installation costs including labor, applicable labor taxes, insurance, fringe benefits, erection equipment, tools, overhead and profit.
- D. Material and equipment shall include all material and manufactured equipment costs including delivery costs, taxes, insurance, overhead and profit.

- E. Schedule, unless objected to by Owner or Architect, shall be used as a basis for reviewing percent complete of line items on Contractor's Applications for Payments.

3.2 WASTE MANAGEMENT PLAN

- A. Submit Waste Management data on form as specified in Section 01 74 19 - Construction Waste Management.

3.3 APPLICATION FOR PAYMENT

- A. On or before 10th day of month, Contractor submit to Architect itemized Application for Payment for work completed during previous calendar month, in accordance with schedule of values.
 - 1. Submit on AIA Document G702 - Application and Certificate for Payment, and AIA Document G703 - Continuation Sheet, or similar format acceptable to Architect.
 - a. Itemize in accordance with approved Schedule of Values, and as indicated in AIA documents.
 - b. Bond and insurance costs may be requested for payment on first application.
 - c. Equal monthly payments may be made for general conditions based upon number of months Contractor is scheduled to be on site.
 - d. May include amounts for changes in work that have been authorized by Construction Change Directives, or by Change Proposal Requests approved by Owner.
 - e. Furnish in triplicate.
 - f. Signed by duly authorized agent of Contractor.
 - g. Notarize Application for Payment.
 - 2. Furnish copies of requisitions from Subcontractors and suppliers to substantiate values.
 - 3. Shall not include request for payments for portions of Work for which Contractor does not intend to pay to a Subcontractor or supplier, unless such Work has been performed by others whom Contractor intends to pay.
 - 4. Provide additional supporting data substantiating Contractor's right to payment, as Owner or Architect may require.
- B. Application for Payment serves as certification of status by Contractor of Project.
- C. Contractor warrants that title to all Work covered by an Application for Payment will pass to Owner upon receipt of payment.
- D. Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from Owner shall, to the best of Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to Work.

3.4 PAYMENT FOR STORED MATERIAL AND EQUIPMENT

- A. Application for Payment may include materials and equipment ready, but not yet incorporated in Work, delivered, and suitably stored at site.
- B. Warranty and guarantee period does not commence until Substantial Completion of work.
- C. Payment will be treated same as "work-in-place," with evidence of delivery to job site, except that payments will not include value of labor and mark-up.
- D. Each subsequent Application for Payment will restate prior month's materials and equipment not incorporated in Work, and current month additions and deletions for materials and equipment incorporated into work. Inventory must be updated and included with each subsequent application to indicate current status.
- E. Upon making of partial payments by Owner, all materials and equipment covered thereby become sole property of Owner. Partial payments, however, do not constitute Owner's

acceptance of material, equipment or work, nor be construed as waiver of any right or claim by Owner.

F. Contractor shall be deemed as having care, custody, and control of items.

3.5 RETAINAGE

- A. Until Substantial Completion of entire project, 5 PCT retainage will be withheld from value of Work completed and material stored.
- B. Any reduction of retainage beyond that allowable by Contract Documents, and including adjustments at Substantial Completion requires Consent of Surety, recommendation of Architect, and approval of Owner prior to incorporating into an Application for Payment.
 - 1. Provide Request for Reduction of Retainage on form included herein and Consent of Surety; AIA Document G707A.
 - 2. If approved by Architect and Owner, Contractor may incorporate reduction in next Application for Payment.
 - 3. Include copy of approved form with Application for Payment.

END OF SECTION

STORED MATERIAL AND EQUIPMENT AFFIDAVIT

PROJECT: _____

PROJECT NO: _____

Item Number	Quantity	Unit	Material or Equipment Description	Value

LOCATION STORED: _____

IDENTIFICATION _____

METHOD: _____

AFFIDAVIT:

Items listed above have been purchased exclusively for use on above referenced Project and have been received in good condition, and items are identified as property for use only on above referenced Project. Owner may enter upon premises for verification, inspection, or for any other purpose considered necessary. It is expressly understood and agreed that this affidavit is furnished to the Owner for purpose of obtaining approval for payment for said items, and that storage thereof at location indicated and payment by Owner shall not relieve Contractor of full responsibility for the protection, safeguarding, insurance, transporting, and proper installation at Project referenced above, and will warrant and defend against claims and demands of all persons. Upon making of partial payment by Owner, said items covered thereby become sole property of Owner.

Attached are receipted invoice(s), bills of sale(s), and/or other documents as evidence that Contractor is unconditional owner of said items, and they are free from all encumbrance, security agreements, mortgages or liens.

FROM CONTRACTOR: _____

BY: _____ DATE: _____

SUBSCRIBED AND SWORN TO BEFORE ME THIS _____ DAY OF _____, _____.

NOTARY PUBLIC: _____ MY COMMISSION EXPIRES: _____

Owner (APPROVES) (DISAPPROVES) location of off site storage, and Contractor's inclusion of cost for above items in an Application for Payment.

OWNER'S APPROVAL:

BY: _____ DATE: _____

Contractor shall include this affidavit and other required documents with Application for Payment and shall maintain an inventory of all stored materials for submittal with future applications.

END OF FORM

STORED MATERIAL AND EQUIPMENT INVENTORY

PROJECT:

FOR APPLICATION NO.:

PAGE: of

The following inventory represents our accounting of the current status of material and equipment in storage which we have received payment for:

Item No.	Material or Equipment Description	Quantity	Value	Appl. No.	Incorporated Date/Quantity

FROM CONTRACTOR: _____

BY: _____ DATE: _____

This form is required to be updated and submitted with each application for payment.

END OF FORM

REQUEST FOR REDUCTION OF RETAINAGE

PROJECT:

PROJECT NO.:

CONTRACT FOR:

Contractor hereby requests that the percentage of partial payment retained by Owner under provision of contract be REDUCED to _____% for following reasons:

CONTRACTOR:

BY: _____ DATE: _____

Power of Attorney and AIA Document G707A must be attached.

Architect (RECOMMENDS) (DOES NOT RECOMMEND) the reduction of retainage to _____%.
Percentage of completion as of _____, _____ is _____%.

ARCHITECT:

BY: _____ DATE: _____

Owner hereby (APPROVES) (DISAPPROVES) reduction of retainage to _____%, and authorizes Architect to certify the reduction in an Application for Payment.

OWNER:

BY: _____ DATE: _____

If approved, Contractor may incorporate reduction by including a copy of this document in the next Application for Payment.

DISTRIBUTION: OWNER ARCHITECT CONTRACTOR

END OF FORM

SECTION 01 30 01
ELECTRONIC SUBMITTAL PROC

1.1 SUMMARY

- A. Shop drawing and product data submittals shall be transmitted to Engineer in electronic (PDF) format using Submittal Exchange, a website service designed specifically for transmitting submittals between construction team members.
- B. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
- C. The electronic submittal process is not intended for color samples, color charts, or physical material samples.

1.2 PROCEDURES

- A. Submittal Preparation - Contractor may use any or all of the following options:
 - 1. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the Submittal Exchange website.
 - 2. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
 - 3. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
- B. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
- C. Contractor shall transmit each submittal to Engineer using the Submittal Exchange website, www.submittalexchange.com.
- D. Architect / Engineer review comments will be made available on the Submittal Exchange website for downloading. Contractor will receive email notice of completed review.
- E. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
- F. Submit paper copies of reviewed submittals at project closeout for record purposes in accordance with Section 01 77 00 – Closeout Submittals.

1.3 COSTS

- A. General Contractor shall include the cost of Submittal Exchange project subscription for bidding purpose in the amount of \$8,550.00 in their proposal. This cost is to be included in the Contract Amount.
- B. At Contractor's option, training is available from Submittal Exchange regarding use of website and PDF submittals. Contact Submittal Exchange at 1-800-714-0024.
- C. Internet Service and Equipment Requirements:
 - 1. Email address and Internet access at Contractor's main office.
 - 2. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.1 PREBID CONFERENCE

- A. Prebid conference:
1. See Section 00 21 13 - Instructions to Bidders.

1.2 PRECONSTRUCTION CONFERENCE

- A. The Architect will schedule and hold preconstruction conference prior to construction.
- B. Attendance Required:
1. Owner:
 - a. Project representative.
 - b. Director of Operations or Engineering.
 2. Architect.
 3. Contractor:
 - a. Home office representative.
 - b. Field Project Manager.
 - c. Project Superintendent
- C. Contractor must be prepared to discuss the following items:
1. List of subcontractors.
 2. Tentative construction schedule.
 - a. Start and completion dates.
 - b. Critical work sequence.
 3. Status of Contract, bonds, and insurance.
 - a. Accepted alternates.
 4. Procedures.
 5. Designation of responsible personnel.
 6. Processing of field decisions and change orders.
 7. Submittal process.
 8. Procedures for maintaining record documents.
 9. Use of premises:
 - a. Office and storage areas.
 - b. Owner's requirements.
 10. Submission and processing of monthly Application for Payment and associated requirements.
 11. For projects requiring demolition of existing structures address removal and disposal of hazardous materials and toxic substances as applicable.
- D. Contractor to conduct a meeting with subcontractors after preconstruction conference to discuss procedures.

1.3 CONTRACTOR MEETINGS

- A. Conduct weekly progress, coordination and scheduling meetings with subcontractors.

1.4 PROGRESS MEETINGS

- A. Attend scheduled meetings; time, day and place to be determined.
1. Generally, meetings will be held monthly or as required by progress of the Work and scheduled to coincide with Architect's regular scheduled site visits.
 2. Meetings to be held at job site or as arranged.
 3. Contractor administer meetings and record minutes.

- B. Attendance Required:
 - 1. Owner's Representative.
 - 2. Architect's Representative.
 - 3. Contractor:
 - a. Home office representative.
 - b. Field Project Manager.
 - c. Superintendent.
- C. Agenda:
 - 1. Review, approve minutes of previous meeting.
 - 2. Review work progress since last meeting.
 - 3. Planned progress during next work period.
 - 4. Review construction schedule.
 - 5. Identify concerns which impede planned progress.
 - 6. Note field observations, questions, and decisions.
 - 7. Review submittal schedules.
 - 8. Review Owner/Contractor coordination items.
 - 9. Review status of changes.

1.5 PREINSTALLATION CONFERENCE

- A. Contractor administer meetings and record minutes.
 - 1. Convene affected parties for coordination where required by Contract Documents.
 - 2. Conduct meetings prior to installation of the Work.
 - 3. Meetings to be held at job site or as arranged.
- B. Attendance Required:
 - 1. Owner's Representative.
 - 2. Architect's Representative.
 - 3. Contractor:
 - a. Field Project Manager.
 - b. Superintendent.
 - c. Fabricator or Supplier.
 - d. Installer.
 - e. Others whose work may affect or be affected by installation.
- C. Agenda:
 - 1. Review or inspect existing conditions.
 - 2. Review submittals.
 - 3. Review construction schedule and identify concerns.
 - 4. Review Owner/Contractor coordination items.
 - 5. Discuss mobilization and delivery.
 - 6. Note field observations, questions, and decisions.

END OF SECTION

SECTION 01 32 16
CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Includes:
1. Upon award of the Contract, Contractor shall prepare and submit a Contractor's construction schedule for the Work for the Owner's and Architect's information.
 - a. Submit in expeditious manner.
 - b. Schedule shall not exceed time limits current under Contract Documents, shall be revised at appropriate intervals as required by conditions of the Work and Project, shall be related to entire Project to extent required by Contract Documents, and shall provide for expeditious and practicable execution of Work.
 2. Coordinate Subcontractors' schedules for entire Project:
 - a. Secure time commitments for performing critical elements of Work from parties involved.
 - b. Coordinate each element on the schedule with other construction activities; include minor elements involved in sequence of Work.
 - c. Show each activity in proper sequence.
 - d. Indicate graphically the sequences necessary for completion of related portions of Work.
 - e. Resolve conflicts among schedules of Subcontractors.
 - f. Revise as required by conditions and progress of Work.
 - g. Furnish copy of schedules for entire Project to each Subcontractor.
 - h. Coordinate with Section 01 50 00 - Construction Facilities, Temporary Controls and Utilities.
 3. Contractor shall perform Work in general accordance with most recent schedules submitted to Owner and Architect.

1.2 SUBMITTALS

- A. Project Information:
1. Preliminary Construction Schedule:
 - a. Submit to Owner and Architect prior to date set for Preconstruction Conference and prior to start of Work.
 2. Project Schedules:
 - a. Provide to Owner and Architect within 60 days of start of construction.
 3. Updated Project Schedules:
 - a. Provide to Owner and Architect quarterly.
 - b. Provide if completion date is revised or sequence of Work is revised.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 FORM OF SCHEDULES

- A. Horizontal Bar Chart:
1. Provide separate horizontal bar column for each line item of the approved Schedule of Values.
 2. Indicate each bar with start and completion date of each item, its total dollar value percent to be completed for each month.
 3. Identify each bar column:

- a. By specification section number, Work element and major component.
 - b. By distinct graphic delineation.
 - 4. Horizontal time scale:
 - a. Identify first week day of each week.
 - 5. Scale and spacing:
 - a. Allow space for updating.
 - 6. As Work progresses, place contrasting mark in each bar to indicate actual progress and completion.
- B. Sheet Size:
 - 1. Maximum 11 x 17 IN.
- C. CPM Schedule:
 - 1. Furnish a CPM schedule covering items of construction with, as a minimum, early/late start and early/late finish and normal float.

3.2 CONTENT OF SCHEDULES

- A. Provide complete sequence of construction by activity.
 - 1. Shop drawings, product data and samples:
 - a. Submittal dates as indicated in approved Submittal Schedule.
 - b. Dates reviewed copies will be required.
 - 2. Decision dates for:
 - a. Selection of finishes.
 - 3. Product procurement and delivery dates.
 - 4. Dates product information and delivery of Owner furnished, installed equipment and materials is needed.
- B. Dates for early and late beginning, and completion of each element of construction.
- C. Identify Work of separate floors, or separate phases, or other logically grouped activities.
- D. Show how requirements for phased completion and partial occupancy by Owner affect sequence of Work.
- E. Indicate important stages of construction for each major portion of Work, including submittal review, testing, and installation.
- F. Identify punch list preparation and completion durations, agencies inspections, and Owner occupancy dates.
- G. Show projected percentage of completion for each item of Work as of last day of every month.
- H. Identify restraints and constraints.
- I. Identify critical path and critical portions of entire schedule. There shall be only one critical path and it shall be clearly identified.

3.3 UPDATING

- A. Show changes occurring since previous submission of updated schedules.
- B. Indicate progress of each activity, actual verses scheduled start and completion dates, and actual verses scheduled percent complete by month.
- C. Include:
 - 1. Major changes in scope.
 - 2. Activities modified since previous updating.
 - 3. Review projections due to changes.
 - 4. Other identifiable changes.
- D. Provide Narrative report Including:
 - 1. Discussion of problem areas including current and anticipated delay factors and their impact.

2. Corrective action taken or proposed and its effect.
3. Effect of change in schedule.
4. Description of revisions.
 - a. Effect on schedule due to changes to Contract.
 - b. Revisions in duration of activities.
 - c. Other changes that may affect schedule.

3.4 DISTRIBUTION

- A. Distribute copies of revised schedules to:
 1. Owner.
 2. Architect.
 3. Contractors/Subcontractors.
 4. Other concerned parties.
- B. Instruct recipients to report inability to comply and provide detailed requirements and schedule, with suggested remedies.

END OF SECTION

SECTION 01 32 26
PROGRESS REPORTS AND PHOTOS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Includes:
 - 1. Compilation and submission of monthly progress reports.
 - 2. Taking and submission of monthly progress photographs.

1.2 SUBMITTALS

- A. Project Information:
 - 1. Progress report:
 - a. Submit monthly prior to or with Application for Payment.
 - 1) Written portion of report shall be in Microsoft Word format.
 - 2. Progress photos:
 - a. Submit digital photographs electronically.
 - 3. Contract Closeout:
 - a. Provide two (2) indexed sets of compact disks (CD) of digital progress photographs.

1.3 PROGRESS REPORTS

- A. Each Subcontractor shall prepare comprehensive Daily Log and maintain it during entire project period. Submit copy to Contractor for compilation into monthly Progress Reports.
- B. Progress report to include following Summary narrative for entire month.
 - 1. Current total percent complete.
 - 2. Current percent complete of major work activities.
 - 3. Percent of work completed during past month.
 - 4. Main work activities completed during prior month.
 - 5. Main work activities in process and scheduled for next month, including major equipment deliveries, system tie-ins and system start-ups.
 - 6. Overall status of project compared with project schedule.
 - 7. Delays or potential delays, if any.
 - 8. Waste Management Plan implementation.
- C. Daily logs to include following data for each day of prior month.
 - 1. Manpower, by trade.
 - 2. Work performed, with location.
 - 3. Weather.
 - 4. Situations or circumstances which could delay work or give cause for claims for extension of time or added cost.
 - 5. List of visitors names, to include officials, Owner's representatives, and other authorities.

1.4 PROGRESS PHOTOGRAPHS.

- A. General:
 - 1. Include digital progress photographs on compact disk (CD).
 - 2. Digital camera requirement:
 - a. Minimum 10 megapixels resolution.
 - b. GPS geo-tagging capable.
 - 3. Photograph format: JPEG format and file extension with 1600 by 1200 pixels, minimum.
 - 4. Digitally date photographs.
- B. Identify photographs with project name, date, direction, and view or vantage point.
- C. Photograph/file naming:

1. Include date (YRMODY), Building or Area, Direction photo taken (N.S.E.W.), and Description of Subject.
 2. File name example: 07 04 12_Area-A1_NE_AHU-6.jpeg.
- D. Provide index of submitted digital photos.
- E. Building exterior: Minimum 6 digital photos monthly until project exterior is finished, taken from different view points of interest, related to current progress.
- F. Building Interior: Minimum 12 digital photos monthly until project interior is finished, taken from different view points of interest, related to current progress.
- G. Aerial, 2 every other month.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Shop Drawings, Product Data, Samples, Project Information submittals including Contract Closeout submittals.
- B. Provisions of this Section take precedence over provisions in General Conditions of the Contract for Construction governing Shop Drawings, Product Data, Samples, Project Information and Contract Closeout Information submittals.
- C. Submittals are not to be used as means for substitution requests.
 - 1. Submittals that include substitutions will be returned without review or action.
- D. Contact Architect in event of non-availability of specified product due to strikes, lockouts, bankruptcy, production discontinuance, proven shortage, or similar occurrences.
 - 1. Notify Architect, in writing, with substantiating data as soon as non-availability becomes apparent.
 - 2. Notify in time to avoid delay in construction.
- E. Appropriateness and accuracy of calculations is responsibility of Contractor, and Contractor's Professional Structural Engineer when such calculations are required to be professionally sealed.
- F. When professional or other certification of performance criteria of materials, systems or equipment is required by Contract Documents, Architect shall be entitled to rely upon accuracy and completeness of such calculations and certifications.

1.2 DEFINITIONS

- A. General:
 - 1. Submittals are not Contract Documents.
 - 2. Purpose of submittals is to demonstrate way by which Contractor proposes to conform to information given and design concept expressed in Contract Documents for those portions of Work for which Contract Documents require submittals..
- B. Shop Drawings Action Submittals:
 - 1. Drawings to scale, diagrams, schedules and other data specially prepared for Work by Contractor or a Subcontractor, sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of Work.
- C. Product Data Action Submittals:
 - 1. Illustrations, standard schedules, performance charts, instructions, brochures, color charts, performance curves, diagrams, test data and other information furnished by Contractor to illustrate material, product, equipment or system for some portion of Work.
- D. Samples Action Submittals:
 - 1. Physical examples which illustrate size, kind, pattern, texture, materials, equipment, systems or workmanship and establish standards by which Work will be judged.
 - 2. Samples also include job site Mock-ups and sample construction.
- E. Project Information Submittals:
 - 1. Examples of Information Submittals, which do not require review or action by Architect, include but are not limited to;
 - a. Progress Reports
 - b. Contractor Coordination Drawings
 - c. Bonds.

- d. Construction Schedules.
 - e. Manufacturer's Installation or Adjustment Instructions.
 - f. Statements of Qualifications.
 - g. Certificates.
 - h. Field Service, Laboratory Test.
 - i. Start-Up Reports,
 - j. Design Calculations.
 - k. Material Safety Data Sheets.
 - l. Safety Programs and Reports.
 - m. Other Information Submittals identified in individual specification sections.
- F. "Contract Closeout Information" Submittals:
- 1. Items pertaining to quality control and Owner information, which are required at Substantial or Final Completion, and do not require review or action by Architect.
 - 2. Architect may review at its sole discretion, for general compliance with Contract Documents only.
 - 3. Review will not constitute a detailed check of submitted design calculations.
 - 4. Examples of Contract Closeout Information Submittals, which do not require review or action by Architect, include but are not limited to Pre-occupancy test reports.
 - a. Operation and Maintenance Data.
 - b. Warranties and Guarantees
 - c. Owner instruction reports.
 - d. Project Record documents.
 - e. Extra materials or tools.
 - f. Other Submittals identified in individual specification sections.
- G. Manufacturers and Products, Base and Optional: See Section 01 61 00.

1.3 SUBMITTALS

- A. Project information:
- 1. Schedule of Submittals:
 - a. Provide in advance of transmittal of first submittal and prior to first application for payment.

1.4 SCHEDULE OF SUBMITTALS

- A. Complete Schedule of Submittals shall include Shop Drawings, Product Data, Samples, Project Information, and Contract Closeout Information required by specification section Submittal paragraphs.
- 1. Submittals Schedule shall be mutually agreed upon, in writing, by Architect and Contractor.
 - 2. Contractor or Subcontractors may require submittals for their coordination purposes even when submittals are not required by Contract Documents for Architect's review. Do not include or submit such submittals to Architect.
 - 3. Schedule shall be in horizontal bar chart format divided by weeks indicate proposed submittal dates for each submittal.
 - 4. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
 - a. Allow at least two weeks for Architect's review and processing of each submittal, excluding mailing.
 - 5. Coordinate each submittal with fabrication purchasing, testing, delivery, other submittals and related activities that require sequential activity.
 - 6. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - 7. Architect reserves the right to withhold action on a submittal which, in the Architect's opinion, requires coordination with other submittals until related submittals are received, and will notify the Contractor, in writing, when he exercises this right.

8. Do not include or submit items not required to be submitted by Contract Documents.
9. Arrange submittals by specification section:
 - a. Submittals shall include items from one specification section only.
 - b. Submit Shop Drawings, Product Data, and Project Information (except for Field Test Reports) items specified in a section at same time for a complete review.
 - 1) Shop Drawings: Individual submittal item. Subparagraphs represent description of items to include.
 - a) Indicate additional submittals that will be generated as result of dividing required submittal by building, floor, area of a floor, or other subdivision.
 - 2) Product Data: Individual submittal item. Subparagraphs represent description of items to include as part of single submittal.
 - 3) Sample and Information submittals: Each subparagraph represents an individual submittal item.
10. Indicate submittals that will be provided to agencies having jurisdiction. Schedule sufficiently in advance of date required to allow agency reasonable time for review, and Contractor resubmission if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
11. Indicate additional submittals that will be generated as result of dividing required submittal by building, floor, area of a floor, or other subdivision.
12. Submit all submittals required by a section at same time which are needed for a complete review, except Contract Closeout Information Submittals, and Shop Drawing submittals divided by building area, such as; structural steel, reinforcing steel, HVAC ductwork, etc.
13. Do not submit large quantities of submittals at one time.
14. Schedule Contract Closeout Information submittals during last quarter of construction period and prior to Substantial Completion.
15. Partial payment requests may be withheld until satisfactory Schedule of Submittals has been received.

1.5 ELECTRONIC SUBMITTAL PROCEDURES

- A. Summary:
 1. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format using Submittal Exchange, a website service designed specifically for transmitting submittals between construction team members.
 2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
 3. The electronic submittal process is not intended for color samples, color charts, or physical material samples
- B. Procedures:
 1. Submittal Preparation - Contractor may use any or all of the following options:
 - a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the Submittal Exchange website.
 - b. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
 - c. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
 2. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
 3. Contractor shall transmit each submittal to Architect using the Submittal Exchange website, www.submittalexchange.com.
 4. Architect / Engineer review comments will be made available on the Submittal Exchange website for downloading. Contractor will receive email notice of completed review.
 5. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
 6. Submit paper copies of reviewed submittals at project closeout for record purposes in accordance with Section 01 77 00 – Contract Closeout.

- C. Costs:
1. General Contractor shall include the full cost of Submittal Exchange project subscription in their proposal. This cost is included in the Contract Amount. Contact Submittal Exchange at 1-800-714-0024 to verify cost prior to bid.
 2. At Contractor's option, training is available from Submittal Exchange regarding use of website and PDF submittals. Contact Submittal Exchange at 1-800-714-0024.
 3. Internet Service and Equipment Requirements:
 - a. Email address and Internet access at Contractor's main office.
 - b. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.

1.6 SHOP DRAWINGS

- A. Shop Drawing Action Submittals are required as called for in each specification section Submittal paragraph.
1. Do not use Contract Drawings as Shop Drawings.
- B. Submit high quality, high contrast copy of Shop Drawings in Portable Document Format (PDF).

1.7 PRODUCT DATA

- A. Product Data Action Submittals are required as called for in each specification section Submittal paragraph.
- B. Submit high quality, high contrast copy of Product Data in Portable Document Format (PDF).
1. Include index if multiple items under specification section are included in submittal.
 2. Mark each copy to show exact item, model, and options submitted for review.
 3. Show compliance with specified reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances; notation of coordination requirements.
 4. Mark through items on manufacturer's standard sheets which are not being proposed. Submittals without indications and deletions will be returned without review.
 5. Include scale details, sizes, dimensions, performance characteristics, capacities, wiring diagrams, controls and other pertinent data.

1.8 SAMPLES

- A. Sample Action Submittals are required as called for in each applicable specification section Submittal paragraph.
1. Identify samples with manufacturer's name, item, use, type, Project designation, specification section or drawing, detail reference, color, range, texture, finish and other pertinent data.
 2. Send samples to address indicated, or Project site if required or requested.
 3. Samples shall have a label affixed or attached thereto of sufficient size to accommodate Contractor's approval stamp.
 4. Submit one sample of each color or type indicated.
- B. When specific colors, textures, or patterns are not specified, submit samples from full range of manufacturer's standards for selection. When custom or standard finishes are specified, submit samples of specified colors, textures or patterns.

1.9 PROJECT INFORMATION AND CONTRACT CLOSEOUT INFORMATION

- A. Project Information and Contract Closeout Information submittals are required as called for in each specification section Submittal paragraph.
- A. Submit high quality, high contrast copy of Product Data in Portable Document Format (PDF).

1.10 SUBMITTALS REQUIRING PROFESSIONAL SEALS AND SIGNATURES

- A. Shall be submitted per following:

1. Unless otherwise agreed to by Architect, submit to Architect's for records one (1) original, or high quality high contrast copy of submittal suitable for reproduction, unless quantity is indicated elsewhere. Submit quantity indicated in specifications sections to Owner.
2. Architect is not required to return submittal.
3. Do not fold. Submit in envelope large enough for submitted items.

1.11 TRANSMITTAL

- A. Contractor is responsible for making submissions.
1. Samples and submittals which require hard copies, submit items to office of Architect:

HDR Architecture, Inc.
8750 N. Central Expressway, Suite 100
Dallas, TX 75231-6431
Attention: Trevor Anderson
- B. Transmit items with Submittal Transmittal form included at end of this section, or supplied by Architect, or similar format approved in advance by Architect.
1. If submittal is based on an Optional manufacturer listed in Part 2 of technical specification sections, in lieu of Base manufacturer listed, submit completed form titled Optional Manufacturer Product or System Comparison included at end of this section along with Submittal Transmittal form.
 - a. Optional Manufacturer Product or System Comparison form is not required to be submitted if Optional manufacturer product name and product or model number is specifically listed in technical specification sections.
 2. Contact Architect for copy made for Project.
 3. Indicate Project name, Architect's project number, specification section title, description of submitted items or systems, manufacturer and submittal type on transmittal form.
 4. Indicate submitted date, approval and sign in appropriate space on transmittal form.
 5. Submittal Transmittal form shall stay with submittal throughout its routing.
 6. Indicate submittal number in space provided on Submittal Transmittal form. Following submittal numbering system shall be used:
 - a. Identify each submittal using applicable 5 or 6 digit specification section number from Contract Documents.
 - b. After section number, indicate sequence number. First submittal of section series would be numbered "#####-1 IN, next would be "#####-2 IN, etc.
 - c. If returned for re-submission, add a designation character. Second submission would be "#####-1A", third would be "#####-1B", etc.
 7. Indicate description of submitted items including drawing numbers, etc.
 8. Indicate "Submittal type" being submitted.
- C. Submittals shall only include items from one specification section.
1. Project Information Submittals and Contract Closeout Information Submittals shall be submitted separately from other submittals required by specification section.
 2. Submit all items specified in section at same time for complete review, except Contract Closeout Information Submittals.
- D. Do not submit following:
1. Submittals not required by specification section Submittal paragraph.
 2. Submittals required by other contractors or trades for their coordination that are not required by specification section Submittal paragraph.
 3. Submittal of products, systems or manufactures not specified.
 4. Submittal of substitution.
 5. Submittal of MSDS information.
 6. Large quantities of submittals at one time.

- E. Do not mark copies with highlighters that black out information, or turn opaque when reproduced, or will not scan or reproduce legibly.

1.12 CONTRACTOR AND SUBCONTRACTOR ACTION

- A. Submit submittals required by Contract Documents in accordance with submittal schedule approved by Architect or, in absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in Work or in the activities of Owner or of separate Contractors.
- B. Direct specific attention in writing with submittal or on submittal, indicating deviations from requirements of Contract Documents.
 - 1. Contractor shall not be relieved of responsibility for any deviation from requirements of Contract Documents by Architect's approval of submittals unless,
 - a. Contractor has specifically informed Architect in writing of such deviation at time of submission, and
 - b. Architect has given written approval to specific deviation as a minor change in Work, or
 - c. a Change Order or Construction Change Directive has been issued authorizing the deviation.
 - 2. Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.
 - 3. Completed Work shall match appearance of approved samples and mock-ups.
- C. Contractor represents and warrants that submittals shall be prepared by persons and entities possessing expertise and experience in the trade for which submittal is prepared, and if required by Architect or applicable law, by a licensed Professional Engineer or Structural Engineer, or other specialized Engineer, where so stipulated.
- D. Contractor is responsible for confirmation and correlation of dimensions at Project site; for information that pertains solely to fabrication processes or to techniques of construction; and for coordination of work of trades.
- E. Contractor and Subcontractor shall review submittal required by Contract Documents for compliance with Contract Documents, approve and submit to Architect.
- F. Submittal to Architect indicates Contractor, Subcontractor represent they have:
 - 1. Reviewed submittal for compliance with the Contract Documents and has approved submittal;
 - 2. Determined and verified field measurements, and field construction criteria related thereto, or will do so;
 - 3. Determined and verified quantities, materials, performance criteria, installation requirements, catalog numbers and similar data related thereto;
 - 4. Determined substitutions have not been included;
 - 5. Checked, determined, verified and coordinated information contained within such submittals with requirements of Work, Contract Documents and other submittals;
- G. Resubmit items returned by Architect and marked "Revise and Resubmit" or "Not Approved" until approval is received.
 - 1. Direct specific attention, in writing, or on resubmitted submittals to revisions other than those requested by Architect on previous submittals.
 - 2. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.
 - 3. Bubble or otherwise clearly identify all changes from previous submittal.
 - 4. Tag each re-submittal with a designation that reuses the previous submittal number and a suffix designating the re-submittal sequence in accordance with the numbering system indicated in this section.

- H. Contractor shall reproduce and distribute copies of submittals after Architect's review to:
 - 1. Project site: Copy of "Approved" or "Approved as Noted" submittals for use by Contractor's field staff, Owner and Architect's representatives.
 - 2. Subcontractor or vendor.
 - 3. Other Contractors, Subcontractors or vendors as may be required for coordination purposes.
 - 4. Owner: Copy of "Approved" or "Approved as Noted" submittals.
 - 5. Authorities having jurisdiction: Copy of "Approved" or "Approved as Noted" submittals if required by Authority Having Jurisdiction (AHJ).
 - 6. Inspector (if any): Copy of "Approved" or "Approved as Noted" submittals.
 - 7. Testing and Inspection Agencies: Copy of "Approved" or "Approved as Noted" submittals required for them to perform inspections and testing.
- I. Contractor shall not be relieved from responsibility for coordination with other submittals or for errors or omissions in submittals by Architect's approval thereof.
- J. Material lists and quantity information included in submittals are sole responsibility of Contractor.
- K. Where a submittal is required by Specifications, any related Work performed prior to Architect's review and approval of the pertinent submission will be sole expense and responsibility of Contractor.

1.13 ARCHITECT ACTION ON SUBMITTALS

- A. Architect's action on submittals:
 - 1. "APPROVED": Submittal is in general conformance with the design concept of Project and in general compliance with information given in Contract Documents.
 - 2. "APPROVED AS NOTED": Submittal has minor issues. Noted corrections must be made in final installation. Architect has option to require re-submission for record.
 - 3. "REVISE AND RESUBMIT": Re-submission is required, due to nature or number of issues.
 - 4. "NOT APPROVED": Submittal does not meet contract requirements or is not required to be submitted.
 - 5. "NO ACTION REQUIRED BY ARCHITECT": Submittal not required, Project Information or Contract Closeout Information Submittal
- B. Architect will review and approve or take other appropriate action upon Contractor's submittals, but only for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
 - 1. Such review and action is limited to only those submittals identified in Contract Documents.
 - 2. Architect's review of such submittals is not conducted for purpose of determining accuracy and completeness of other details and information such as dimensions, quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain responsibility of the Contractor.
 - 3. Architect's review or approval of a specific item shall not indicate approval of an assembly of which the item is a component.
 - 4. Architect's review or approval shall not constitute a review of safety or health precautions, or of any construction means, methods, techniques, sequences or procedures.
 - 5. Architect's review or approval on a resubmission shall not apply to revisions that Contractor has not directed specific attention to in writing on resubmitted submittals, other than those requested by Architect on previous submittal.
- C. Architect's action will be taken with such reasonable promptness as to cause no delay in Work or in activities of Owner, Contractor or separate contractors, while allowing sufficient time in Architect's professional judgment to permit adequate review by Architect, Architect's consultants, and Owner, if needed.
 - 1. Architect's obligation to review or approve submittals and to return them with reasonable promptness is conditional upon prior review and approval of submittals by Contractor, and

Contractor's transmittal of submittals in accordance with Contract Documents and approved Schedule of Submittals.

- D. Items not submitted in accordance with provisions of this section may be returned, without review or action.
 - 1. Submittals which do not indicate Contractor has reviewed submittal for compliance with Contract Documents, and approved submittal.
 - 2. Submittals which are not required by Contract Documents.
 - 3. Submittal on items not approved for use by Contract Documents.
 - 4. Submittals which include information from more than one specification section.
 - 5. Project Information Submittals or Contract Closeout Information Submittals included with other submittals required by specification section Submittal paragraph.
 - 6. Submittals required by other contractors or trades for their coordination that are not required by specification section Submittal paragraph.
 - 7. Submittal of products, systems, or manufactures not specified.
 - 8. Submittal of substitution.
 - 9. Submittal of MSDS information.
 - 10. Information on only a portion of a submittal.
 - 11. If approved Submittal Transmittal form was not used.
- E. If a submittal must be delayed for coordination with other submittals not yet submitted, Architect may, as an option, either return submittal with no action or notify Contractor of other submittals which must be received before submittal will be reviewed.
- F. Additional copies of submittals not required or requested may not be returned.
- G. Architect may review Project Information Submittals or Contract Closeout Information Submittals at its sole discretion, for general compliance with design concept expressed in Contract Documents.
- H. Architect will return submittal indicating comments and action taken for Contractor's use and distribution.
 - 1. Submittals may be returned by regular mail.
 - 2. Architect is not required to return Samples, Project Information and Contract Closeout Information submittals.

END OF DOCUMENT

SUBMITTAL TRANSMITTAL

PROJECT: _____ **SUBMITTAL NO.:** _____
 _____ SECTION NUMBER: _____
 _____ SEQUENCE NUMBER: _____
ARCH PROJ. NO.: _____ RE-SUBMITTAL CHARACTER: _____
SPECIFICATION TITLE: _____
MANUFACTURER: _____

Base Manufacturer Optional Manufacturer

- Do not submit on manufacturers not listed in Specifications.
- Complete attached Optional Manufacturer Product or System Comparison form if manufacturer is an Optional manufacturer.
- Architect's Action Taken in accordance with provisions of the Contract Documents.
- This Transmittal Form shall stay with the submittal throughout routing. Copy for file.

DESCRIPTION OF SUBMITTED ITEM: _____

Routing Sequence	Action Taken By	Date Rec'd	Date Sent	Number Copies	Action Taken
Subcontractor/Supplier:					A Note 1
Contractor:					A Note 1
Architect: HDR Inc.					
Contractor:					
Subcontractor/Supplier:			N.A.		
Owner:	N.A.		N.A.		N.A.

ACTION LEGEND

Indicated in Action Taken column above.

- A** APPROVED
- B** APPROVED AS NOTED
- C** REVISE AND RESUBMIT
- D** NOT APPROVED
- E** NO ACTION REQUIRED BY ARCHITECT
- E1** Submittal not required
- E2** Project Information or Contract Closeout Information Submittal

Note 1: Submittal transmittal to Architect indicates Contractor and subcontractor have reviewed for compliance with Contract Documents and have approved submittal.

COMMENTS

- SEE ATTACHED COMMENTS SEE ENCLOSED SUBMITTAL FOR COMMENTS
- SUPPLEMENTAL INFORMATION REQUIRED

END OF SUBMITTAL TRANSMITTAL

OPTIONAL MANUFACTURER PRODUCT / SYSTEM COMPARISON

**IF SUBMITTING OPTIONAL MANUFACTURER LISTED IN TECHNICAL SPECIFICATIONS,
COMPLETE THIS FORM, AND INCLUDE WITH FIRST SUBMITTAL TRANSMITTAL.**
Form not required if Optional manufacturer product name, product number, or model number is listed in
technical specification sections.

PROJECT: _____

SUBMITTAL NO: _____ - _____
 SECTION NUMBER -----| | |
 SEQUENCE NUMBER -----| |
 RE-SUBMITTAL CHARACTER -----|

Specification Section No.: _____
Article/Paragraph: _____

PRODUCT / SYSTEM COMPARISON

Provide a one-to-one comparison with specified requirements.

	SPEC DESIGNATION (IF ANY)	BASE MANUFACTURER'S PRODUCT/SYSTEM	SUBMITTED MANUFACTURER'S PRODUCT/SYSTEM
Manufacturer,	_____	_____	_____
Name, Brand,	_____	_____	_____
Catalog No.,	_____	_____	_____
Features	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____

EFFECT OF PRODUCT

Optional affects other parts of Work: No Yes (If yes, explain below)
 Optional requires dimensional revision or redesign of
 structure or mechanical and electrical Work: No Yes (If yes, explain below)
 Same warranty provided as specified base product: No Yes (If no, explain below)
 Explanation: _____

STATEMENT OF CONFORMANCE OF PRODUCT OR SYSTEM TO CONTRACT REQUIREMENTS

Supplier, Subcontractor and Contractor in making submittal of Optional manufacturer’s product or system, or in using an Optional manufacturer’s product or system represent:

- Will coordinate installation of proposed product or system into Work, to include necessary changes or modifications or both to the Work, including additional costs to other contractors, when such changes result solely from the use of an Optional Manufacturer.
- Waive all claims for additional costs or time extensions related to proposed product or system that subsequently become apparent or are caused by product.
- Will modify other parts of Work as may be needed by use of proposed product or system to make all parts of Work complete and functioning.

ACKNOWLEDGEMENTS

FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF OPTIONAL PRODUCT OR SYSTEMS

Requested by (firm): _____
 Acknowledged by (print & sign): _____ Date: _____
 Position: _____ Phone _____

Subcontractor: _____
 Acknowledged by (print & sign): _____ Date: _____
 Position: _____ Phone _____

Contractor: _____
 Acknowledged by (print & sign): _____ Date: _____
 Position: _____ Phone _____

END OF OPTIONAL PRODUCT / SYSTEM COMPARISON

SECTION 01 41 00
CODES, REGULATIONS, AND GUIDELINES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Project design based on, but not limited to, following codes, regulations, and guidelines.
 - 1. Including:
 - a. Nationally published amendments.
 - b. Local Amendments.
 - 2. Additional requirements may be indicated in specification sections.
- B. Contractor is not required to ascertain Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, unless they bear upon construction means, methods, techniques or safety and health precautions, however nonconformity discovered by or made known to Contractor shall be reported promptly to Architect.

1.2 INDEX

- A. Reference Sheet G-002 for applicable codes.
- B. Reference Standards:
 - 1. Refer to technical specifications sections for listed standards.
 - 2. Refer to Section 01 42 19 for applicable edition of each stand indicated.

END OF SECTION

SECTION 01 42 11

ABBREVIATIONS - ORGANIZATIONS AND STANDARDS

Where abbreviations and acronyms are used in Specifications, they shall mean the recognized name of the entities in the following list. If not listed, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
ABAA	Air Barrier Association of America
ABMA	American Boiler Manufacturers Association
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Accessibility Guidelines
ADC	Air Diffusion Council
AGA	American Gas Association
AGC	Associated General Contractors of America
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AMCA	Air Movement and Control Association International
ANSI	American National Standards Institute
APA	APA – The Engineered Wood Association
ARI	Air Conditioning and Refrigeration Institute
ASA	Acoustical Society of America
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BAAQM	Bay Area Air Quality Management District
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association
BIFMA	Business and Institutional Furniture Manufacturers Association
CAC	California Administrative Code
CP	Comprehensive Procurement Guide (EPA)
CRA	California Redwood Association
CRREL	Cold Region Research Engineering Lab
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard (U.S. Department of Comm.)
CRI	Carpet and Rug Institute
CSI	Construction Specifications Institute
CTI	Cooling Tower Institute
EIA	Electronics Institute of America
EJMA	Expansion Joint Manufacturers Association
EIFSA	Exterior Insulation Finish Systems Association

EPA	Environmental Protection Agency
FCI	Fluid Controls Institute, Inc.
FM	Factory Mutual
FS	Federal Specification
FSC	Forest Stewardship Council
GS	GreenSeal
HEI	Heat Exchanger Institute
HI	Hydraulic Institute
HMI	Hoist Manufacturers Institute
HYDI	Hydronics Institute
IBI	Intelligent Buildings Institute
IBR	Institute of Boiler and Radiator Manufacturers
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IESNA	Illuminating Engineering Society of North America
IIA	Incinerator Institute of America
IPCEA	Insulated Power Cable Engineers Association
LEED	Leadership in Energy and Environmental Design Green Building Rating System (US Green Building Council)
MSS	Manufacturers Standardization Society
MCAA	Mechanical Contractors Association of America
NAAMM	National Association of Architectural Metal Manufacturers
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NCRP	National Council on Radiation Protection and Measurements
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NECS	National Electrical Code Standards
NEMA	National Electrical Manufacturers Association
NIST	National Institute of Standards and Technology
NFoPA	National Forest Products Association
NFPA	National Fire Protection Association
NOAA	National Oceanographic and Atmospheric Administration
NRCA	National Roofing Contractors Association
NSF	National Sanitation Foundation
NSPE	National Society of Professional Engineers
NTMA	National Terrazzo and Mosaic Association
OSHA	Occupational Safety and Health Act
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PDI	Plumbing Drainage Institute
PS	Public Standard (U.S. Dept. of Comm.)
PTI	Post Tensioning Institute
RFCI	Resilient Floor Covering Institute

SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Markers Association
SCAQMD	South Coast Air Quality Management District
SCS	Scientific Certification Systems
SDI	Steel Deck Institute / Steel Door Institute
SFIA	Steel Framing Industry Association
SFPA	Southern Forest Products Association
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.
SPRI	Single Ply Roofing Institute
SSMA	Steel Stud Manufacturers Association
SSPC	Structural Steel Painting Council
TEMA	Tubular Exchanger Manufacturers Association
TIA	Telecommunications Institute of America
UFC	Uniform Fire Code
UL	Underwriters Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
USGBC	US Green Building Council
WI	Woodwork Institute
WWPA	Western Wood Products Association

END OF SECTION

SECTION 01 42 13

ABBREVIATIONS FOR UNITS OF MEASURE - ENGLISH SYSTEM OF UNITS (IP)

Where abbreviations and acronyms are used in Specifications as units of measure, they shall mean as defined in the following list. If not listed herein, they shall mean as listed and defined in ASME Y14.38 "Abbreviations and Acronyms for Use on Drawings and Related Documents."

A (amp)	ampere, area
ACFM	actual CFM
AIC	amps interrupting capacity
AWG	American Wire Gauge
BF	board foot (feet)
BHP	brake horsepower
BTU	British Thermal Unit
BTUH	British Thermal Units per Hour
C Value	thermal conductance (BTU/(HR)(SF)(F) per inch thickness
CF	cubic feet
CFH	cubic feet per hour
CFM	cubic feet per minute
CM	centimeter
CM/SEC	centimeter per second
CPS	cycles per second
CU	cubic
CU FT	cubic feet
CU IN	cubic inch
CY	cubic yard
dB	decibel
DbmV	decibel millivolts
DEG	degree (angular)
degF	degree Fahrenheit
EDR	equivalent direct radiation
F	Fahrenheit
FPM	feet per minute
FPS	feet per second
FT	feet, foot
GAL	gallon
GAL/SF	gallons per square foot
GPH	gallons per hour
GPM	gallons per minute
GPS	gallons per second
GHZ	gigahertz
GR	grains
GSF	gross square feet
HD	head
HP	horsepower
HR	hour
Hz	hertz

IN	inch
IN Hg	inches - mercury
IN-LB	inch-pounds (force)
IN WG	inches - water gage
K	kip
K value	thermal conductivity (BTU/(HR)(SF)(F/IN)
KHz	kilohertz
KSF	Kips per square foot
KV	kilovolt
KVA	kilovolt ampere
KVAR	kilovars
KW	kilowatt(s)
KWH	kilowatt-hours
LB	pound(s)
LBF-IN	pound (force) inch
LF	linear foot, linear feet
LIN	linear, lineal
mA	milliamps
MBTU	thousand BTU
MBH	thousand BTU/HR
MCFH	thousand cubic feet per hour
MCM	thousand circular mils
MFBM	thousand feet board measure
MHz	megahertz
mHz	millihertz
MI	mile
MIN	minute
MO	month
MPH	miles per hour
MVA	megavoltamperes
NSF	net square feet
OZ	ounce(s)
PCE	pyrometric cone equivalent
PCF	pounds per cubic foot
PCY	pounds per cubic yard
PPH	pounds per hour
PPM	parts per million
PSF	pounds per square foot
PSI	pounds per square inch
PSIA	Pounds per square inch absolute
PSIG	pounds per square inch gage
Q	total heat transfer (BTUH)
QT	quart
RH	relative humidity
R value	thermal resistance (HR)(SF)(F)/BTU
RMS	root mean square
RPM	revolutions per minute
RPS	revolutions per second

S	second
SCFM	standard CFM
SF	square feet
SQ IN	square inch
SQ FT	square foot
SSU	saybolt seconds universal
T	ton
TR	tons refrigeration
U value	thermal conductance (1 divided by total R value) (BTU/(HR)(SF)(F))
uV	microvolts
V	volt, volume, velocity
VAC	volt AC
VAR	volt amperes reactive
VDC	volt DC
W	watt
YD	yard
YR	year

END OF SECTION

SECTION 01 42 14
INTERNATIONAL SYSTEM OF UNITS (SI) STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The United States Government has adopted the International System of Units, abbreviated SI, from the French “Le Systeme International d’Unites,” the definitive reference on the SI published in 1991 by the International Bureau of Weights and Measures (BIPM).
- B. The Omnibus Trade a Competitive Act of 1988 designates “the metric system of measurement as the preferred system of weights and measures for United States trade and commerce.”

1.2 BASIC METRIC STANDARDS

A. Definition of SI Units:

- 1. Six metric SI base units of measurement are used in design and construction:

Quantity	Unit	Symbol
Unit of length *	meter	m
Unit of mass (weight)	kilogram	kg
Unit of time	second	s
Unit of electric current	ampere	A
Unit of thermodynamic temperature **	kelvin **	K
Unit of luminous intensity	candela	cd

* Length includes linear measurements: length, width, height, thickness, diameter and circumference.

** Celsius temperature (°C) is more commonly used than kelvin (K), but both have same temperature gradients. Celsius temperature is 273.15 DEG warmer than kelvin, which begins at absolute zero. For design and construction, Celsius will be used.

- 2. Two decimal multiples and submultiples of base SI units are in common use in design and construction. They are the prefixes kilo (1000) and milli (0.001). For example, kilogram (kg) and millimeter (mm).
- 3. Using the base units; derived units are used in design and construction. The following derived metric units are used by all design disciplines:

Quantity	Name	Symbol
Length	millimeter	mm
Area	square millimeter	mm ²
	square meter	m ²
Volume	cubic millimeter	mm ³
	cubic meter	m ³

- 4. Additional derived metric units used for specific engineering disciplines are defined in the article “Engineering Data” in this section.
- 5. Following is a list of units outside of SI but that are used with the International System:

Name	Symbol	Value in SI Units
Liter	L	0.001 m ³

Ton	t	1000 kg
Degree	°	($\pi/180$) rad
Minute	'	(1/60)°
Second	"	(1/60)'
Hour	h	1 (same unit)
Second	s	1 (same unit)

B. Basic rules for writing metric symbols and names:

1. Unit symbols are printed in upright type and in lower case except for the liter (L) or unless the unit name is derived from a proper name, then the first letter of the symbol is in upper case. (i.e., millimeter = mm; newton = N).
2. Unit names are printed in lower case, even those derived from a proper name. (i.e., kelvin = K).
3. Unit symbols are unaltered in the plural, but unit names are written in the plural. (i.e., 100 kilograms = 100 kg not 100 kgs).
4. Unit symbols are not followed by a period, except at the end of a sentence. (i.e., write 100 MM not 100 MM.).
5. Leave a space between a numeral and a symbol. (i.e., write 100 MM not 100mm).
6. Do not leave a space between a unit symbol and its decimal prefix. (i.e., write millimeter not milli-meter and kg not k g).
7. Do not use a degree mark with kelvin temperature (i.e., 293 K), but a degree mark is used with Celsius temperature. (i.e., 20 °C, or degC).
8. Symbols are used in conjunction with numerals (i.e., the total area is 100 m²). Write out unit names if numerals are not used. (i.e., area is expressed in square meters).
9. Do not mix names and symbols. (i.e., write kilograms or kg not k-grams).
10. Use decimals, not fractions. (i.e., write 0.75 g not 3/4 g).
11. Use a zero before the decimal marker for values less than one. (i.e., write 0.45 g not .45 g).
12. Millimeters are always expressed as whole numbers (ie. 1200) and meters are expressed as decimal numbers taken to 3 places (i.e. 1.200).
13. Use spaces in lieu of commas to separate blocks of three digits for any number over four digits. Four digit numbers do not require a space. (i.e., write 10 500 MM not 10,500 MM, but write 1500 MM).

C. Conversion Standards:

1. Hard metric refers to products manufactured to round, nominal metric dimensions such as 300, 600, and 1200. The product must be physically modified in order to be efficiently utilized in a metric project. A “hard conversion” number is a rounded, rationalized metric number that is created and that is easy to work with. It is the intent of the design to make maximum use of domestically produced, hard metric products when available, or when products are custom made.
2. For example: Rectangular metal ductwork is a custom product. Drawings will show hard metric sizes such as 300 x 600 MM.
3. Soft metric means no physical change. Products are metric in name only, having been “re-labeled” in metric dimensions. Soft metric is mathematically converting an inch-pound measurement to its exact metric equivalent and then rounding to the highest degree possible to obtain the largest, cleanest, most easily constructible numbers.
4. When converting from inch-pound units to metric units, always convert lengths to inches before converting to metric units and rounding. For example, 10 FT, 3 IN = 123 IN x 25.4 MM = 3124.2 MM, rounded to 3124 MM. It is preferable to round to increments of 1000, 100 or 10. If 3200 MM is considered excessive, round to 3120 MM or 3150mm.
5. Round to the nonoffending direction (left to right). For example, the building code may require 36 IN (914 MM) of unobstructed width for pedestrian walkways. The left most digit is 9, representing 900 MM which would offend the code. The nonoffending direction is higher, so round to 1000 MM.
6. General Metric Conversion Factors for Area, Length, Volume and Mass:

From Inch-

Quantity	Pound Units	To SI units	Multiply By
Length	foot (ft)	m	0.304 8
		mm	304.8
	inch (in)	mm	25.4
Area	square foot (ft ² , sf)	m ²	0.092 903 04
	square inch (in ²)	mm ²	645.16
Volume	cubic foot (ft ³ , cf)	m ³	0.028.316 8
	cubic foot (ft ³ , cf)	L(0.001 m ³)	28.316.85
	gallon (gal)	L(0.001 m ³)	3.785.41
	cubic inch (in ³)	mm ³	16 386.064
Mass	pound (lb)	kg	0.453.592

1.3 ENGINEERING DATA

- A. Engineering calculations will be produced in metric, to the extent feasible. Because some calculation software is not available in metric, calculations may be executed in inch-pound units and the relevant output data converted to metric.
- B. Civil Engineering:
 1. General metric rules for civil engineering:
 - a. Slope is expressed in nondimensional ratios. The vertical component is shown first and then the horizontal. For example, a rise of one meter in four meters is expressed as 1:4. The units that are compared should be the same (meters to meters, millimeters to millimeters).
 - b. For slopes less than 45°, the vertical component should be unitary (i.e., 1:20). For slopes over 45°, the horizontal component should be unitary (i.e., 5:1).
 - c. Plane angles in surveying (cartography) will continue to be measured in degrees (°), minutes (') and seconds (") rather than the metric radian.
 - d. Contour intervals will be every half-meter (0.500 M or 500 MM).
 - e. Elevation references will be expressed in meters.

2. Metric units used specifically for civil engineering are:

Quantity	Unit	Symbol
Length	kilometer	km
Area	hectare (10 000 m ²)	ha
	square kilometer	km ²
Mass (weight)	metric ton (1000 kg)	t
Rate of flow	liters/second	L/s
	cubic meters/second	m ³ /s

3. Civil Engineering Conversion Factors:

Quantity	From Inch-Pound Units	To SI Units	Multiple By
Area	acre	hectare (ha)	0.404 687
	square yard	square meter (m ²)	0.836 127 36
Length	mile	kilometer (km)	1.609 344
	yard	meter (m)	0.914 4
Volume	cubic yard	cubic meter (m ³)	0.764 555
	acre foot	cubic meter (m ³)	1 233.49
Rate of Flow	gallons per minute	liters/second (L/s)	0.063 090
	cubic feet per second	cubic meters/second (m ³ /s)	0.028 316 8

C. Structural Engineering:

1. General metric rules for structural engineering:
 - a. There are separate units for mass and force.
 - b. Kilogram (kg) is the base unit for mass, which is the unit quantity of matter independent of gravity.
 - c. Newton (N) is the derived unit for force (mass times acceleration, or kgm/s²). It replaces the unit “kilogram-force” (kgf), which should not be used.
 - d. Newton meter (Nm) is the unit for torque or moment. Do not use the unit “joule.”
 - e. Pascal (Pa) is the unit for pressure and stress. The term “bar” is not a metric unit and should not be used.
 - f. Structural calculations should be shown in MPa or kPa.
2. Metric units used specifically for structural engineering are:

Quantity	Unit	Symbol
Mass	metric ton (1000 kg)	t
Mass per unit length	kilogram/meter	kg/m
Mass per unit area	kilograms/sq meter	kg/m ²
Mass density	Kilograms/cubic meter	kg/m ³
Force	newton	N
	kilonewton	kN
Force per unit length	newtons/meter	N/m
	kilonewtons/meter	kN/m
Pressure, stress, modulus of elasticity	pascal	Pa
	kilopascal	kPa
Bending moment, torque moment of force	newton meter	Nm
	kilonewton meter	kNm
Moment of mass	kilogram meter	kgm
Moment of inertia	millimeters to the fourth power	mm ⁴
	cubic millimeters	mm ³

3. Structural Engineering Conversion Factors:

Quantity	Units	Units	By
Mass	kip	metric ton	0.453 592
Mass/unit length	plf	kg/m	1.488 16
Mass/unit area	psf	kg/m ²	4.882 43
Mass density	pcf	kg/m ³	16.018 5
Force	lb	N	4.448 22
	kip	kN	4.448 22
Force/unit length	plf	N/m	14.593 9
	klf	kN/m	14.593 9
Pressure, stress, modulus of elasticity	psf	Pa	47.880 3
	ksf	kPa	47.880 3
	psi	kPa	6.894 76
	ksi	MPa	1.355 82
Bending moment, torque, moment of force	ft-lb	Nm	1.355 82
	ft-kip	kNm	1.355 82
Moment of mass	lbft	kgm	0.138 255
Moment of inertia	in ⁴	mm ⁴	416 231.

Section modulus in³ mm³ 16 387.064

D. Mechanical Engineering:

1. General metric rules for mechanical engineering:
 - a. Joule (J) is the unit for energy, work and quantity of heat. It is equal to a newton meter (Nm) and a watt second (Ws). It replaces a large number of inch-pound units.
 - b. Watt (W) is both the inch-pound and metric unit for power and heat flow. It replaces horsepower, foot pound- force per hour, Btu per hour, calorie per minute, and ton of refrigeration.
 - c. Moisture movement is expressed by the terms “vapor permanence” and “vapor permeability.”
 - d. The inch-pound unit “perm” continues to represent the degree of retardation of moisture movement. The lower the value, the greater the retardation.
2. Metric units used specifically for mechanical engineering are:

Quantity	Unit	Symbol
Capacity	liter	L
Airflow	meter/second	m/s
Volume flow	cubic meter/second	cm ³ /s
	liter/second	L/s
Temperature	degree Celsius	°C, degC
Force	newton, kilonewton	N, kN
Pressure	pascal	Pa
	kilopascal	kPa
Energy, work	kilojoule, megajoule	kJ, MJ
Rate of heat flow	watt, kilowatt	W, kW
Heat release	kilowatt/square meter	kW/m ²
Steam flow rate	kilogram/second	kgs
Heat flux	watt/square meter	W/m ²
Mass density	kilogram/cubic meter	kg/m ³
Thermal conductivity	watt/meter at degree kelvin	W/m K
Thermal conductance	watt/square meter at degree kelvin	W/m ² K
Thermal resistivity	meter at degree kelvin/watt	m K/W
Thermal resistance	square meter at degree kelvin/watt	m ² K/W
Specific volume	cubic meter/kilogram	cm ³ /kg
Rotational frequency	revolution/minute	rpm
Heating value, solid	megajoule/kilogram	Mj/kg
Heating value, gas	megajoule/cubic meter	Mj/kg

3. Mechanical Engineering Conversion Factors:

Quantity	From Inch-Pound units	To SI units	Multiply by
Power	ton (refig)	kW	3.517
	Btu/s	kW	1.054 350
	hp (electric)	W	745.700
	Btu/h	W	0.293.071
	boiler hp	kW	9.81
Heat flux	Btu/h ft ²	W/m ²	3.154 591 3
Rate of heat flow	Btu/s	kW	1.055.056
	Bth/h	W	0.293 071 1
Thermal conductivity (k value)	Btu in/ft ² h F	W/m K	0.144 227 5
Thermal conductance			

(U value)	Btu/ft ² h F	W/m ² K	5.678 263
Thermal resistivity [r value]	ft ² h F/Btu in	m K/W	6.933 464
Thermal Resistance [R value]	ft ² h F/Btu	m ² K/W	0.176 11
Heat capacity, enthrophy	Btu/F	kJ/K	1.899 1
Specific heat capacity, specific enthrophy	Btu/lb F	kJ/kg K	4.186 8
Specific energy, latent heat	Btu/lb	kJ/kg	2.326
Volume rate of flow	cf/h	mL/s	7.866
	cf/s	mL/s	0.028 316 8
Volume rate of flow	cfm, cf/min	mL/s	0.000 471 947 4
	cfm, cf/min	L/s	0.471 947 4
Velocity, speed	ft/min	m/s	0.00508
	ft/s	m/s	0.3048
Temperature			5/9(degF-32)
Energy, work, quantity of heat	kWh	MJ	3.6
	Btu	kJ	1.055 056
	ftlb	J	1.355 82
Rate of flow	gpm	L/s	0.063 1
	gph	ML/s	1.05
Pressure	psi	kPa	6.895
	Inch of water	Pa	248.8
	Inch of water per 100 FT of pipe	Pa/m	8.175
	Foot of water	kPa	2.99
	Foot of water per 100 FT of pipe	kPa/m	0.0981

E. Electrical Engineering:

1. General metric rules for electrical engineering:
 - a. Candela (cd) is the unit for luminous intensity. It replaces candle and candlepower.
 - b. Lux (lx) is the unit for illuminance. It replaces lumen per square foot and footcandle.
 - c. Luminance is expressed in candela per square meter (cd/m²). It replaces candela per square foot, footlambert, and lambert.
2. Units used specifically for electrical engineering:

Quantity	Unit	Symbol
Frequency	hertz	Hz
Power	watt, kilowatt	W, kW
Energy	kilowatt hour	kWh
Electric current	ampere	A
Electric potential	volt, kilovolt	V, kV
Resistance	ohm	ohm
Luminous intensity	candela	cd
Luminance	candela/square meter	cd/m
Luminous flux	lumen	lm
Illumiance	lux	lx

3. There are no unit value changes for electrical engineering except for illuminance and luminance. The units are neither English “inch pound” nor metric, but rather are the same value for each system.

Quantity	IP units	SI units	Value
Power, radiant flux	W	W	1 (same unit)
Frequency	Hz	Hz	1 (same unit)
Electric current	A	A	1 (same unit)
Electric potential	V	V	1 (same unit)
Resistance	ohm	ohm	1 (same unit)
Luminous intensity	cd	cd	1 (same unit)
Luminous flux	lm	lm	1 (same unit)

4. Electrical Engineering Conversion Factors:

Quantity	From Inch-Pound units	To SI units	Multiply by
Luminance	lambert	kcd/m	3.183 01
	cd/ft	cd/m	10.753 9
	footlambert	cd/m	3.426 26
Illuminance	footcandle	lx	10.763 9

1.4 CONSTRUCTION DOCUMENTS

A. Scales:

1. Drawings are produced with metric drawing scales which are expressed in non-dimensional ratios.
2. There are nine (9) preferred base scales: 1:1 (full size), 1:5, 1:10, 1:20, 1:50, 1:100, 1:200, 1:500, 1:1000.
3. Three others have limited usage: 1:2 (half size), 1:25, 1:250.
4. Floor plans are generally drawn at 1:100 which is similar to 1/8 IN scale.

B. Dimensioning:

1. Only one unit of measurement is used on Drawings for all disciplines except civil engineering.
2. Dimensioning on Construction Documents are in millimeters (mm).
 - a. Use of millimeters is consistent with how dimensions are specified in major building codes.
3. There will not be any dual dimensioning.
4. For civil drawings only, dimensions will be stated in meters (m), expressed to the third decimal where required.
5. Centimeters are not used for dimensioning.
6. On the Drawings the unit symbol is eliminated and only an explanatory note such as: “All dimensions are shown in millimeters” or “All dimensions are shown in meters,” is provided.
7. Whole numbers indicate millimeters; decimal numbers taken to three places indicate meters.

C. Metric Module:

1. A metric module can be used to facilitate drawings and dimensioning. Where modules are used, the recommended basic metric module is 100 MM, which is similar to the 4 IN module used in building construction. Acceptable multimodules and submodules may be 6000, 3000, 1200, 600, 300, 100, 50, 25, 20, and 10.

D. Specifications:

1. For specifications, dimensional references are stated in metric, in millimeters (mm), with no dual dimensioning.

2. Domestically produced hard metric products are specified to maximum extent feasible. In event a product is not available domestically in hard metric sizes, a non-metric sized product may be specified, and its data will be soft converted to a metric equivalent.
- E. Submittals:
1. For shop drawings; manufacturers are required to submit all product data and shop drawings using metric units. Product literature and engineering data shall be provided with metric dimensions. It is acceptable if product data contains dual dimensions. Shop drawings must be dimensioned in millimeters.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 42 15

ABBREVIATIONS FOR UNITS OF MEASURE INTERNATIONAL SYSTEM OF UNITS (SI)

Where abbreviations and acronyms are used in Specifications as units of measure, they shall mean as defined in the following list. If not listed herein, they shall mean as listed and defined in ASME Y14.38 "Abbreviations and Acronyms for Use on Drawings and Related Documents."

A (amp)	ampere, area
AIC	amps interrupting capacity
AWG	American Wire Gauge
C	Celsius
cm ³	cubic centimeter
cd	candela
cm ³ /s	cubic centimeters per second
cm	centimeter
cm ²	square centimeter
cm/s	centimeters per second
cps	cycles per second
CU	cubic
dB	decibel
Db/m	decibel/meter
DbmV	decibel millivolts
DEG	degree (angular)
degC	degree Celsius
FV	face velocity
g	gram
GHZ	gigahertz
GR	Grains
ha	hectare
HD	head
HR, h	hour
Hz	hertz
J	joule
K	kelvin
k value	thermal conductivity (W/mK)
kg	kilogram
kg/ha	kilogram/hectare
kg/m	kilogram/meter
kg/mm	kilogram/millimeter
kHz	kilohertz
kJ	kilojoule
km	kilometer
km/h	kilometer/hour
kNm	kilonewton meter
kPa	kilopascal
km ²	kilograms per square meter
kV	kilovolt

kVA	kilovolt ampere
kVAR	kilovars
kW	kilowatt
kWh	kilowatt-hours
L	liter, length
L/h	liters/hour
L/ha	liters/hectare
L/m	liters/meter
L/s	liters/second
LIN	linear, lineal
lm	lumen
Lm	linear meter
L/m	liters/meter
Lpf	liters per flush
L/s	liters/second
lx	lux
m	meter
m ²	square meter
m ³	meters cubed
mA	milliamps
MCM	thousand circular mils
MHz	megahertz
mHz	Millihertz
min	minute
m/h	meters/hour
mL	milliliter
m/L	meters/liter
mL/s	milliliter/second
mm	millimeter
MPa	megapascal
m/s	meters/second
MVA	megavoltamperes
N	newton
Pa	Pascal
PCE	pyrometric cone equivalent
PPM	parts per million
R value	thermal resistance (m ² K/W)
r value	thermal resistivity (mK/W)
RH	relative humidity
RMS	root mean square
rpm	revolutions per minute
rps	revolutions per second
s	second
SSU	saybolt seconds universal
t	ton
t/ha	tons/hectare
U value	thermal conductance (1 divided by total R value) (W/m ² K)

mV	microvolts
V	volt, volume, velocity
VAC	volt AC
VDC	volt DC
W	watt
W/m	watts/meter

END OF SECTION

SECTION 01 42 16
DEFINITIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. General:
1. Basic definitions are included to define terminology used throughout specifications.
 2. Source for some definitions in this section is THE AMERICAN INSTITUTE OF ARCHITECTS DOCUMENT A201-2007, the GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, Copyright 2007.
 - a. Some AIA definitions have been modified.

1.2 THE CONTRACT DOCUMENTS

- A. The Contract Documents consist of the Agreement between Owner and Contractor (hereinafter the Agreement), Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Project Manual, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order or a Change Proposal Request, (3) a Construction Change Directive or (4) a clarification, interpretation or a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include other documents such as bidding requirements (advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or portions of Addenda relating to bidding requirements).*
- B. The Contract Documents shall be enumerated on attachment(s) to the Agreement, and attachment(s) shall be signed by the Owner and Contractor.*
1. These Documents shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.
- C. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them.*
- D. Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed, nor to limit the scope of work performed by any trade or by any Subcontractor or supplier.*
1. Conditions of the Contract, Supplementary Conditions, and General Requirements apply to all specifications.
- E. Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.*
- F. The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect and/or Architect's consultants are instruments of service through which the Work to be executed by the Contractor is described. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect or the Architect's consultants, and unless otherwise indicated the Architect and/or the Architect's consultants shall be deemed the author of them and will retain all common law, statutory and other reserved rights, in addition to the copyrights, unless

indicated differently in the Owner - Architect Agreement. The Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and Architect's consultants. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and/or the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect and/or the Architect's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' copyrights or other reserved rights.*

1.3 THE CONTRACT

- A. The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind 1) between the Architect and Contractor, 2) between the Owner and a Subcontractor or Sub-subcontractor or 3) between any persons or entities other than the Owner and Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.*

1.4 THE WORK

- A. The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.*
- B. Although not indicated, Work includes providing supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

1.5 THE PROJECT

- A. The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate contractors.*

1.6 THE DRAWINGS

- A. The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.*

1.7 THE SPECIFICATIONS

- A. The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.*

1.8 THE PROJECT MANUAL

- A. The Project Manual is the volume usually assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.*

1.9 FURNISH

- A. Unless specifically limited in context, means; furnishing to project site items specified, to include unpacking and assembly if necessary.

1.10 INSTALL

- A. Means incorporating in the Work including all necessary labor, materials, equipment and connections to perform work indicated.

1.11 PROVIDE

- A. Means furnish and install.

1.12 INDICATED AND SHOWN

- A. The word “indicated” or “shown” and any derivative thereof shall mean; as detailed, scheduled, or stated in Contract Documents.

1.13 THE CONTRACTOR SHALL

- A. In interest of conciseness; sentences, statements, and clauses may be verb phrases with expressed verbs such as “furnish,” “install,” “provide,” “perform,” “construct,” “erect,” “comply,” “apply,” “submit,” etc. Any such sentences, statements, and clauses are to be interpreted to include the applicable form of the phrase “the Contractor shall” preceding the expressed verb, with the requirements described interpreted as mandatory elements of Contract.

1.14 EVALUATION

- A. “Evaluate” or “Evaluation” means, “to become generally familiar with the process and quality of the work and to determine if the work is proceeding in general accordance with the Contract Documents based on what is plainly visible at the construction site, without the removal of materials or other construction that is in place”.

1.15 INSPECT

- A. As used in these documents means: “The type of observation that a reasonably prudent architect, in the exercise of ordinary care, would make to determine if the work is in general compliance with the Contract Documents; they are not inspections as would necessarily disclose a defect.”

1.16 SEE

- A. In interest of conciseness, references to specification sections and details are preceded by word “see.” Any such references are to be interpreted to include applicable form of phrase “, and comply with,”.

1.17 CAPITALIZATION

- A. Terms capitalized in these General Conditions include those which are 1) specifically defined, 2) the titles of numbered articles and identified references to Paragraphs, Subparagraphs and Clauses in the document or 3) the titles of other documents published by the American Institute of Architects.*

1.18 OWNER

- A. The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term “Owner” means the Owner or the Owner’s authorized representative.*
- B. Owner as referred to in these documents is Denton County

1.19 CONTRACTOR

- A. The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term “Contractor” means the Contractor or the Contractor’s authorized representative.*

1.20 SUBCONTRACTOR

- A. A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term “Subcontractor” is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term “Subcontractor” does not include a separate contractor or subcontractors of a separate contractor.*

1.21 SUB-SUBCONTRACTOR

- A. A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term “Sub-subcontractor” is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.*

1.22 ARCHITECT

- A. The Architect is the person lawfully licensed to practice architecture or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term “Architect” means the Architect or the Architect’s authorized representative.*

1.23 ARCHITECT, ENGINEER, ARCHITECT/ENGINEER OR ENGINEER/ARCHITECT

- A. Each of these terms mean HDR Architecture, Inc., or an affiliate as otherwise provided in Contract Documents, or duly authorized representatives, such representatives acting severally within scope of particular duties entrusted to them, unless otherwise provided in Contract Documents.

1.24 BASE AND OPTIONAL

- A. See Acceptable Manufacturers and Products, Section 01 61 00.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

* Content provided by AIA Document A201, General Conditions of the Contract for Construction.

END OF SECTION

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Materials specified by reference to number, symbol, or title of a specified standard such as a State standard, commercial standard, federal specifications, ASTM or trade-association standard, or other similar standard shall comply with requirements in the revision thereof and any amendments or supplements thereto in effect on date execution of Contract.
- B. Standard referred to, except as modified herein, shall have full force and effect as though printed in these specification.
 - 1. These standards are not furnished to Contractor, since manufacturers and trades involved are assumed to be familiar with their requirements.
- C. By submitting a Bid, Contractor is deemed to represent self as competent to accomplish Work of this Division in conformance with applicable Codes. In case of conflict between the Contract Documents and Code requirements, the Codes shall take precedence. Should such conflicts appear, cease Work on parts of Contract affected and immediately contact Architect in writing. It shall be Contractor's responsibility to correct, at no cost to Owner, work Contractor executes in violation of Code requirements.

1.2 REFERENCE STANDARDS

- A. Perform Work in conformance with latest edition of applicable standards recognized by local Authority Having Jurisdiction (AHJ) at the time of Contract Award, including, but not limited to following:

AAMA	American Architectural Manufacturers Association
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ASA	American Standard Association
AFI	Air Filter Institute
AMCA	Air Moving & Conditioning Association
ARI	Air Conditioning & Refrigerating and Air
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	ASTM International
AWI	American Woodwork Institute
AWS	American Welding Society
ANSI	American National Standards Institute
FGI	Facilities Guidelines Institute
FR	Federal Register - Volume 44, No. 106 by Department of Transportation
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
--	Joint Commission
NAAMM	National Association of Architectural Metal Manufacturers
NAFM	National Association of Fan Manufacturers
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration

PUC	Public Utilities Commission
SDI	Steel Deck Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UL	UL
--	State and Municipal Codes in force in the Specific Project Area

- B. Where locally adopted Codes or authorities having jurisdiction otherwise stipulate, follow the specific edition.
- C. Conflicts between referenced Standards: Comply with one establishing more stringent requirements.
- D. In event conflicts between referenced Standards and Contract Documents appear, comply with the standard or document establishing more stringent requirements.

END OF SECTION

SECTION 01 43 43
COORDINATION DRAWINGS (GC)

PART 1 - GENERAL

1.1 DESCRIPTION - INTERIOR

- A. Coordinate construction operations included in various Sections of Specifications to assure efficient and orderly installation of all parts of Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
- B. Coordination drawings: Reproducible overlay drawings showing work with horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, equipment, lights, mechanical, electrical, conveying systems, and other services:
 - 1. In and above ceilings.
 - 2. Within walls.
 - 3. Within chases and shafts.
 - 4. Under concrete floors on grade.
 - 5. In mechanical spaces.
 - 6. In electrical spaces.
 - 7. Below grade.
- C. Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities.
- D. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
- E. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
- F. Work out all “tight” conditions involving Work of various Sections in advance of installation.
- G. Sleeve, coredrill and blockout layout drawings:
 - 1. Drawings showing proposed locations and sizes of sleeves, coredrills blockouts, and embedded items in concrete walls, columns, floors and beams.
- H. Prior to start of work in any given area, each Subcontractor approve, in writing, coordination drawings affecting Subcontractor’s work in that area.
- I. Modifications required as result of failure to resolve interferences, provide correct coordination drawings, or call attention to changes required in other work as result of modifications shall be paid for by responsible Subcontractor.
- J. Coordination meetings scheduled by Contractor, with all affected Subcontractors.

1.2 PRODUCTION OF COORDINATION DRAWINGS

- A. Contractor provide minimum 1/4 IN scale plan, elevation and section drawings, showing:
 - 1. Partitions.
 - a. Fire/smoke rated barriers.
 - 2. Ceiling heights.
 - 3. Structural framing locations and elevations.
 - 4. Column lines.
 - 5. Support systems.
 - 6. Other work.
- B. Subcontractors produce combined coordination layout drawings plan and sections of HVAC ductwork, hydronic, steam, condensate, fuel oil, fire protection piping, plumbing, special water

systems, natural gas and medical gas systems electrical cable tray, conduit, conveying systems, equipment, and other work.

- C. Resolve major interferences at initial coordination meeting prior to production of any drawings.
- D. Produce initial coordination drawings within 30 days after initial meeting.
- E. Contractor arrange for production of said drawings not provided by that time.
- F. Meet as required to resolve interferences and correct drawings.

1.3 AFTER APPROVAL

- A. After Subcontractors' written approval of coordination drawings, Contractor determine method used to resolve interferences not previously identified.
- B. Contractor give written approval of changes to coordination drawings prior to start of work in affected area.
- C. Maintain one copy of current approved Coordination Drawings at project site.

1.4 PRECEDENCE OF SERVICES FOR COORDINATION DRAWINGS

- A. In event of conflicts involving location and layout of work; use following priority to resolve disputes:
 - 1. Structure and partitions have highest priority.
 - 2. Equipment location and access.
 - 3. Support systems
 - 4. Ceiling system and recessed light fixtures.
 - 5. Gravity drainage lines.
 - 6. High pressure ductwork and devices.
 - 7. Large pipe mains, valves and devices.
 - 8. Pneumatic tube and material conveying systems.
 - 9. Low pressure ductwork, diffusers, registers, grilles, HVAC equipment.
 - 10. Fire protection piping, devices and heads.
 - 11. Small piping, tubing, electrical conduit, and devices.
 - a. Conduits installed in corridors shall be maintained at least 9 IN above finished ceiling. Conduits shall be grouped within a 12 IN width.
 - b. The space utilized for conduit shall be selected to allow access to all devices which normally require adjustment, repair, resetting, etc.
 - 12. Sleeves through rated partitions.
 - 13. Access panels.

1.5 PRODUCTION OF LAYOUT DRAWINGS

- A. Contractor provide scale plan and elevation drawings.
- B. Subcontractors indicate proposed location and size of their required sleeves, coredrills, blockouts and embedded items.
 - 1. At floor slabs and walls to be core drilled or cut, Find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer.
 - 2. Submit sketch showing location of rebar and proposed cores for review.

1.6 SUBMITTALS

- A. Project information:
 - 1. Contractor's approved Coordination Drawings.
 - a. Letter indicating one copy of approved Coordination Drawings available at project site.
 - b. One copy of approved Coordination Drawings to Architect for information, if requested.
 - 2. Contractor's proposed sleeve, coredrill and blockout layout drawings.
 - a. One copy of drawing to Architect for information.

END OF SECTION

SECTION 01 45 23
TESTS AND INSPECTIONS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. General:

1. Work shall be subject to inspection, testing and approval by testing agency, inspector and building official, or public authorities having jurisdiction.
2. Approval as result of inspection or testing shall not be construed to be an approval of a violation of provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
3. Testing, inspections and approvals presuming to give authority to violate or cancel provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations shall not be valid.
4. It shall be duty of Contractor to cause Work to remain accessible and exposed for testing and inspection purposes.
5. It shall be duty of Contractor to notify testing agency, inspector and building official or public authorities having jurisdiction when Work is in conformance with Contract Documents and is ready for testing and inspection.
6. It shall be duty of Owner and Contractor to provide access to, and means for testing and inspections of such Work required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
7. Any portion that does not comply shall be corrected and shall not be covered or concealed until authorized by testing agency, inspector and public authorities having jurisdiction.
8. Tests, inspections and approvals of portions of Work required by Contract Documents or by codes, laws, ordinances, rules, regulations or orders of building official or public authorities having jurisdiction shall be made at an appropriate time.
9. Contractor shall give testing agency, inspector, building official or public authorities having jurisdiction, and Architect, if requested, timely notice of when and where tests and inspections are to be made so that they may be present for such procedures.
10. In event such procedures for testing, inspection and approval reveal portions of Work fail to comply with requirements established by Contract Documents, or by governing codes, laws, ordinances, rules or regulations, costs made necessary by such failure, including those of repeated procedures and compensation for Architect's services and expenses, shall be at Contractor's expense.
11. Required certificates of testing, inspection and approval shall, unless otherwise required by Contract Documents, be secured by Contractor and promptly delivered to Architect, inspector, building official and public authorities having jurisdiction.
12. If Architect, Owner, building official, public authorities having jurisdiction, testing agency or inspector is to observe tests, inspections and approvals required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations or orders of building official or public authorities having jurisdiction, they will do so promptly, and where practicable, at normal place of testing.
13. Construction or Work for which a building permit is required shall be subject to inspections by building officials and such construction or Work shall remain accessible and exposed for inspection purposes until approved.
 - a. Building officials is authorized to accept reports of approved inspection agencies, provided such agencies satisfy requirements as to qualifications and reliability.
 - b. See governing codes, laws, ordinances, rules and regulations for additional requirements.

- B. Test and inspection method standards: See technical sections and governing codes, laws, ordinances, rules and regulations.

- C. Qualifications of independent testing agencies:
 - 1. Testing agency shall comply with governing codes, laws, ordinances, rules and regulations.
 - a. Testing agency shall provide information necessary for building official to determine that testing agency meets applicable requirements.
 - b. Testing agency shall be objective, competent and independent from Contractor responsibility for Work being inspected.
 - c. Agency shall disclose possible conflicts of interest so that objectivity can be confirmed.
 - d. Agency shall have adequate equipment to perform required tests, and equipment shall be periodically calibrated.
 - e. Agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and/or inspections.
 - f. See governing codes, laws, ordinances, rules and regulations for additional requirements.
 - 2. Meet American Council of Independent Laboratories, Recommended Requirements of Independent Laboratory Qualification, latest edition.
 - 3. Meet requirements of ASTM E329, Standards of Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as used in Construction, latest edition.
 - 4. Meet requirements of AASHTO Materials Reference Library (AMRL) R18 Standard Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories.
 - 5. Meet requirements of ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories.
 - 6. Satisfy inspection criteria of Materials Reference Laboratory of National Institute of Standards and Technology.
 - 7. See technical sections for additional requirements.
- D. Testing equipment calibration shall be by accredited calibration agency, at maximum 12 month intervals, by devices of accuracy traceable to either:
 - 1. National Institute of Standards and Technology.
- E. Special Inspections:
 - 1. Owner will employ one or more special inspectors to perform inspections during construction on types of Work required by governing codes.
 - a. These inspections are in addition to inspections by building officials having jurisdiction.
 - b. See governing codes, laws, ordinances, rules and regulations for additional requirements.
- F. Structural Observations:
 - 1. Owner will employ a registered design professional to perform structural observations as defined in the governing codes where required by provisions of governing codes.
 - a. See governing codes, laws, ordinances, rules and regulations for additional requirements.

1.2 DESCRIPTION

- A. Owner will arrange and pay for following testing and inspections performed by testing agency or special inspector:
 - 1. Site excavation and rough grading inspection: Section 31 22 00.
 - 2. Soil compaction inspection and testing: Section 31 23 33, Section 31 23 00.
 - 3. Excavation inspection: Section 31 23 33, Section 31 23 00.
 - 4. Earth retention systems inspection and concrete testing: Section 31 50 00.
 - 5. Auger cast piling inspection: Section 31 63 16.
 - 6. Drilled pier excavation inspection and testing: Section 31 63 29.
 - 7. Pressure injected footings observation of load tests and concrete testing: Section 31 62 14.
 - 8. Concrete testing and evaluation of installed work: Section 03 08 13.
 - 9. Concrete reinforcing testing and inspection: Section 03 20 00.

10. Underslab Vapor Retarder inspection of installed work: Section 03 31 10.
11. Concrete floor finish tolerance testing: Section 03 35 00.
12. Architectural Precast Concrete: Section 03 45 00.
13. Concrete Tilt Up Wall Panels: Section 03 47 13.
14. Portland cement-lime mortars and grout testing: Section 04 05 13.
15. Masonry accessory installation inspection: Section 04 05 23.
16. Dovetail slots installation inspection: Section 04 05 21.
17. Brick masonry construction inspection: Section 04 21 13.
18. Concrete masonry inspection: Section 04 22 00.
19. Structural steel welding, bolts and stud testing and inspection, except testing to qualify welders: Section 05 12 10.
20. Metal roof deck inspection: Section 05 31 23.
21. Composite metal form deck inspection: Section 05 36 00.
22. Roof deck: Section 05 31 23.
23. Concrete Floor Moisture Testing: Section 07 16 04.
24. Fireproofing testing and inspection: Section 07 81 16.
25. Curtain Wall field testing: Section 08 44 13.
26. Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

- B. Contractor arrange and bear related costs for following tests, inspections and approvals with an independent testing agency or entity acceptable to Owner:
1. Concrete testing for qualification of proposed materials, establishment of mix design, and for Contractor's convenience: Section 03 08 13.
 2. Portland cement-lime mortars and grout testing for qualification of materials and for Contractor's convenience: Section 04 05 13.
 3. Structural steel welding testing to qualify welders: Section 05 12 10.
 4. Radiation Shielding: Section 09 29 00.
 5. Radiation Shielding: Section 13 49 00.
 6. Rebar locating for drilling, core drilling or cutting of concrete.
 7. Testing and inspections of Contractor provided shoring or forming.
 8. Additional inspection and testing required by public authorities having jurisdiction.
 9. Contractor's duties for Owner provided tests, as specified.
 10. Testing and balancing mechanical systems: Section 20 08 00
- C. Contractor shall arrange for, and bear related costs for following with Owner provided independent testing agency or entity acceptable to Owner:
1. Re-testing due to failure of initial test or due to nonconformance with Contract Documents.
 2. Re-inspections of Work due to failure of Work to pass initial inspection or due to nonconformance with Contract Documents.

1.3 JOB CONDITIONS

- A. Employment of independent testing agency does not relieve Contractor of obligation to comply with Contract Documents.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. Perform indicated inspections, sampling and testing of materials and methods of construction.
- B. Use test and inspection or sampling methods or both conforming with methods indicated.
- C. Report each test and inspection or sampling or both as indicated.

- D. Report results called for by test method, in form specified.
- E. Retest failed products and systems.

3.2 REPORTS

- A. Submit reports and logs promptly to Architect, Structural Engineer, Contractor, inspector, and public authorities having jurisdiction.
- B. Include following for test or inspection reports or both:
 - 1. Project name and number.
 - 2. Project location.
 - 3. Product and specification section applicable.
 - 4. Type of test or inspection or both.
 - 5. Name of testing agency, if used.
 - 6. Name of testing or inspecting personnel, or both.
 - 7. Date of test or inspection or both.
 - 8. Record of field conditions encountered; i.e., temperature, weather.
 - 9. Test location.
 - 10. Observations regarding compliance.
 - 11. Test method used.
 - 12. Results of test.
 - 13. Date of report.
 - 14. Signature of testing or inspecting personnel or both.
- C. Maintain log of tests which have failed:
 - 1. Type of test or inspection or both.
 - 2. Date of test or inspection or both.
 - 3. Test or inspection number or both.
 - 4. Reason failed.
 - 5. Date of retest or inspection or both.
 - 6. Results of retest.
 - 7. Method of retest.

3.3 INDEPENDENT TESTING AGENCY DUTIES AND LIMITATIONS OF AUTHORITY

- A. Cooperate with Architect and Contractor.
- B. Provide qualified personnel promptly on notice.
- C. Promptly notify Architect and Contractor of irregularities, or deficiencies of work which are observed during performance of services.
- D. Testing agency is not authorized to:
 - 1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Approve or accept any portion of Work.
 - 3. Perform any duties of Contractor.

3.4 CONTRACTOR'S DUTIES

- A. Cooperate with testing agency personnel, inspector and public authorities having jurisdiction and provide access to work.
- B. Provide preliminary representative samples of materials to be tested, in required quantities.
- C. Furnish copies of mill test reports.
- D. Furnish labor and facilities:
 - 1. To provide access to work to be tested.
 - 2. To obtain and handle samples at site.
 - 3. To facilitate inspections and tests.
 - 4. Storage and curing facilities for testing agency's exclusive use.

- E. Notify building official and testing agencies when Work is ready for inspections.
- F. Construction or Work for which Special Inspections are required shall remain accessible and exposed for special inspections purposes until completion of required special inspections.
- G. Provide access to and means for inspections by building officials and testing agencies of such Work that are required.
- H. Work shall not be done beyond point indicated in each successive inspection without first obtaining approval of building official.
- I. Any portion of Work that does not comply shall be corrected and such portions shall not be covered or concealed until authorized by building official.
- J. Notify appropriate testing agency, inspector or public authorities having jurisdiction sufficiently in advance of operations.

END OF SECTION

SECTION 01 50 00

CONSTRUCTION FACILITIES, TEMPORARY CONTROLS AND UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Construction Facilities, Temporary Controls and Utilities, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to following:
 - 1. NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations.
 - 2. International Building Code, Chapter 33, Safeguards During Construction.
 - 3. Local building codes.
 - 4. Health and safety regulations.
 - 5. Utility company regulations.
 - 6. Police, fire and rescue rules.
 - 7. Environmental protection regulations.
 - 8. Local agencies requirements and regulations.
- B. Maintain required exits, existing structural elements, fire protection devices and sanitary safeguards during remodeling, alterations, repairs or additions to any building or structure, except; make adequate substitute provisions when such required elements or devices are being remodeled, altered or repaired, or when existing building is not occupied.
- C. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use.
- D. Obtain and include in base bid certifications, permits for temporary utilities, fees, labor and materials for necessary services.
- E. Locate facilities to serve Project adequately and result in minimum interference with performance of Work.
- F. Relocate and modify facilities as required.

1.3 TEMPORARY UTILITIES - GENERAL

- A. Provide fees, labor, and materials, including temporary equipment and connection thereof, required to provide temporary utility services necessary for maintaining existing services and for execution of Work, and tests required in various sections of Specifications at Contractor's expense, except where otherwise specified.
- B. Maintain temporary services and facilities clean and neat in appearance, including those furnished or provided by Owner for Contractor's use.
- C. Coordinate with Owner to relocate temporary services and facilities as Work progresses.
- D. Do not overload facilities or permit them to interfere with progress.
- E. Take necessary fire prevention measures.
- F. Preclude hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on site.
- G. Prepare schedule indicating dates for implementation, shut downs, tie-ins and termination of each temporary utility and coordinate with Owner.

- H. At earliest possible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
- I. Remove temporary equipment and connections, and leave premises and existing permanent apparatus in an equivalent condition as existed prior to making temporary connections.
 - 1. Service utility connections shall be discontinued and capped in accordance with the approved rules and the requirements of the authority having jurisdiction.
 - 2. At completion of Work, remove and replace damaged parts of permanent systems.
- J. Extend warranty or guarantee period on permanent systems used during construction period so they commence on date of Substantial Completion.

1.4 WEATHER PROTECTION

- A. Prior to enclosure of building, provide temporary heating, ventilation, and cooling as required to perform Work activities.
- B. Provide temporary insulated weathertight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual Sections and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.5 TEMPORARY HEATING, VENTILATION, AND COOLING

- A. Maintain temperature of spaces where concrete is being placed or cured: See Section 03 31 10.
- B. Provide temporary heating, ventilation, and cooling equipment; and provide temporary heating ventilation, and cooling as required to perform Work.
 - 1. Substantially complete exterior envelope prior to start of energy systems.
 - 2. Make temporary electrical connections and disconnect temporary connections at completion of temporary heating, ventilation and cooling period.
 - 3. Operate system, furnishing necessary labor and supervision.
 - 4. Maintain interior temperature and humidity at service temperature and service humidity for at least 48 HRS prior to, concrete slab moisture emission and relative humidity testing, and continue through placement of interior finishes, and until Substantial Completion. See Section 07 16 04.
 - a. Provide temperature and humidity range required by interior-finish manufacturer's instructions.
- C. Select equipment that is harmless on occupants, elements being installed and completed installations.
- D. Coordinate requirements to produce condition required and minimize consumption of energy.
- E. Provide adequate forced ventilation of enclosed areas for welding, painting, curing of installed materials and fume producing equipment, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
- F. Comply with construction ventilation and preconditioning requirements:
 - 1. See Section 01 81 21.
- G. Owner pay energy costs.
- H. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is acceptable for operation, equipment is lubricated and filters are in place.
- I. Provide and pay for operation, maintenance and regular replacement of filters, and worn or consumed parts.
- J. Use devices complying with codes and ordinances.

1.6 TEMPORARY ELECTRICITY AND LIGHTING

- A. Provide equipment, poles, meter, wiring, switches, outlets, to provide 480V, 3 phase power and necessary step down transformers for 208V and 120V power for construction lighting and power requirements.
 - 1. Permanent building power distribution system may be used.
 - 2. Remove temporary electrical equipment when no longer needed.
- B. Provide adequate lighting with local switching for safe access and egress, security, and for providing adequate illumination for construction operations.
 - 1. Turn off lighting in areas at end of work day to conserve energy.
 - 2. Re-lamp permanent light fixtures used during construction with new lamps at Substantial Completion.
- C. Temporary electrical power used will be paid for by Owner.
 - 1. Contractor provide any additional electrical power required for Contractor's operation, exceeding available power.
 - 2. Contractor provide electricity required for electrical welding devices and temporary heating devices.
- D. Provide own extension cords and electrical safety devices.
- E. Provide any additional electrical power required for installer's operation, exceeding available power.

1.7 TEMPORARY WATER

- A. Make arrangements; provide equipment, piping, and outlets for an adequate supply of clean water for construction purposes.
 - 1. Existing water distribution system may be used for temporary service.
 - 2. Provide pressure backflow preventer at each connection.
 - 3. Disinfect temporary piping before use.
- B. Owner is responsible to pay for water used.
- C. Furnish drinking water for those connected with the Work.

1.8 TEMPORARY SANITARY FACILITIES

- A. Provide temporary sanitary facilities for use of construction workers during construction, remodeling or demolition activities.
- B. Do not use existing toilet facilities in occupied areas or new toilet facilities in construction area without Owner's written consent.
- C. Provide facilities complying with local, State and Federal sanitary laws and regulations.
- D. Maintain and service in clean and sanitary condition.
- E. Provide adequate supplies of toilet paper, cleaning and other required items.

1.9 CONTRACTOR'S FIELD OFFICE

- A. Provide field office for Owner/Architect use within the Contractor field office
- B. Office to be minimum of 10'0"x12'0" with two work stations
- C. Separate toilet Owner/Architect use
- D. Separate lockable entrance
- E. Telephone, Internet, and Copier:
 - 1. Provide telephones, answering machine telephone service in field office.
 - 2. Provide broadband service with wireless internet connection for use by Owner and Architect.
 - 3. Provide commercial grade photocopy machine with document scanning capability.

4. Contractor pay service and use charges.

1.10 TEMPORARY ENCLOSURES/PARTITIONS

- A. Provide temporary enclosures, doors, etc. as required to protect building from damage due to vandalism, or the elements, to maintain suitable temperature during installation of finishes, and for security.
- B. Maintain Owner's access to occupied facilities.

1.11 TEMPORARY PEDESTRIAN PROTECTION

- A. Protect pedestrians from injury due to construction activities by temporary barriers or covered walkways or both, or by construction railings in accordance with requirements of IBC Section 3305.

1.12 PROTECTION OF ADJOINING PROPERTY

- A. Protect adjoining public and private property from damage during construction, remodeling and demolition work in accordance with IBC 3307 requirements.
 1. Protect footings, foundations, party walls, chimneys, skylights and roofs.
 2. Control water runoff and erosion during construction or demolition activities.
 3. Provide written notice to owners of adjoining properties advising of construction plans and excavations to be undertaken 10 days prior to the scheduled date of excavation.

1.13 TEMPORARY STORAGE AND STAGING AREAS

- A. Store and place construction equipment and materials so as not to endanger public, workers or adjoining property for duration of Project.
- B. Comply with provisions of authority having jurisdiction for temporary use of streets or public property for storage or handling of materials or of equipment required for construction or demolition, and the protection provided to the public shall.
- C. Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 FT of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.
- D. Building materials, fences, sheds or obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in gutter. Protection against damage shall be provided to such utility fixtures during the progress of Work, but sight of them shall not be obstructed.
- E. Prior to start of Work, meet with installers to arrange and prepare plot plan defining staging, storage, field office and traffic areas.
 1. Obtain Owner's approval of plan.
 2. Except as specifically provided, working and storing outside these areas will not be permitted.
 3. Arrange and locate temporary structures and storage to avoid interfering with construction.
- F. Within area designated for Contractor and Subcontractor's use, Contractor and Subcontractors provide suitable and sufficient enclosed and covered spaces, with raised flooring, to protect materials and equipment from damage by weather or construction work.
 1. Maintain storage and working areas in clean and orderly condition.
- G. Prior to start of work, Contractor shall meet with all installers to arrange and prepare plot plan defining staging, storage, field office and traffic areas.
 1. Obtain Owner's approval of plan.
 2. Except as specifically provided, working and storing outside these areas will not be permitted.

1.14 TEMPORARY FIRE EXTINGUISHERS

- A. Structures under construction, alteration or demolition shall be provided with not less than one approved portable fire extinguisher and sized for not less than ordinary hazard as follows:
 - 1. At each stairway on floor levels where combustible materials have accumulated.
 - 2. At each storage, construction shed and temporary construction office.
 - 3. Provide additional portable fire extinguishers where special hazards exist, such as storage and use of flammable and combustible liquids.
- B. Strictly observe provisions of codes to safeguard against fire hazards attendant upon construction operations.

1.15 FIRE PROTECTION STANDPIPES

- A. Buildings four stories or more in height shall be provided with not less than one standpipe for use during construction.
 - 1. Such standpipes shall be installed where the progress of construction is not more than FT in height above the lowest level of fire department access.
 - 2. Such standpipe shall be provided with fire department hose connections at accessible locations adjacent to usable stairs.
 - 3. Such standpipes shall be extended as construction progresses to within one floor of highest point of construction having secured decking or flooring.
 - 4. Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of codes as to capacity, outlets and materials.
 - 5. Water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material accumulates.

1.16 AUTOMATIC SPRINKLER SYSTEM

- A. In buildings where an automatic sprinkler system is required by code, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved.
- B. Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties.
 - 1. When sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at end of each work period to ascertain that protection is in service.

1.17 TEMPORARY FENCES AND BARRICADES

- A. Furnish, install and maintain temporary fences, barricades, trench and hole covers, warning lights and safety devices necessary to prevent injury to persons and damage to property.
 - 1. Provide padlocks manufactured by Knox keyed to the Fire Department keying system to the construction areas.
 - 2. Provide 24 FT wide gates to facilitate Fire Department access.
 - 3. Fire Department apparatus shall be able to turn into construction site in one turn.
- B. Contractor is responsible to design construction barricades and fences with proper sizes of members and with adequate supports to protect public from injuries or accidents, arising from construction Work.

1.18 TEMPORARY ACCESS

- A. Provide and maintain required stairs, runways, guard rails, platforms, floor openings and similar temporary construction, for duration of Work and performance of construction operations.
 - 1. Provide type and arrangements as required for their specific use; shall be substantially constructed throughout, strongly supported, and well secured.
- B. Permanent stairways may be used if protected against damage.

- C. Contractor's access to construction area will be permitted only through designated approaches in such a manner that traffic will not interfere with Owner's activities.

1.19 PROJECT SIGNS

- A. Limit signs located on site to Contractor, Architect's, and Project Sign.
 - 1. Post no other signs on site except those required by law and those approved by Owner.
 - 2. Upon completion of the Work, or sooner if directed, remove project signs.
- B. Provide Project Sign.
 - 1. Size: 4 x 8 FT.
 - 2. Metal or wood frame, with 3/4 IN thick MDO exterior grade plywood surface.
 - 3. Support on two 4 x 6 IN x 12 FT treated wood posts, properly braced, set approximately 4 FT in earth and with bottom of sign approximately 4 FT above grade.
 - 4. Paint surfaces of sign and frame with two coats of exterior paint and have professionally lettered thereon following information:
 - a. Name of Project.
 - b. Owner.
 - c. Owner's logo.
 - d. Architect.
 - e. Architect's logo.
 - f. Contractor.
 - g. Mechanical installer.
 - h. Electrical installer.
 - 5. Layout of sign shall be approved by Owner and Architect.

1.20 TEMPORARY SIGNAGE

- A. Provide, maintain, and remove temporary signage throughout Project, both interior and exterior, when no longer required, including those required by prevailing code requirements and Authorities having jurisdiction.
 - 1. Such signage shall include, but not be limited to, signage as may be required for issuance of Certificates of Occupancy, both Temporary (TCO) and Final (C of O).

1.21 TEMPORARY PROTECTION

- A. Protect Work in progress and adjoining materials in place, during handling and installation.
- B. Supervise construction operation to assure that Work, completed or in progress, is not subject to harmful, dangerous, damaging or otherwise harmful exposure throughout construction period.
 - 1. Prevent accumulation of water on site:
 - a. Remove standing water.
 - b. Pump or direct away from site and adjoining property.
 - 2. Prevent accumulation of water on slabs, adjacent to building or foundations, or in utility trenches.
 - 3. Prevent damage to structural members.
- C. Apply protective covering to assure protection of Work from damage or deterioration.
 - 1. Remove coverings at Substantial Completion.
- D. Adjust, lubricate and maintain operable components to assure operability without damaging effects throughout construction period.

1.22 SECURITY

- A. Provide security and facilities to protect Work and existing facilities and Owner's operations from unauthorized entry, vandalism or theft.
- B. Coordinate with Owner's security program..

1.23 TEMPORARY ACCESS ROADS

- A. Provide access on building site as required to perform Work.

- B. Maintain construction site access roads free of obstruction.
- C. Clean up debris, materials, etc., that falls from vehicles in route to and from site.
- D. Do not block access to Owner's facilities.
- E. When this access is no longer required, restore to its original condition.
- F. Provide means of removing mud from vehicle wheels before leaving site and entering public streets or Owner's roads.

1.24 TEMPORARY PARKING

- A. Provide temporary parking areas to accommodate construction personnel.
- B. When site space is not adequate, provide additional off-site parking.
- C. Do not allow heavy vehicle or construction equipment on existing parking areas without Owner approval.

1.25 TRAFFIC CONTROL

- A. Provide traffic control necessary to effect smooth Owner operations.
- B. Provide and maintain adequate traffic control and flagmen's services at points where transporting of equipment and materials engaged on Work, enters and exits from Project site and on site.

1.26 WASTE MANAGEMENT FACILITIES

- A. Maintain facilities for separate collection of construction wastes and materials.
- B. Conform with Waste Management Plan per Section 01 74 19.

1.27 COMPLETION OF WORK

- A. Upon completion of Work or as progress of work dictates or sooner if directed by Owner or Architect, remove temporary facilities, and return improvements on or about site and adjacent property which are not shown to be altered, removed or otherwise changed; to condition which existed previous to starting Work.

1.28 USE OF PREMISES

- A. Limit use and operation at site to "Limits of Construction", indicated and required to perform Work. Portions of site beyond area of required work shall not be disturbed.
- B. Conform to all laws, ordinances, permits and regulations affecting the Work on site.
- C. Existing roads, streets, drives, parking lots, entrances and required fire exitways shall be kept clear and available for their intended use. Do not use these areas for parking, staging or storage without Owner's written approval.
- D. Do not unreasonably encumber site with equipment, materials or vehicles.
- E. Do not load structure with weights that will endanger structure.
- F. Smoking is prohibited within occupied facilities or after interior finishes have started to be installed.
- G. Audio devices and radios are prohibited, except two-way radios needed for Contractor's operations. Use of two-way radios within occupied facilities shall be limited, so not to disrupt occupants.
- H. Use of telephones, elevators, toilet facilities, cafeterias, dining areas, etc. within occupied facility or areas shall not be used without Owner's written consent.
- I. Use of toilet facilities within occupied facility is not allowed.

END OF SECTION

SECTION 01 61 00
ACCEPTABLE MANUFACTURERS AND PRODUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Performance of product, material, or system is result of manufacturing, fabrication, installation procedures, use, and maintenance:
 - 1. Therefore, Architect endeavors to specify quality levels for products, materials, or systems that are advertised to conceptually meet performance goals and desired attributes for Project.
 - a. For most conceptually equal systems and materials, the Architect may specify multiple manufactures.
 - b. In some cases, based on quality and attribute goals for Project, number of manufacturers may be limited.
- B. Product, material, or system substitutions:
 - 1. Prior to bid: See Section 00 26 00.
 - 2. After execution of the contract: See Section 01 25 13.

1.2 SPECIFYING METHODS AND PRODUCT OPTIONS

- A. Method 1: Products are specified by naming two or more manufacturers. Substitutions are not permitted. Any one of manufacturers named may be used that meet specified requirements.
- B. Method 2: Products are specified by naming one or more manufacturers. Substitutions are permitted. Any one of manufacturers named may be used that meet specified requirements. Submit a substitution request for any manufacturer not specifically named.
- C. Method 3: Proprietary: No Substitutions. Products are specified by naming only one manufacturer.
- D. Method 4: "Base" and "Optional".
 - 1. Base:
 - a. Manufacturer listed as Base in Part 2 of specification section.
 - b. Manufacturer listed as Base is particular manufacturer of a specific product used as basis of design.
 - 1) Products of the Base manufacturer are specific products, assemblies or systems used and identified with model numbers, dimensions or other identifying features.
 - 2. Optional:
 - a. Manufacturer listed as Optional in Part 2 of specification section.
 - b. More than one manufacturer may be listed as Optional.
 - c. Proposals may be based on any of the manufacturers listed.
 - d. Manufacturers listed as Optional are particular manufacturers of products similar to specific product used as basis of design.
 - e. Optional products are without model numbers, dimensions or other identifying features.
 - f. Listing manufacturer as Optional indicates acceptance of that manufacturer as supplier of a product to extent product complies with specified descriptive requirements listed in technical specification, including salient qualities provided by Base manufacturer's product.
 - 1) Salient qualities include, but are not necessarily limited to following:
 - a) Purpose and function.
 - b) Material and finish.
 - c) Strength, durability and other applicable physical properties.
 - d) Compatibility and performance attributes for indicated application.
 - e) Capacity and operating characteristics, where applicable.

- f) Size and configuration to extent required for fit with adjoining and adjacent conditions and within spatial limitations.
 - g) Appearance, including exposed dimensions, profile, texture, pattern and color, where visible to personnel in finished space, or from exterior.
 - 2) Optional Products that significantly differ in appearance or quality of Base product will not be accepted.
 - g. Contractor is responsible for costs to provide dimensional, operational, structural, and utility or any other related adjustments to fit an Optional manufacturer's product into Work.
 - h. Submit Optional Manufacturer Product/System Comparison form with Bid for the Optional product.
 - 1) See Section 01 33 00, Submittal Procedures, for protocol and form.
- 3. Refer to specification sections for additional requirements.
- E. Method 5: Generic: Products are specified by reference standard, by performance, by description or by any combination of these three.
 - 1. Products meeting or exceeding specification requirements may be used.
 - 2. Contractor assumes responsibility for compatibility of products selected.

1.3 DEFINITIONS

- A. "Product(s)" means material, machinery, components, equipment, fixtures and systems forming Work. The term does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
- B. New Products: Items not previously incorporated into another project or facility, [except products consisting of recycled-content materials are allowed, unless explicitly stated otherwise]. Products salvaged or recycled from other projects are not considered new products.

END OF SECTION

SECTION 01 71 21
SPECIALTY ENGINEERING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish engineering design, drawings and calculations for Specialty Engineering Requirements, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 DEFINITIONS

- A. Structural Engineer of Record (SER):
 - 1. Structural engineer legally eligible to seal structural Contract Documents for project.
 - 2. Seal acknowledges SER performed or supervised analysis, design, and document preparation for building structure and has knowledge of requirements for structural system.
 - 3. The SER is responsible for the design of the primary structural system.
- B. Specialty Structural Engineer (SSE):
 - 1. Registered Engineer other than Structural Engineer of Record (SER), licensed to practice structural engineering in state in which project is located.
 - 2. Undertakes engineering calculations, design and drawing preparation of components, systems, or installation methods and equipment for specific temporary portions of Work or special items of permanent Work required to be furnished by Contractor.
 - 3. Provide designs and details for items of permanent Work declared to be minor or non-structural.
 - 4. Employee or officer of Contractor or fabricator, employee or officer of an entity providing components to a fabricator, or an independent consultant.

PART 2 - MATERIALS

2.1 NOT USED

PART 3 - EXECUTION

3.1 SYSTEM DESIGN

- A. Contract Documents show conceptually detailed components describing aesthetic intent and provides a performance-type prescription for the design, fabrication and installation.
- B. Contractor is responsible for the engineering and design of components and materials as well as fabrication and installation.
- C. Develop conditions not shown in Contract Documents to same level of aesthetics in compliance with performance and aesthetic criteria specified and indicated for detailed areas.
- D. Provide engineering design with drawings and calculations sealed by registered Engineer, licensed to practice structural engineering where the project is located.
- E. Comply with requirements of Contract Documents, codes, regulations, standards and guidelines including:
 - 1. Nationally published amendments.
 - 2. Local Amendments.
 - 3. Structural criteria provided.
 - 4. Additional requirements indicated in specification sections.
- F. Reference Standards:

1. Refer to technical specification sections for listed standards.
 2. Refer to Section 01 42 19 for edition of each standard indicated.
- G. Minor deviations in dimensions and profiles may be considered provided design concept is unchanged or intended performance is not compromised as judged by the Architect.
- H. Where SSE exercises professional judgment and takes exception to specified criteria or reference standards, disclose exception in writing.

3.2 DOCUMENTATION

- A. Include following items common to project:
1. Project Identification
 - a. Project name
 - b. Project location
 - c. Identifying project numbers
 - d. North arrow
 - e. Scale
 2. Governing Codes
 - a. Building code and edition
 - b. Referenced codes and standards
 - c. Design method used for the design
 3. Service Loads
 4. Strength loads or factors
 5. Design Load
 - a. Dead loads
 - b. Live loads
 - c. Snow loads
 - d. Wind loads
 - e. Seismic loads
 6. Material Properties
 - a. Design properties
 - b. ASTM designations
 7. Computer Submittals
 - a. Documentation of computer programs including the program name and version should be included with any submittal of computer calculations. In the case of custom software or spreadsheet developed in house it may be necessary to provide hand calculation of representative elements to verify the use of the program.
- B. Include maximum design loads at connection points to primary structure.
1. Indicate values consistent with method used for design including service loads or strength loads with factors.
 2. Design system to apply loads to the structure through the centerlines of the supporting element.
 3. Assume building supports are free to rotate. Torsional or flexural fixed supports shall not be used unless approved by the SER.
 4. When fixed or eccentric supports are used, provide additional framing as deemed necessary by the SER at no additional cost.
- C. Include member sizes, required reinforcing, connection details and material specifications.
- D. Include statements where the SSE has exercised professional judgment and takes exception to the specified criteria or referenced standard. Final authority and responsibility for decisions concerning structural design criteria shall belong to the SER. When exceptions are stated as qualifications to the contractor's proposal, the SER shall be notified and respond prior to award.
- E. SSE shall review and approve the shop drawings and special erection drawings prepared by a fabricator or supplier and attest to that review with a signed shop drawing stamp, or other means, prior to submittal of the drawings to the SER. When standardized erection drawings are used, there is no need to provide a shop drawing approval stamp.

END OF SECTION

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Cutting and Patching in accordance with provisions of Contract Documents.
- B. Completely coordinate with the work of other trades.

1.2 DESCRIPTION

- A. This section covers cut and patch work either in remodel, add-on or new construction as necessary for execution of the Work.
- B. Install Work in such a manner and sequence as to preclude or minimize cutting and patching of new Work.
- C. Execute cutting, including excavation, fitting or patching of Work, required to:
 - 1. Make several parts fit properly.
 - 2. Uncover Work to provide for installation of ill-timed Work.
 - 3. Remove and replace defective Work.
 - 4. Remove and replace non-conforming Work.
 - 5. Remove samples of installed Work for testing.
 - 6. Install specified Work in existing construction.
 - 7. Provide rerouting penetrations of non-structural surfaces for installation of piping and electrical conduit.
 - 8. Patch and repair fireproofing damaged after installation of other Work or demolition activities.
 - 9. Remove and finish construction at connections to other structures.
 - 10. Remove existing roofing where required by new Work, and patch to match existing roofing.
- D. Do not endanger any Work or Work of other Contractors, by cutting, excavating, or otherwise altering Work except with written consent of Contractor subject to review by Architect.
- E. Do not cut into or cut away structural concrete, other concrete or other structural members nor dig under foundations or into structural walls or other parts, or in any case allow same to be done without full knowledge and written consent of Architect.
- F. Repair or replace damaged work resulting from violation of these provisions.
- G. Use only firms or individual trades qualified to perform Work required under this Section.

1.3 QUALITY ASSURANCE

- A. Employ skilled persons experienced with material requiring cutting and patching.
 - 1. To the greatest extent practicable, employ original installer to perform cutting and patching for weather-exposed and moisture-resistant components, and sight-exposed surfaces.
- B. Written Requests:
 - 1. Submit requests in advance of cutting or alteration which affects:
 - a. Structural integrity of any component of Project.
 - b. Integrity of weather-exposed or moisture-resistant component.
 - c. Efficiency, maintenance, or safety of an operational component.
 - d. Visual qualities of sight-exposed components.
 - e. Work of Owner or separate contractor.
 - 2. Include in Request:
 - a. Location and description of affected work.

- b. Necessity for cutting or alteration.
 - c. Description of proposed work, and products to be used.
 - d. Alternatives to cutting and patching.
 - e. Effect on work of Owner or separate contractor.
 - f. Written permission of affected separate contractor.
 - g. Date and time work will be executed.
- C. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- D. Operational Limitations:
- 1. Cut and patch operating elements or related components in a manner that results in maintaining their capacity to perform as intended.
 - 2. Cut and patch operating elements or related components in a manner that does not result in increased maintenance or decreased operational life or safety.
- E. Structural Work:
- 1. Cut and patch structural elements in a manner that maintains their load-carrying capacity or load-deflection ratio.
 - 2. Follow applicable NFPA Standards when torch cutting is required.
- F. Visual Requirements:
- 1. Cut and patch construction exposed on exterior or in occupied spaces in a manner to, in Architect's opinion, retain the building's aesthetic or visual qualities.
 - 2. Cut and patch construction in a manner to avoid visual evidence of cutting and patching.
 - 3. Remove and replace construction which was cut and patched in a visually unsatisfactory manner.
- G. Warranties and Existing Warranties:
- 1. Replace, patch, and repair material and surfaces cut or damaged by methods and with materials and in such manner to maintain warranties.

1.4 JOB CONDITIONS

- A. Before start of Work, obtain and pay for permits required by authorities having jurisdiction and notify utilities companies.
- B. Obtain approval of Owner and authorities having jurisdiction for Work which affects existing means of egress.
 - 1. Review with and obtain approval of authorities for temporary construction.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Protect existing construction during cutting and patching to prevent damage.
- E. Provide protection from adverse weather conditions.
- F. Avoid cutting existing utilities, pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until alternate provisions have been provided.
- G. Carefully remove and store items to be salvaged in an area as directed by or easily accessible by Owner.

1.5 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide dimensioned drawings showing position and size of sleeves and openings in relation to structural grid of building, equipment, and other assemblies.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use materials identical to existing materials.

- B. For exposed surfaces, use materials that visually match existing adjacent surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used.
- C. Use materials whose installed performance will equal or surpass that of existing materials.
- D. Where applicable, comply with specifications for type of Work to be performed.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Prior to bid, become knowledgeable of existing facilities, utility requirements and construction.
 - 1. Existing facility documents may be available through the Owner for review.
- B. Perform preliminary investigations to determine extent of Work.
 - 1. Conditions evident by such investigation will not be allowed as claim for extra cost.
- C. Inspect conditions for work, including elements subject to movement or damage during:
 - 1. Cutting and patching.
 - 2. Excavating and backfilling.
- D. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.
- E. Before proceeding, meet at site with parties involved in cutting and patching, including mechanical and electrical trades.
 - 1. Review areas of potential interference and conflict.
 - 2. Coordinate procedures and resolve potential conflicts before proceeding.
- F. After uncovering existing conditions for Work, inspect conditions affecting installation of new products or Work.

3.2 PREPARATION PRIOR TO CUTTING

- A. Provide shoring, bracing and support to maintain structural integrity.
- B. Provide protection for other affected portions of Project.
- C. Provide protection from elements when required.
- D. Existing Utility Services and Mechanical/Electrical Systems:
 - 1. Bypass existing utility services and building systems to be removed, relocated, or abandoned, before cutting to prevent interruption to occupied areas.
- E. Maintain excavations free of water.

3.3 CUTTING AND REMOVAL - GENERAL

- A. Execute fitting and adjustment to provide finished installation to comply with specified tolerances and finishes.
- B. Execute cutting with methods to avoid damage of existing or other Work and provide surfaces to receive installation of new Work.
- C. Perform backfilling as specified in applicable sections.
- D. Neatly cut and remove materials, and prepare openings to receive new work.
- E. Remove masonry or concrete in small sections.
- F. Provide shoring, bracing, and other supports to prevent movement, settlement, or collapse of remaining or adjacent wall areas, structure, or facilities.
- G. Arrange shoring, bracing, and supports to prevent overloading of structure.
- H. Exercise precaution to prevent damage to existing remaining work or to adjacent facilities.

- I. Execute Work using methods which will prevent interference with use of remaining and adjacent facilities by Owner.
- J. Remove existing work indicated to be removed, or as necessary for installation of new Work.
- K. Provide for cutting, fitting, repairing, patching and finishing of Work disturbed by installation of new Work.
- L. Do not remove or damage fireproofing materials.
 - 1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
 - 2. Repair or replace damaged fireproofing.

3.4 CUTTING

- A. Cut existing construction to:
 - 1. Provide for installation of other components or performance of other construction activities, and subsequent fitting and patching to restore surfaces to their original condition.
 - 2. Fit products together, to integrate with other work.
 - 3. Uncover work to install ill-timed work.
 - 4. Remove and replace defective and non-conforming work.
 - 5. Provide openings for mechanical and electrical penetrations.
- B. Cut existing construction using methods least likely to damage components to be retained or adjoining construction.
 - 1. Where possible, review proposed procedures with original installer or comply with original installer's recommendations.
 - 2. Use hand or small power tools designed for sawing or grinding, not hammering and chopping.
 - a. Cut holes and slots to size required, with minimum disturbance of adjacent surfaces.
 - b. Temporarily cover openings when not in use.
 - 3. Cut or drill existing finished surfaces from exposed or finished side into concealed surfaces.
 - 4. Cut concrete and masonry using a carborundum saw or diamond core drill.
 - 5. Comply with requirements of Division 31, where cutting and patching requires excavating and backfilling.
 - 6. Bypass portions of existing utility services to remain, removed, relocated or abandoned, before cutting.
 - a. Cut pipe or conduit partitions to be removed in walls.
 - b. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting.

3.5 CUTTING IN CONCRETE CONSTRUCTION

- A. Do not cut or core drill openings or holes in beams, joists, and columns without prior written approval of Architect.
 - 1. Comply with additional requirements and instructions of Architect.
- B. In members other than beams, joists, and columns and unless shown on architectural or structural drawings; obtain prior written approval of Architect for openings larger than 10 IN in any dimension, or where dimension between 2 openings in less than 2 times maximum dimension of largest opening.
- C. At floor slabs and walls to be core drilled or cut, locate and mark reinforcing in both faces by means of x-ray, ground penetrating radar, pach-ometer, or prof-ometer.
 - 1. Submit drawings showing location of rebar and proposed cuts or cores for review.
- D. When written approval is obtained, comply with additional requirements and instructions of Architect.

3.6 CUTTING IN POST TENSIONED CONCRETE CONSTRUCTION

- A. Do not cut into nor core drill openings or holes in beams or joists.

- B. Do not cut into nor core drill openings or holes in slabs without prior written approval of Architect.
 - 1. When approval is obtained, comply with additional requirements and instructions of Architect.
- C. Openings not greater than 6 IN in any dimension are permitted in flat slab portions of construction except that such openings shall not interfere with or disturb strands.
 - 1. Do not place closer than 12 IN to any column face, or closer than 24 IN to any post tensioning strand anchor.
- D. Do not install any trenched duct electrical systems.

3.7 CUTTING IN PRECAST/PRESTRESSED CONCRETE CONSTRUCTION

- A. Do not cut openings nor core drill vertically nor horizontally through stems of members.
- B. Openings smaller than 6 IN diameter or 6 IN maximum dimension may be cut in flanges of units after obtaining prior written approval of Architect.
 - 1. When approval is obtained, comply with instructions of Architect.

3.8 CUTTING IN STEEL FRAME AND METAL DECK CONSTRUCTION

- A. Do not cut nor drill holes in webs and flanges of columns, beams, purlins, and joists without prior written approval of Architect.
 - 1. When approval is obtained, comply with requirements and instructions of Architect and provide reinforcing at such locations when required.
- B. When openings are cut into metal decks having cast-in-place concrete slab over metal deck:
 - 1. No reinforcing of holes is required for circular openings or sleeves up to 6 IN diameter and for rectangular openings having no side dimension greater than 6 IN.
 - 2. Reinforce openings greater than 6 IN.
 - 3. Obtain prior written approval of Architect for openings not shown on architectural or structural drawings.
 - a. Comply with additional requirements and instructions of Architect.
- C. When openings are cut into metal roof decks that have no concrete cast-in-place (except lightweight insulating cementitious roof fill) over deck:
 - 1. No reinforcing of holes is required for circular openings less than 6 IN diameter and for rectangular openings having no side dimension greater than 6 IN.
 - 2. Reinforce openings between 6 IN and 12 IN, with 20 GA flat steel sheet 12 IN greater in dimension than opening; fusion weld to top surface of deck at each corner and on each side midway between corners.
 - 3. Do not cut openings greater than 12 IN without prior written approval of Architect.
 - a. Comply with requirements and instruction of Architect.

3.9 MATCHING AND PATCHING

- A. Where items are removed from existing walls, ceilings, floors or partitions to remain, repair wall, ceiling, floor or partition disturbed by removal.
- B. Where walls, ceilings, floors or partitions are removed, repair abutting walls, ceilings or floors disturbed by removal.
- C. Where existing construction is cut, removed or otherwise disturbed to permit installation of new Work, match and patch existing disturbed construction.
- D. Install new products to provide completed Work in accordance with requirements of Contract Documents.
- E. Use methods and materials similar in appearance, and equal in quality to areas or surfaces being repaired.
- F. Patch Work to match existing work and adjacent surfaces.

- G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.
 - 1. Refinish continuous surfaces to nearest intersections.
 - 2. Refinish assemblies entirely.
- H. Remove and replace existing ceilings and finishes for installation of Work, if not shown to be removed on Architectural Drawings and Schedules.
 - 1. If existing ceiling cannot be satisfactorily reinstalled, replace with like materials and construction.
- I. Provide firestopping at penetrations of fire-rated walls and smoke partitions, ceiling or floor construction, in accordance with Section 07 84 00.
- J. Repair or replace non-coordinated or defective Work, or Work not conforming to Contract Documents.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Owner has established that this Project shall include proactive measures for waste management participation by all parties to the contract.
1. The purpose of this program is to ensure that during the course of the Project all diligent means are employed to pursue practical and economically feasible waste management and recycling options.
 2. Upon award, each subcontractor shall be required to furnish documentation from suppliers or manufacturers regarding waste management and recycling options for those products and procedures furnished.
 3. Waste disposal to landfills shall be minimized.
- B. Definitions:
1. Waste: Any material that has reached the end of its intended use. Waste includes salvageable, returnable, recyclable and reusable construction materials that would otherwise be discarded or destroyed.
 2. Construction waste: Solid wastes including, but not limited to, building materials, packaging materials, debris and trash resulting from construction operations.
 3. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or Waste to Energy facility acceptable to authorities having jurisdiction.
 4. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
 5. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
 6. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the work.
 7. Hazardous waste: Any material or byproduct of construction that is regulated by the Environmental Protection Agency and that may not be disposed in any landfill or other waste end-source without adherence to applicable laws.
 8. Trash: Any product or material unable to be returned, reused, recycled or salvaged.
 9. Landfill: Any public or private business involved in the practice of trash disposal.
 10. Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site.

1.2 PERFORMANCE GOALS AND REQUIREMENTS

- A. General: Develop Waste Management Plan that results in end-of-Project rates for salvage/recycling of a minimum of [50] [75] [insert number] percent by weight of total waste generated by the Work.

1.3 SUBMITTALS

- A. LEED Implementation Plan:
1. Construction Waste Management Plan.
- B. LEED Progress Reports:
1. Submit reports concurrent with each Application for Payment, submit copies of report. Include separate report for demolition and construction waste. Include the following information:
 - a. Material category.
 - b. Total quantity of waste in tons.

- c. Quantity of waste salvaged, both estimated and actual in tons.
- d. Quantity of waste recycled, both estimated and actual in tons.
- e. Total quantity of waste recovered (salvaged plus recycled) in tons.
- f. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

C. Project Closeout:

- 1. Waste Reduction Calculations: Before request for Substantial Completion, submit copies of calculated end of Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- 2. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- 3. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- 4. Recycling and Processing Facility Records: Indicate receipt and acceptance of waste by landfills and Waste to Energy facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Project Manager shall conduct conference at Project site to review methods and procedures related to waste management including but not limited to, the following:
 - 1. Review and discuss Waste Management Plan.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.5 CONSTRUCTION WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. [Include separate sections in plan for demolition and construction waste.] Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of [demolition] [land-clearing] [and] [construction] waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed in landfill or Waste to Energy facilities. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone number.
 - 3. Recycled Materials: Assign recycling to recycling subcontractor, or list local receivers and processors, and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 4. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and Waste to Energy facility. List hazardous material waste and disposal separately.

5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Waste Management Plan shall include locations of sorting and waste storage facilities on Site Plan of project.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Implement waste management plan as approved by [Architect] [Owner] [Construction Manager].
1. Establish waste diversion goals for the project by identifying at least five materials (both structural and nonstructural) targeted for diversion. Approximate a percentage of the overall project waste that these materials represent.
 - a. Common materials may include drywall, wood, scrap metals, brick, and concrete. Finish materials such as floor or ceiling tiles may also be included.
 2. Specify whether materials will be separated or commingled and describe the diversion strategies planned for the project.
 3. Provide where the material will be taken and how the recycling facility will process the material.
 4. Alternative daily cover (ADC) does not qualify as material diverted from disposal.
 5. Land-clearing debris is not considered construction, demolition, or renovation waste that can contribute to waste diversion.
- B. Implement the following practices to ensure construction waste is handled and diverted properly.
1. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 2. Define specific areas to facilitate separation of materials for recycling, salvage, reuse or return.
 3. If single-stream recycling is not used:
 - a. Separate construction waste by type at Project site to the maximum extent practical.
 - b. Do not mix recyclable materials.
 - c. Recycle and waste bin areas are to be maintained in an orderly manner and clearly marked to avoid contamination of materials. Inspect containers and bins weekly for contamination and remove contaminated materials if found.
 4. Stockpile processed materials on site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 5. Store materials away from construction area. Do not store within drip line of remaining trees.
 6. Store components off the ground and protect from weather.
- C. Source Reduction: Identify source reduction strategies. Strategies include:
1. Modular construction, reduced packaging, using industry-standard measurements, and prefabrication.
- D. Hazardous Wastes: Store in secure areas and comply with the following:
1. Hazardous wastes shall be separated, stored and disposed of in accordance with local and EPA regulations and additional criteria listed below:
 - a. Building products manufactured with PVC or containing chlorinated compounds shall not be incinerated.
 - b. Disposal of fluorescent tubes and ballasts to open containers is not permitted.
 - c. Disposal of building elements containing mercury to open containers is not permitted.
- E. Unused fertilizers shall not be co-mingled with construction waste.

- F. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - 1. Distribute waste management plan to everyone concerned within seven days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on site. Review plan procedures and locations established for salvage, recycling, and disposal.
- G. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with environmental controls specified in Division 01 Section 01 50 00 Temporary Facilities, Construction Controls and Facilities.

3.2 RECYCLING [DEMOLITION] [AND] [CONSTRUCTION] WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.

3.3 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or Waste to Energy facility acceptable to authorities having jurisdiction.
 - 1. Utilize a waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with this section.
 - 2. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 3. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials on site.
- C. Incineration/ Burning: Incineration/ burning of waste materials is not acceptable unless it is a part of a waste to energy diversion strategy.
- D. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 74 23
CLEANING

PART 1 - GENERAL

1.1 FIRE PROTECTION

- A. Store volatile waste in listed disposal containers.
- B. Maintain site and building so no condition provides a fire hazard.
- C. Remove combustible debris from building at end of each shift and from site daily.
- D. Sources of ignition and smoking are prohibited in flammable and combustible storage areas.
- E. Do not burn on-site.

1.2 POLLUTION CONTROL

- A. Conduct cleanup and disposal operations to comply with codes, rules, regulations, ordinances, and anti-pollution laws.
- B. Do not burn or dispose of combustible debris, rubbish and waste material on site.
- C. Do not discharge volatile, harmful, or dangerous materials into storm or sanitary drains or sewer systems.
- D. Prevent accumulation of wastes that create hazardous conditions.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

- A. Use materials recommended by manufacturers of surfaces to be cleaned.
- B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.
- C. Use only those cleaning materials which will not create hazards to health or property and will not damage surfaces.

2.2 CLEANING MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property, are non-toxic to both humans and aquatic life, and will not damage surfaces, and comply with the following:

PART 3 - EXECUTION

3.1 GENERAL

- A. Clean items installed under this Contract.
 - 1. Leave free of stains, dirt, dust, damage, or defects.
 - 2. Include washing, sweeping, polishing of wall surfaces, floors, windows, hardware, mirrors, lighting fixtures, equipment, etc.

3.2 DURING CONSTRUCTION

- A. Provide on-site listed disposal containers for collection of waste materials, debris, and rubbish.
 - 1. Dispose of off site once a week at an approved solid waste disposal site.
 - 2. Cover container to prevent blowing by wind.
- B. Keep work areas clean so as not to hinder health, safety or convenience of personnel in existing facility operations.

- C. Interior cleaning:
 - 1. Clean and vacuum interior space prior to start of painting, and continue cleaning daily until substantial completion.
 - 2. Schedule cleaning operations so contaminants do not fall on wet painted surfaces.
 - 3. Clean and protect Work in progress and adjoining materials in place, during handling and installation.
 - 4. Clean lunch/break area after each use.
- D. Exterior cleaning:
 - 1. Wet down dusty materials and rubbish to prevent blowing dust during entire construction period.
 - 2. If use of water is prohibited by law, seek an alternate method to prevent blowing dust.
 - 3. Perform cleaning operations as required during construction to prevent accumulations of dust, soil, and debris.
 - 4. Keep weeds and other vegetation trimmed to 3 IN maximum height.
 - 5. Remove snow and ice from access to buildings.

3.3 FINAL CLEANING

- A. At Substantial Completion, perform final cleaning of Work and existing areas wherever any area are left less than clean by construction operations.
 - 1. Complete cleaning operations before requesting review for Substantial Completion.
- B. Use experienced professional cleaners for final cleaning.
- C. Repair and touch-up marred areas.
- D. Broom clean and remove stains from paved surfaces; rake clean other surfaces of grounds.
- E. Ventilation systems:
 - 1. Clean permanent filters and replace disposable filters if units were operated during construction.
 - 2. Clean ducts, blowers, and coils in air conditioning units operated during construction.
- F. Remove grease, dust, dirt, stains, labels, fingerprints, mastic, adhesive, and foreign materials from interior and exterior surfaces, and fixtures, hardware, and equipment.
- G. Wash and shine glazing, mirrors, stainless steel, etc., including existing windows in area of construction.
- H. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.
 - 1. Replace all burned out lamps.
- I. Polish glossy surfaces to a clear shine.
- J. Remove temporary protection and facilities installed for protection of the Work during construction.

3.4 FIELD QUALITY CONTROL

- A. Prior to Owner occupancy, Contractor and Owner shall conduct an inspection of interior and exterior surfaces and Work areas to verify Project is clean to Owner's satisfaction.

SECTION 01 77 00
CONTRACT CLOSEOUT (GC)

PART 1 - GENERAL

1.1 PROVISIONS FOLLOWED BY AN ASTERISK (*) INCLUDE SOME OR ALL PROVISION AS OBTAINED FROM AIA DOCUMENT A201 - GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION.

1.2 SUBMITTALS

- A. Contract Closeout Information:
1. For substantial completion:
 - a. Comprehensive list of all items to be completed or corrected.
 - b. Contractor's Notice of Substantial Completion.
 - c. Certificates of governing authorities.
 - d. Submittals required by other Sections.
 2. For final completion:
 - a. Contractor's Certificate of Completion.
 - b. Evidence of payments and release or waiver of liens in triplicate.
 - 1) Contractor's Affidavit of Payments of Debts and Claims: AIA Document G706.
 - 2) Contractor's Affidavit of Release of Liens: AIA Document G706A.
 - 3) Contractor's release or waiver of liens.
 - 4) Separate releases or waivers of liens for subcontractors, suppliers, and others with lien rights against Owner, together with list of all such parties.
 - 5) If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
 - c. Consent of Surety (if any) to Final Payment: AIA Document G707.
 - d. Certificates evidencing that insurance to remain enforce.
 - e. Final application for payment.
 - f. Initialed list(s) of items to be completed or corrected verifying completion of each items.
 - g. List of Subcontractors and equipment suppliers. Include:
 - 1) Name.
 - 2) Address.
 - 3) Telephone number.
 - 4) Representative.
 - h. Letter of site conformance.
 - i. Closeout submittals required by other Sections.

1.3 SUBSTANTIAL COMPLETION

- A. Substantial Completion is the stage in the progress of Work when the Work or designated portion thereof is sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work for its intended use. *
1. Work will not be considered for Substantial Completion until all systems and equipment are operational; all designated or required governing agency inspections and certifications have been made and posted, instruction of designated Owner's personnel in operation of systems and equipment has been completed, operation and maintenance data has been satisfactorily turned over to Owner, and finishes are in place. In general, the only remaining Work shall be minor in nature, such that Owner may occupy or utilize Work or designated portion thereof, and completion or correction of Work by Contractor would not materially interfere or hamper Owner's intended business use or operation.
 2. Contractor shall certify that all remaining Work will be completed within 30 consecutive calendar days following date of Substantial Completion, or as agreed to in writing, and failure to do so shall automatically reinstate provisions for damages due Owner as contained

elsewhere in Contract Document or as provided by law for such period of time as may be required by Contractor to fully complete Work whether Owner has occupied Work or not.

- B. Obtain evidence of compliance with requirements of governing authorities:
 - 1. Certificates of inspection of:
 - a. Mechanical.
 - b. Electrical.
 - c. Plumbing.
 - d. Fire protection and life safety systems.
 - e. Elevators.
 - f. Etc.
 - 2. Health Department and other governing authorities as required.
 - 3. Certificate of Occupancy.
- C. When Contractor considers that Work, or a portion thereof which Owner agrees to accept separately, is substantially complete, Contractor shall thoroughly inspect Work, and prepare and submit to Architect a comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion (utilize form at end of this Section). *
- D. Contractor certify that:
 - 1. Work performed under this Contract has been thoroughly inspected and considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work for its intended use.
- E. Failure of Contractor to include an item on such list(s) does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents. *
- F. Contractor shall proceed promptly to complete and correct the items on list.
- G. After receipt of Contractor's comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion, Architect and Owner will, within reasonable period after notification, review list of items to be completed or corrected, or inspect Work, or designated portion thereof, to determine whether Work is Substantially Complete. *
- H. If Architect's or Owner's review or inspection discloses any item, whether or not included on Contractor's list, which is not sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work or designated portion thereof for its intended use: *
 - 1. Contractor will be notified stating reasons.
 - 2. Contractor shall substantially complete or correct Work.
 - 3. Contractor shall thoroughly re-inspect Work.
 - 4. Contractor shall submit another Contractor's Notice of Substantial Completion, a revised list of items to be completed or corrected, and a request for another review.
 - 5. Architect and Owner will again review list of items to be completed or corrected and Work.
- I. If Contractor prematurely submits a Contractor's Notice of Substantial Completion or requests Architect's review of Work, and Architect determines that Project or designated portion thereof is not Substantially Complete, Architect may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.
- J. Architect will not perform more reviews of sub-projects or phases than number indicated in Contract Documents or Owner – Architect Agreement, unless otherwise mutually agreed to by Architect and Owner.
- K. When Work or designated portion thereof is considered Substantially Complete, Architect will prepare a Certificate of Substantial Completion.
 - 1. The Certificate of Substantial Completion shall establish date of Substantial Completion, shall establish responsibilities of Owner and Contractor for security, maintenance, heat, utilities, damage to Work and insurance, and shall fix time within which Contractor shall complete and correct Work.

2. Warranties and guarantees required by Contract Documents shall commence on date of Substantial Completion of Work or designated portion thereof unless otherwise provided in Certificate of Substantial Completion.
 3. The Certificate of Substantial Completion shall be submitted to Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. *
- L. Owner may occupy Project, or designated portion thereof, under provisions agreed to in Certificate of Substantial Completion, and if required, a certificate of occupancy has been issued by governing authorities.
1. If Owner is going to occupy Project, or designated portion thereof, Contractor shall perform final cleaning immediately.
 2. If Owner or Architect discovers any Work which is not complete and/or is not in conformance with Contract Documents, during or after occupying or utilizes Work, whether included on a list or not, Owner shall notify Contractor to complete or correct item(s) identified.
- M. Contractor shall proceed expeditiously with adequate forces to complete or correct Work, and to complete all Project closeout requirements within designated time.
- N. Upon completion of Work, employ Licensed Surveyor to make survey of site to assure conformance of elevations, grade and site work to contours shown. Provide letter of site conformance.

1.4 FINAL COMPLETION

- A. After Contractor has completed all Work, and has thoroughly inspected Work to determine that it is sufficiently complete, is in general accordance with Contract Documents, and Contract is fully performed, Contractor shall submit Contractor's Certificate of Completion to Architect, and the list(s) of items to be completed or corrected initialed to indicate Contractor has verified completion of each item. * Utilize form at end of this section. Contractor certifies that:
1. Work has been thoroughly inspected by Contractor for compliance with Contract Documents.
 2. Work has been completed in accordance with Contract Documents.
 3. Equipment and systems have been tested and are operating satisfactorily.
 4. Contract closeout requirements have been completed satisfactorily and submitted.
 5. Contractor knows of no reason that insurance will not be renewable to cover period required by Contract Documents.
 6. Work is ready for final inspection and acceptance.
- B. Contractor submit final closeout submittals required by this and other Sections.
- C. Owner and Architect will make final walk through within a reasonable time after receipt of Contractor's Certificate of Completion and final Application for Payment. *
1. If Contractor prematurely submits a Contractor's Notice of Final Completion or requests Architect's final review of Project, and Architect determines that Project is not satisfactorily complete, Architect may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.
- D. Contractor shall remedy any remaining deficiencies or incomplete Work, at Contractor's expense.
- E. When Owner and Architect finds Work acceptable under Contract Documents and Contract satisfactorily performed, Architect will promptly issue a final Certificate for Payment. *
- F. Neither final payment nor any remaining retained percentage shall become due until Contractor submits to Architect;
1. an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with Work for which Owner or Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied (AIA Documents G706 and G706A),

2. a certificate evidencing that insurance required by Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to Owner,
 3. a written statement that Contractor knows of no substantial reason that insurance will not be renewable to cover period required by Contract Documents,
 4. consent of surety, if any, to final payment (AIA Document G707),
 5. Contractor's and Subcontractor's final release or waiver of liens,
 6. if required by Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of Contract, to extent and in such form as may be designated by Owner, for Owner's review, and
 7. if a Subcontractor refuses to furnish a release or waiver required by Owner, Contractor may furnish a bond satisfactory to Owner to indemnify Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to Owner all money that Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees. *
- G. If Substantial Completion or Final Completion is delayed through no fault of Owner or Architect, Architect may invoice Owner as a change in services for such costs, and associated travel costs. Contractor shall reimburse the Owner for such costs.

END OF SECTION

CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION

PROJECT: _____

ARCH PROJ. NO.: _____ CONTRACT DATE: _____

CONTRACT FOR: _____

WORK OR DESIGNATED PORTION SHALL INCLUDE: _____

Work performed under this Contract has been thoroughly inspected and is considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work or designated portion thereof for its intended use.

- Certificates of inspections indicating compliance with requirements of governing authorities, are attached hereto.
- Certificate of Occupancy have been obtained from governing authorities, are attached hereto.
- A comprehensive list of items to be completed or corrected, prepared by Contractor is attached, hereto. Failure to include any items on such list does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents.

Contractor will complete or correct Work by: _____

CONTRACTOR: _____

BY: _____ DATE: _____

OWNER (agrees) (does not agree) to accept portion designated above separately from rest of Project.

Owner intends to utilize, occupy or take use on: _____

OWNER: _____

BY: _____ DATE: _____

The Work designated above, has been determined to be:

- Substantially Complete and a Certificate of Substantial Completion will be issued.
- Not substantially complete for following reasons: _____

ARCHITECT: HDR Architecture, Inc. _____

BY: _____ DATE: _____

DISTRIBUTION: OWNER ARCHITECT CONTRACTOR

END OF CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION

CONTRACTOR'S CERTIFICATE OF COMPLETION

PROJECT: _____
ARCH. PROJECT _____
NUMBER: _____
CONTRACT FOR: _____
CONTRACT DATE: _____

This is to certify that I am an authorized official of, and have been properly authorized by said firm or corporation to certify following:

I know of my own personal knowledge, and do hereby certify on behalf of Contractor, that Work has been reviewed and thoroughly inspected for compliance with Contract Documents, that Work has been completed, in accordance with Contract Documents and Contract is fully performed, that all equipment and systems have been tested and are operating satisfactorily, that all Contract closeout requirements have been completed satisfactorily and submitted, know of no substantial reason that insurance will not be renewable to cover period required by Contract Documents, and Work is ready for final inspection and acceptance.

Attached are three (3) copies of following documents, which are required prior to final payment:

- Final Application for Payment.
- Contractor's Affidavit of Payments of Debts and Claims: AIA Document G706.
- Contractor's Affidavit of Release of Liens: AIA Document G706A.
- Contractor's Final Release or Waiver of Liens.
- Consent of Surety (if any) to Final Payment: AIA Document G707.
- Certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to Owner.
- The list(s) of if items which were to be completed and corrected, with each item initialed to indicate Contractor has verified completion or correction of each.
- List of subcontractors and equipment suppliers.
- Certified list of all sales and service taxes paid.
- Letter of site conformance by licensed surveyor.
- If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
- Bond satisfactory to Owner to indemnify Owner against liens from Subcontractors.
- Transmittal indicating Owner has received Project Record Documents.

I understand that acceptance of final payment by Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at time of final Application for Payment.

CONTRACTOR: _____ BY: _____

TITLE: _____ DATE: _____

Subscribed and sworn to me this _____ day of _____

NOTARY PUBLIC: _____

My commission expires: _____

DISTRIBUTION: OWNER ARCHITECT

END OF CONTRACTOR'S CERTIFICATE OF COMPLETION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Operation and Maintenance Data.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE MANUALS

- A. Assemble data indicated and data required to completely describe operation and maintenance procedures.
- B. Assemble information in form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Index files by specification section, with each item clearly labeled.
 - 2. Identify each volume with Project name and contents.
 - 3. Identify each item in manner consistent with names and identification numbers used in Contract Documents, not with manufacturer's catalog numbers.
 - 4. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- C. Use electronic files prepared by manufacturer where available.
 - 1. Scan paper documents and configure scanned file for minimum readable file size.
- D. Include each item on Table of Contents.

2.2 DATA REQUIRED FOR EQUIPMENT AND SYSTEMS

- A. Sequence of Operation:
 - 1. List valves, switches, etc., used to start, stop and adjust systems.
 - 2. Provide flow diagrams, control sequences and valve directory.
 - 3. Submit valve directory for review prior to inclusion in manual:
 - a. Show valve number, location.
 - b. List equipment controlled.
- B. Lubrication Instructions:
 - 1. Frequency of inspection and lubrication recommended.
 - 2. Type of grease.
 - 3. Amount of lubrication recommended.
- C. Maintenance and Troubleshooting Data:
 - 1. Manufacturer furnished data.
 - 2. Project record wiring diagrams.
 - 3. Name and address of manufacturer.
 - 4. Name and address of local representatives who stock or distribute repair parts.

2.3 DATA REQUIRED FOR FINISH MATERIALS

- A. Maintenance Data:
 - 1. Precautions necessary.
 - 2. Manufacturer's instructions and recommendations.
 - 3. Maintenance materials and tools required.
 - 4. Repair and/or replacement instructions.
 - 5. Name and address of manufacturer.

6. Name and address of local supplier of materials.

PART 3 - EXECUTION

3.1 DELIVERY

- A. Deliver electronic copies to Owner sixty (60) days prior to Owner instruction of systems and equipment, and substantial completion.
- B. Use Operation and Maintenance Data Transmittal form at end of this Section.
- C. Acquire Owner's acceptance of items listed on transmittal form.
- D. Forward copy of transmittal form with Owner's acceptance to Architect.

END OF SECTION

OPERATION AND MAINTENANCE DATA TRANSMITTAL

Project:

To Owner:

Date:

From C.M./Contractor:

Assemble data required to describe operation and maintenance procedures. Deliver as an indexed electronic PDF file. Include name, address, and phone number of closest supplier for each item.

Section	Description	Quantity
---------	-------------	----------

Owner's Verification and Acceptance

Accepted by: _____ **Date:** _____

Forward copy of this transmittal to the Architect.

DISTRIBUTION: OWNER CONTRACTOR C. M. ARCHITECT

END OF TRANSMITTAL

SECTION 01 78 26
INTERIOR FINISH FIRE PERFORMANCE DATA

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Copy of transmittal letter indicating Owner's acceptance to Architect.

PART 2 - PRODUCTS

2.1 INTERIOR FINISH FIRE PERFORMANCE DATA MANUALS

- A. Provide manuals in electronic data format .
 - 1. Coordinate with Owner.
- B. Include each item on table of contents.
- C. Assemble data indicated and other data required to completely describe operation and maintenance procedures.
- D. Index by specification section, with each item clearly labeled.
 - 1. Identify each volume with Project name and contents.
- E. Identify each item in manner consistent with names and identification numbers used in Contract Documents, not with manufacturer's catalog numbers.

2.2 DATA REQUIRED FOR FINISH MATERIALS

- A. Interior finish fire performance data:
 - 1. Provide for each interior finish and furnishing material and type specified:
 - a. Manufacturer's printed information including:
 - 1) Fire class.
 - 2) NFPA test number.

PART 3 - EXECUTION

3.1 DELIVERY

- A. Deliver two copies to Owner 60 days prior to Owner instruction of systems and equipment, and substantial completion.
- B. Use Interior Finish Fire Performance Data Transmittal form at end of this Section.
- C. Acquire Owner's acceptance of items listed on transmittal form.
- D. Forward copy of transmittal form with Owner's acceptance to Architect.

END OF SECTION

INTERIOR FINISH FIRE PERFORMANCE DATA TRANSMITTAL

Project:

SECTION 01 78 36
WARRANTIES AND GUARANTEES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Execute and provide notarized Project Warranty on form furnished at end of Section.
- B. Warranties specified in Divisions 02 through 48 Sections shall be in addition to, and run concurrent with other warranties required by Contract Documents.
 - 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to the Owner.
 - 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for the Owner.
- C. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.
- D. Manufacturer's Warranties:
 - 1. Provide for products, equipment, systems and installations required by Divisions 02 through 48 Sections of Contract Documents for duration indicated.
 - 2. Where manufacturer's standard warranties or guarantees or both expire before duration required by other Sections of Contract Documents, obtain and pay for extensions as part of Contract Price.
- E. Special Warranties:
 - 1. Refer to Divisions 02 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.
 - 2. Provide written Special Warranties for products, equipment, systems, installations, and joint responsibilities as noted and required by Divisions 02 through 48 Sections of Contract Documents for duration indicated.
 - 3. Prepare a written document that contains appropriate terms and identification, ready for execution.
 - a. Modified and properly executed Manufacturer's standard form to include project specific information.
 - b. Submit draft for approval before final execution.
 - 1) See Section 01 33 00.
- F. Provide Warranties, Special Warranties and Guarantees prior to final payment.
 - 1. Provide in electronic data format.
 - a. Coordinate format with Owner.
- G. Warranties, Special Warranties and Guarantees required by Contract Documents shall commence on date of Substantial Completion of Work unless otherwise indicated in Certificate of Substantial Completion.

1.2 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Full executed and notarized Project Warranty on included form.
 - 2. Transmittal letter indicating Owner's receipt of electronic data format containing product equipment and system warranties or guarantees or both required by other Sections of Contract Documents.

1.3 JOB CONDITIONS

- A. If for any reason, Contractor cannot warrant or guarantee or both any portion of Work using products or construction methods indicated or required by other Sections of Contract Documents, notify Architect in writing during bid period, and before contracts are awarded, indicating reasons and names of products and data on substitutions that can be warranted or guaranteed or both.
 - 1. Should Contractor fail to notify Architect, Contractor will be considered as having agreed to warrant or guarantee the Work indicated.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 PROJECT WARRANTY

- A. Execute and provide notarized Project Warranty on form furnished at end of Section.
 - 1. Provide Contractor's name, address, signature and date.
 - 2. Notarial Act and notarization:
 - a. Warranty document is required to be signed, dated, and sealed with Notary Public seal or stamp in accordance with state and territorial notary laws.

3.2 PRODUCT, EQUIPMENT AND SYSTEM WARRANTIES AND GUARANTEES

- A. Compile approved warranties and guarantees or both required by other Sections of Contract Documents.
 - 1. Index by Section, with each warranty, guarantee, or both clearly labeled.
 - a. Identify each volume with project name and contents.
 - 2. Identify each warranty or guarantee or both in manner consistent with names and identification numbers used in Contract Documents.
 - 3. Provide transmittal letter containing:
 - a. Date
 - b. Project title
 - c. Contractor's name and address
 - d. Title and number of warranties, guarantees, or both
 - e. Indication of Owner's receipt
 - 4. Deliver to Owner prior to final payment with copy of transmittal letter indicating Owner's receipt.

END OF SECTION

PROJECT WARRANTY

PROJECT:

PROJECT NO.:

OWNER:

DATE OF SUBSTANTIAL COMPLETION:

As indicated on Certificate of Substantial Completion

Contractor, warrants to Owner that Work is free from defects not inherent in the quality required or permitted, and that Work conforms with requirements of Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor’s warranty excludes remedy for damage or defect caused by abuse, modifications not executed by Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

If, within one-year after the date of Substantial Completion of Work or designated portion thereof, or by terms of an applicable Special Warranty required by Contract Documents, any of the Work is found to be not in accordance with requirements of Contract Documents, the Contractor shall correct it promptly after receipt of written notice from Owner to do so unless Owner has previously given Contractor a written acceptance of such condition. Owner shall give such notice promptly after discovery of the condition.

The above shall not be construed to establish a period of limitation with respect to other obligations which Contractor might have under Contract Documents. Establishment of one-year period for correction of Work relates only to specific obligation of Contractor to correct Work, and has no relationship to time within which obligation to comply with Contract Documents may be sought to be enforced, nor to time within which proceedings may be commenced to establish Contractor’s liability with respect to Contractor’s obligations other than specifically to correct Work.

CONTRACTOR:
ADDRESS:

BY:
TITLE:

SIGNATURE: _____
DATE: _____

Subscribed and sworn to me this ____ day of _____ in the year of _____

NOTARY PUBLIC:
LOCATION:

SIGNATURE: _____

My Commission Expires:

END OF DOCUMENT

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. All documents required by Contract Documents, including but not limited to:
 - 1. Contract Drawings.
 - 2. Project Manual and Specifications.
 - 3. Addenda.
 - 4. Shop Drawings.
 - 5. Product Data.
 - 6. Samples and Mock-ups.
 - 7. Project Information.
 - 8. Change documents.
 - 9. Request for Information responses, directives, clarifications, interpretations, etc.
 - 10. Field test records.
 - 11. Warranties.
- B. Field Documents:
 - 1. Complete set of all documents required for construction.
 - 2. Used for construction of project.
- C. Periodic Update Documents:
 - 1. Complete separate set of all documents required for construction, with exception of samples and mock-ups, used for posting and updating on weekly basis.
 - 2. Do not use for construction of project.
- D. Project Record Documents:
 - 1. Complete set of all documents required for construction, with exception of samples and mock-ups, for updating at end of Project.

1.2 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Copy of transmittal letter to Owner.
 - a. At completion of project, turn over Project Record Documents to Owner with letter of transmittal.
 - b. Submit Record Documents in suitable containers .
 - c. Provide Transmittal Letter containing:
 - 1) Date.
 - 2) Project title.
 - 3) Contractor's name and address.
 - 4) Title and number of each Project Record Document.
 - 5) Certification that Project Record Documents submitted are complete, accurate and reflect actual construction of project.
 - 6) Owner's signature indicating receipt and acceptance of Project Record Documents.
 - 2. Electronic copy of Record Drawing files to Architect.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 POSTING PRIOR TO CONSTRUCTION

- A. After Contract is executed, but prior to start of construction, obtain Contract Drawings and Project Manual/Specifications that will be used for Field Documents and Periodic Update Documents.

3.2 OBTAIN COPIES OF ALL ADDENDA AND POST TO ALL ABOVE DOCUMENTS. FIELD DOCUMENTS

- A. Field Documents are intended for use in the construction of the project.
- B. Maintain minimum of one copy at project site.
- C. Label each document, "FIELD."
- D. Post documents with changes on a daily basis.

3.3 PERIODIC UPDATE DOCUMENTS

- A. Periodic Update Documents are intended for use by Architect, Owner, Owner's consultants, Authorities Having Jurisdiction, Special Inspections, and Testing Agencies.
- B. Maintain electronic file of project documents at project site.
- C. Identify each document within file, "PERIODIC UPDATE."
- D. Update documents on weekly basis:
 - 1. Contract drawings:
 - a. Amend to record actual construction including but not limited to:
 - 1) Addenda.
 - 2) Change orders or field orders.
 - 3) Clarifications, interpretations, directives.
 - 4) Depths of various elements of foundations in relation to first floor level.
 - 5) Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
 - 6) Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - 7) Field changes of dimension and/or detail.
 - 8) Revisions incorporated into the contract by Change Order, Field Order, Clarifications, Interpretations or Directives.
 - 2. Project Manual/Specifications:
 - a. Amend affected sections to record changes including but not limited to:
 - 1) Addenda.
 - 2) Change orders or field orders.
 - 3) Clarifications, interpretations, directives.
 - 4) Include added sections to Project Manual/Specifications.
 - 5) Indicate manufacturer, makes, and models used for actual construction of project.
 - 3. Concealed work:
 - a. Do not conceal work until concealed information is recorded on Periodic Update Documents.
 - b. Work concealed prior to recording must be uncovered.
 - c. Upon recording on Periodic Update Documents, restore work at Contractor's expense.

3.4 PRODUCTION OF PROJECT RECORD DOCUMENTS

- A. Record Drawings:

1. Architect will furnish one set of Contract Documents in Adobe "PDF" file format with Architect's seals and signatures removed for use as base Record Documents.
 2. Mark Contract Drawings completely and accurately.
 3. Employ personnel proficient at recording electronic graphic information in production of marked-up drawings to transfer all changes, corrections, entries, and other items from the Periodic Update Documents to Record Documents.
 - a. Refer instances of uncertainty to Architect for resolution.
 4. Record Digital Data Files:
 - a. Prepare full set of corrected digital data files of Contract Drawings immediately before inspection for Certificate of Substantial Completion:
 - 1) Provide in annotated PDF electronic file with comment function enabled.
 - b. Incorporate changes and additional information previously entered on Periodic Update Drawings.
 - c. Delete, redraw, and add details and notations where applicable.
 - d. Name each PDF file to match Contract Drawing identification, i.e. "A-103G.pdf".
 - e. Label each document "PROJECT RECORD PRODUCED BY CONTRACTOR" and date in prominent place.
 5. Provide Owner and Architect original Record Drawings, and digital data files in linked PDF electronic format.
 - a. Include:
 - 1) Addenda.
 - 2) Change order or field order.
 - 3) Clarifications, interpretations, directives.
 - 4) Bind added sections into Project Manual/Specifications.
- B. Record Computer Aided Drafting (CAD) System Drawings:
1. Provide Record Drawings in electronic CAD format for systems indicated in Submittal Procedures, Section 01 33 00.
 - a. Employ skilled CAD technicians to update CAD files with information from Periodic Update Documents.
 - b. Comply with current version of National CAD Standards.
 - c. Provide in same size and scale as original Contract Drawings.
 - d. Organize CAD information into separate electronic files that correspond to each sheet of Contract Drawings.
 - 1) Name and number CAD drawing with corresponding information on Contract Drawing.
 - 2) Name each CAD drawing file with drawing identification.
 - e. Label each document "PROJECT RECORD PRODUCED BY CONTRACTOR" and date in prominent location.
 - f. Redraw, delete or add details and notations where applicable.
 - g. Produce new CAD drawings in lieu of updating original CAD drawing file where not suitable to indicate actual installation.
 - 1) Produce new CAD drawings when a contract change document was issued, as a result of acceptance of alternate, substitution, or other modification.
 - h. Architect will furnish Contractor with revised CAD drawing file of architectural plan backgrounds if significantly revised by Architect during construction phase.
 - 1) CAD floor plan backgrounds will indicate wall layout, column lines and room names and numbers.
 - 2) Architect makes no representation as to accuracy or completeness of CAD files.
 2. Submit preliminary CAD files to Architect for review prior to submitting final CAD files.
 3. Submit final updated CAD files.
 - a. Include all system drawing files, whether or not changes and additional information from Periodic Update Documents.
 4. Submit data files to Owner and Architect of final Record Drawings in PDF format electronically created from CAD files.
 - a. Do not scan.

- b. Include all system drawing files, whether or not changes and additional information was included in Periodic Update Documents.
- C. Other Record Documents:
- 1. Transfer recorded changes from original to replacement copy.
 - 2. Label each document "PROJECT RECORD PRODUCED BY CONTRACTOR" and date in prominent location.

END OF SECTION

SECTION 01 78 43
SPARE PARTS, TOOLS AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Submit spare parts, tools and materials directly to Owner.
 - 2. Submittal to Architect is not required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Spare Parts and Tools:
 - 1. Package in clearly identified boxes.
 - 2. Indicate manufacturer's name, part name and stock number.
 - 3. Indicate piece of equipment part or tool is for.
 - 4. Indicate name, address and phone number of closest supplier.
- B. Maintenance Materials:
 - 1. Package in clearly identified boxes.
 - 2. Indicate trade name and stock number.
 - 3. Indicate which item material is to be used with.
 - 4. Indicate name, address and phone number of closest supplier.
- C. Extra Materials:
 - 1. Package in clearly identified containers, or install where indicated.
 - 2. Indicate trade name, stock number, size, color, etc.
 - 3. Indicate where product is to be used.
 - 4. Indicate name, address and phone number of closest supplier.

PART 3 - EXECUTION

3.1 DELIVERY

- A. Deliver to Owner prior to substantial completion unless Owner requests earlier delivery.
- B. Deliver to location directed by Owner.
- C. Complete Maintenance Material Transmittal form at end of this Section.
 - 1. Acquire Owner's acceptance of items listed on transmittal.
 - 2. Transmittal to indicate Owner's acceptance.
 - 3. Forward copy of transmittal forms with Owner's acceptance to Architect.

END OF SECTION

SPARE PARTS, TOOLS AND MAINTENANCE MATERIAL TRANSMITTAL

Project:

To Owner:

Date:

From C.M./Contractor:

Package extra material, maintenance materials, spare parts, and tools in clearly identified boxes; indicate manufacturer's name, trade name, part name, stock number, size, color, etc. Indicate which item maintenance material is to be used with, piece of equipment part or tool is for, or where extra material is to be used. Indicate name, address, and phone of closest supplier.

Section	Description	Quantity

Owner's Verification and Acceptance

Accepted by: _____

Date: _____

Forward copy of this transmittal to the Architect.

DISTRIBUTION: OWNER CONTRACTOR C. M. ARCHITECT

END OF TRANSMITTAL

SECTION 01 79 00
SYSTEM DEMONSTRATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide instruction for equipment and systems which require Operation and Maintenance Data specified in technical sections.

1.2 QUALITY ASSURANCE

- A. Instructors:
1. Member of installer's staff, and authorized representative of component, assembly, or system manufacturer.
 2. See specification technical sections for additional requirements.

1.3 SUBMITTALS

- A. Contract Closeout Information:
1. Transmittal letter indicating Owner's receipt of required demonstrations, copies of completed reports and video files.

1.4 JOB CONDITIONS

- A. Complete instruction prior to Substantial Completion.
1. Submit separate report for each system or type of equipment to Owner for approval.
 - a. Submit report form attached, with preliminary information to Owner at least two (2) weeks prior to first instruction period.
 - b. Submit completed report to Owner and Architect.
 2. Submit video files for each instruction to Owner.
 - a. Name each file with description of equipment or system.
 - b. Provide index of instruction files.
 - c. Provide on DVD.

PART 2 - EXECUTION

2.1 PREPARATION

- A. Assemble instructional aids.
- B. Supply operation and maintenance data for use during instruction.
- C. Provide video equipment available for each instruction.
- D. Schedule instruction with Owner when component, assembly, or system has been tested, is in correct operating condition and is fully functional.

2.2 INSTRUCTION

- A. Provide video and physical instruction.
- B. Explain use of operating and maintenance manuals.
- C. Furnish tools required.
- D. Instruct Owner's personnel in operation and maintenance of equipment and systems.
1. Provide instruction to satisfaction of Owner.
- E. Tour building areas involved and identify:
1. Maintenance points and access.
 2. Control locations and equipment.

- F. Operating Sequences:
 - 1. Identify location and show operation of switches, valves used to start, stop and adjust systems.
 - 2. Explain use of flow diagrams and operating sequence diagrams.
 - 3. Demonstrate operation through complete cycle or cycles and full range of operational modes, including testing and operational adjustment.
- G. Control Equipment:
 - 1. Temperature settings.
 - 2. Switch modes.
 - 3. Available adjustments.
 - 4. Reading of gauges.
 - 5. Functions serviced only by authorized factory representatives.
- H. Troubleshooting:
 - 1. Demonstrate common occurring problems.
 - 2. Identify procedures requiring attention of factory personnel.
- I. Maintenance Procedures:
 - 1. Identify items requiring periodic maintenance.
 - 2. Demonstrate preventive maintenance procedures and recommended maintenance intervals.
 - 3. Demonstrate commonly occurring maintenance procedures not part of preventive maintenance program.
 - 4. Identify maintenance tools and materials used.

END OF SECTION

EQUIPMENT AND SYSTEMS OWNER INSTRUCTION REPORT

Project: _____

Project Number: _____

Contractor: _____

System or Equipment: _____

Specification Section: _____

PRELIMINARY INFORMATION

To be completed by Contractor/Construction Manager:

Proposed dates for instruction period: _____ to _____.

Contractor Representative conducting instruction: _____.

Number of hours of instruction required by Contract Documents: _____.

To be completed by Owner:

Owner's personnel to be instructed (designate supervisor if required).

Contractor's Representative/Construction Managers Representative maintain and complete this report during course of instruction.

Instruction Log						
Date	Hours	Material Covered	Instructor Initials	Owner's Personnel Receiving Instruction	Personnel Initials	Comments

Total Hours Completed: _____ Instructor's Signature: _____

Date Instruction Completed: _____ Owner's Signature: _____

Distribution: Owner Architect Construction Manager Contractor

END INSTRUCTION REPORT

SECTION 01 81 21

INDOOR AIR QUALITY MANAGEMENT (IAQ) DURING CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing protection of indoor air quality (IAQ), absorbent materials, and mechanical system from contamination during construction and building flush out.

1.2 QUALITY ASSURANCE

- A. SMACNA Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).

1.3 DESCRIPTION - GENERAL

- A. IAQ Management During Construction: Minimize contaminants generated during construction. Methods to include, but not limited to:
 - 1. Practices which minimize the amount of dust generated.
 - 2. Reduction of solvent fumes and volatile organic compound (VOC) emissions.
 - 3. Maintaining good housekeeping practices including sweeping and periodic dust and debris removal.
 - 4. Maintain dry conditions to protect stored on-site and installed absorptive materials from moisture damage.
 - 5. No visible haze in air.
- B. Prevent migration of moisture from exterior to building interior and prevent release of moisture from building materials that could result in formation of mold, delamination of adhesive applied materials or other damages caused by water.

1.4 PRECONSTRUCTION CONFERENCE

- A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner and Architect to discuss the proposed IAQ Management Plan and to develop agreement relative to details of IAQ Management During Construction procedures.

1.5 SUBMITTALS

- A. Project Information:
 - 1. Construction IAQ Management Plan.
 - 2. Compliance Photographs:
 - a. Provide a minimum of six (6) photographs at three distinct phases of completion demonstrating compliance with standard or examples of remediation efforts to bring into compliance.
 - b. Date and time stamp photographs and identify approach taken for each.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT

- A. Construction IAQ Management Plan:
 - 1. Meet or exceed SMACNA Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3), and include following measures:

- a. HVAC Protection.
 - b. Source Control.
 - c. Pathway Interruption.
 - d. Housekeeping.
 - e. Scheduling.
2. Provide solid physical barriers to isolate areas of construction.
 - a. Securely attach and seal at floor and structure above.
 3. Schedule adequate time for product installation.
 4. Maintain negative pressure in construction area.
 5. Do not recirculate air prior to occupancy.
 6. Seal return air ducts and use direct exhaust to outside.
 7. Factory age sheet goods.
 8. Comply with manufacturer's instructions for appropriate drying times.
 9. Protect installed absorbent materials with recycled or recyclable materials.
- B. HVAC Protection:
1. Protect air handling and distribution equipment, and air supply and return ducting during construction.
 2. Adequately cover and protect exposed air inlets and outlets, openings, grilles, ducts, plenums, as required to prevent water, moisture, and other contaminant intrusion.
 3. Apply protection immediately after installation of equipment and ducting.
 4. Protect duct runs at end of each day's Work.
 5. During dust producing activities, e.g. drywall installation and finishing, turn ventilation system off, and protect HVAC supply and return openings from dust infiltration.
 - a. Provide temporary ventilation.
 6. Provide temporary filtration media for permanently installed air handlers if used during construction,
 - a. Provide minimum efficiency reporting value (MERV) of 8 at each return air grille, per ASHRAE Standard [52.2 – 1999, 52.2-2007].
 - b. Replace filtration media immediately prior to occupancy.
- C. Source Control:
1. Protect stored on-site or installed absorptive or porous materials such as batt insulation and drywall from exposure to moisture.
 2. Do not use wet, damaged porous materials in the building. Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove them from the site and properly dispose.
 3. Preconditioning:
 - a. Prior to site delivery off-gas odorous products, or products with significant volatile organic compound (VOC) emissions, in dry, well ventilated space for 14 calendar days.
 - b. Condition products, without containers and packaging, to maximize off-gassing of VOCs.
 - c. Condition products in a ventilated warehouse or other building. Provide a temperature range of 60 DEGF minimum to 90 DEGF maximum continuously during ventilation period.
 - d. Do not ventilate within limits of Work unless otherwise accepted by Architect.
 - e. Comply with substitution requirements for consideration of other locations.
 4. Take special care to prevent accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew, including materials with moisture stains.
 5. Replace moldy materials with new, undamaged materials.
 6. Provide ventilation, air circulation and air changes to dissipate excess humidity when present.
 7. Prohibit the use of tobacco products inside the building and within 50 FT of building during construction.
- D. Pathway Interruption:

1. Isolate work areas from other spaces by sealed doorways or windows or through the use of temporary barriers.
 2. Install exhaust ventilation equipment to maintain negative pressure differential between work area and adjacent areas of building.
 3. Exhaust ventilation units to outside of building.
- E. Housekeeping:
1. Provide temporary ventilation during construction to minimize accumulation of dust fumes, vapors, or gases in the building.
 2. Continuously ventilate during and after installation of materials that emit VOCs until emissions dissipate:
 - a. Period after installation shall be sufficient to dissipate odors and elevated levels of VOCs. Where no specific period is specified, ventilate for minimum of 72 HRS.
 - b. Ventilate areas directly to outside.
 - c. If continuous ventilation is not possible via building's HVAC system, ventilate via openings and temporary fans at no less than 3 air changes per hour.
 3. Suppress dust with wetting agents or sweeping compounds.
 4. Remove dust using a wet method.
 5. Increase cleaning frequency when dust build-up is noted.
 6. Remove spills or excess applications of solvent-containing products as soon as possible.
 7. Remove accumulated water and keep work areas as dry as possible.
 8. Keep and store volatile liquid containers closed when container is inside of building and not in use.
- F. Scheduling:
1. Where odorous or high VOC-emitting products are applied on site, apply before installation of porous and fibrous materials. Where not possible, protect porous materials with polyethylene vapor retarders.
 2. Insure wet applied interior finish materials, such as paints, adhesives, sealants, coatings, finishes, and spray-applied materials, such as structural fireproofing, are fully cured prior to installation of finish materials.
 3. Install carpets and furnishings after interior finish materials have been applied and fully cured.
 4. Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.
 5. Complete interior finish material installation no less than 14 days prior to Substantial Completion.

END OF SECTION

SECTION 01 91 00

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 COMMISSIONING AUTHORITY

The Commissioning Authority (CxA) has been contracted directly with the Architect for this project. The CxA has overall responsibility for planning and coordinating the commissioning process. However, commissioning involves all parties involved in the design and construction process.

1.2 CONTRACTOR RESPONSIBILITY

This Section of the Specifications defines the Contractor's responsibilities with respect to the commissioning process. Each Contractor and Subcontractor shall review this Section, and shall include in their participation in their proposals for carrying out the work described, as it applies to each Division and Section of these specifications, individually and collectively. The Contractor shall be responsible for initiating the actions required on the checklists to verify the systems.

1.3 DESCRIPTION OF WORK

The purpose of the commissioning process is to provide the Owner/operator of the facility with assurance that the systems included in the scope have been installed according to the contract documents, and operate within the performance guidelines throughout their full range of intended operation set out in the design documents and these specifications. The CxA shall provide the Owner with an unbiased, objective view of the system's installation, operation, and performance. The commissioning process does not take away or reduce the responsibility of the installing Contractors to provide a finished product, installed and fully functional in accordance with the contract documents.

Commissioning is intended to enhance the quality of system start-up and aid in the orderly completion and transfer of systems for beneficial use by the Owner. The CxA shall be the leader of the commissioning team, planning all commissioning activities in coordination with the A/E Professionals, Contractor, Subcontractors, 3rd Party Testing Agencies and Equipment Vendors.

The General Contractor and Subcontractors shall be responsible for cooperating and coordinating their work with the CxA. They shall also be responsible for carrying out all the physical activities required for installation of components and systems, and operating them during the commissioning process as required in this Section. The CxA shall witness and document the operation of the systems as conducted by the contractors.

The Commissioning effort does not take away or change the Contract Documents or Specifications and the A/E Professionals maintain the responsibility of the final approval of the design and the installed systems.

Successful commissioning requires not only that all building systems comply with contract requirements but also that installation is achieved early enough in the construction phase to allow full operational check-out, testing, and adjusting of equipment prior to Substantial Completion. Planning adequate time for this testing will require the development and maintenance of a detailed commissioning schedule with input and participation of all members of the commissioning team.

1.4 RELATED DOCUMENTS

The general and supplementary conditions, applicable requirements of all Divisions of the Contract Specifications, and Contract Drawings reference and apply to the work of this Section.

1.5 COMMISSIONING PLAN

The Commissioning Plan identifies processes and procedures necessary for a successful commissioning effort. The plan also further defines the roles and responsibilities of all parties involved in the commissioning effort, including lines of communication and deficiency and conflict resolution. The Owner's CxA is responsible for the development of the Commissioning Plan. The Contractor is responsible for the implementation of the plan and applicable tools for the scheduling and tracking of the commissioning activities outlined in the plan.

1.6 MEMBERS OF THE COMMISSIONING TEAM

The commissioning team shall consist of representatives of the following:

1. Owner (O)
2. Design Team (A/E)
3. Commissioning Authority (CxA)
4. General Contractor (GC)
5. Subcontractors (Subs)
6. Testing, Adjusting, and Balancing Firm (TAB)
7. 3rd Party Testing Agencies (TA)
8. Owner's Operations and Maintenance Staff (O&M)

During the commissioning process, participation of team members shall generally be required as noted in the following Part 3 of this Specification (with abbreviations as noted in brackets in the preceding list of team members).

1.7 REFERENCES

ASHRAE Standard 202 - 2013
ASHRAE Commissioning Guideline 0 – 2013
ASHRAE Guideline 1.1 - 2007
Associated Air Balance Council Commissioning Guideline

PART 2 - PRODUCTS

2.1 SYSTEMS TO BE COMMISSIONED

Systems installed under this contract are to be inspected, tested, signed off as complete and operational, and operated for CxA verification as described in Part 3 of this Section.

Systems to be commissioned include the following:

1. *Mechanical Systems*
2. *Energy Management System*
3. *Plumbing Systems*
4. *Electrical Lighting Control System*

5. *Electrical Power Systems*

The contractor shall be responsible for carrying out all work required for commissioning these systems that is defined as a contractor responsibility in Part 3 of this Section.

2.2 SYSTEM VERIFICATION CHECKLISTS (SVC)

System Verification Checklists (SVCs), also known as Pre-Functional Checklists (PFC), are important to ensure that the equipment and systems are connected and operational and that Operational and Functional Performance Testing proceeds without unnecessary delays. The Contractor, appropriate Subcontractors and Vendors shall support the CxA in development of a SVCs for each system and components by reviewing and commenting on the checklists in accordance with the Project Specifications. These checklists document the inspections and procedures necessary to take a piece of equipment from a static state into an operating state. These checklists augment the manufacturer's start-up checklists to provide a complete document from procurement to functional testing when combined. It is the responsibility of the Contractor and Subcontractors to complete the documentation of the checklists during construction.

2.3 FUNCTIONAL PERFORMANCE TEST CHECKLISTS (FPT)

The Owner's CxA shall develop the Functional Performance Test Forms in accordance with the Specifications and submit to the Contractor and appropriate Subcontractors for review and comment. The Contractor shall review the FPTs and submit to the Owner and A/E team for approval. Once approved, the forms shall be included in the Commissioning Plan for use during the commissioning process. The installing Contractors should use the approved FPTs as a basis for any pre-testing that shall occur prior to official Functional Performance Testing.

2.4 INTEGRATED SYSTEMS TESTING (IST)

The objective of the Integrated Systems Testing (IST) is to demonstrate that each system operates jointly and independently of other systems according to the contract documents. The Subcontractors shall operate each system, jointly and independently of other systems through selected modes of operation including normal and emergency power modes and life safety interaction.

The Owner's CxA will develop the Integrated Systems Test in accordance with the Specifications and submit to the Contractor and Owner for review. The Contractor will review the IST and submit to the Owner and Design team for approval. Once approved, the test will be input into the Commissioning Plan for use during the commissioning process. The installing Subcontractors should use the approved IST as a basis for any pre-testing that will occur prior to official Integrated Systems Testing.

The Contractor schedules Integrated Systems Testing and coordinates all involved members of the Commissioning Team. The Owner will coordinate any necessary personnel or facility impacts. Functional Performance Testing for all systems will be complete before scheduling the IST. The Contractor oversees the actual testing, which is usually performed by the installing Subcontractors or vendors. The CxA will facilitate and guide the test utilizing the approved IST.

PART 3 - EXECUTION

3.1 COMMISSIONING RESPONSIBILITIES - NON-CONTRACTOR TEAM

3.1.1 INTRODUCTION

As noted in 1.3, a multidisciplinary team carries out commissioning. The commissioning responsibilities of some non-contractor team members during the construction and acceptance phases of the project are provided here for information, and to provide some context for the overall process.

3.1.2 COMMISSIONING AUTHORITY RESPONSIBILITIES

The CxA shall provide the following:

1. Prepare a commissioning plan and develop checklists for the commissioning process as specified herein
2. Prepare the commissioning documents, and ensure its distribution for review and comment
3. Revise the commissioning plan as required during construction
4. Coordinate commissioning meetings; in conjunction with the Contractor, coordinate commissioning activities among all contractors, sub-trades and suppliers
5. Monitor system verification checks, and ensure the results are documented as the checks are done
6. Monitor controls point-to-point checks done by the controls contractor, and ensure the results documented as the checks are done
7. Observe equipment start-ups and initial system operations tests scheduled in coordination with the Contractor at the discretion of the CxA
8. Attend and witness the contractors while operating equipment and systems as required to ensure that all required functional performance tests are carried out for verification purposes
9. Witness all functional performance tests and document the results
10. Prepare and submit a Commissioning Report which documents all checks and tests done throughout the Commissioning process, and the results obtained from each
11. Ensure all required O&M manuals are provided
12. Ensure instructions and demonstrations (training) are provided to the Owner's designated O&M staff

3.1.3 A/E DESIGN TEAM RESPONSIBILITIES

The A/E Team shall be responsible for developing and providing the Owner Project Requirements (OPR) and Basis of Design (BOD) to the Commissioning Team.

The A/E shall also review the Commissioning Specifications and Checklists, and shall participate, as appropriate, in onsite commissioning meetings. During the acceptance

phase of the commissioning process, the A/E may be on site to review commissioning documentation, to witness Functional Performance Tests, and to analyze the installation and its performance. The A/E is responsible for reviews of all submittals pertaining to the Contract Documents and to provide response to all questions during the commissioning process.

3.1.4 OWNER'S RESPONSIBILITIES

The Owner shall ensure the availability of the O&M staff for all scheduled instruction and demonstration sessions. This staff shall possess sufficient skills and knowledge to operate and maintain the installation following attendance at these sessions.

The Owner shall also review the Commissioning Specifications and Checklists, and shall participate, as appropriate, in onsite commissioning meetings. During the acceptance phase of the commissioning process, the Owner may be on site to review commissioning documentation, to witness functional performance tests, and to analyze the installation and its performance. The Owner is responsible for reviews of all submittals pertaining to the contract documents and to provide response to all questions during the commissioning process.

The Owner shall also ensure the appropriate involvement of the Commissioning Team as required in the commissioning process.

3.2 COMMISSIONING RESPONSIBILITIES – CONTRACTOR TEAM

3.2.1 CONTRACTOR RESPONSIBILITIES

The Contractor has responsibility to ensure the overall completion of the Work. In this regard, he shall:

1. Participate in the commissioning process,
2. Ensure the cooperation and participation in the commissioning process of all Subcontractors and Vendors as applicable.
3. Develop and carry-out a comprehensive project schedule including inspections, O&M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment startup, TAB, 3rd party testing and task completion for use by the CxA. The General Contractor shall schedule the commissioning events to coincide with the completion of systems and the substantial completion of the overall project.
4. It shall be the General Contractor's responsibility to possess and maintain the commissioning documents on site and throughout the process.
5. The General Contractor shall assign a representative to the Commissioning Team, and submit the person's name to the CxA, within one (1) month of the award of the contract. The representative shall have the authority to make decisions on behalf of the General Contractor as they relate to the organization and scheduling of commissioning. The representative shall facilitate communications among all contractors and suppliers and other Commissioning Team members, and shall foster the necessary cooperative action. The General Contractor shall attend commissioning meetings and ensure action items arising from them are attended to as required to allow the commissioning process to precede on schedule.

6. The General Contractor shall have the responsibility of verifying that each discrepancy noted during the commissioning process are addressed and completed by the appropriate Subcontractor. It is the responsibility of the General Contractor to address design issues and to submit in Request For Information (RFI) format to the team, track, and verify follow-up and completion of each RFI.
7. The General Contractor shall be responsible for all submittal. Submittal shall be submitted to the required Owner, Architect, and Engineers and not the CxA. The General Contractor shall notify the CxA when submittals are submitted and track all responses and re-submittals until all submittals are accepted. The final submittal matrix or checklist indicating all submittals have been accepted shall be forwarded to the Owner and the CxA.
8. It shall be the General Contractor's responsibility to generate the Owner Training Agenda and schedule in coordination with the Owner and CxA.

In the event that any scheduled equipment or system start-ups or functional performance tests are terminated because the Owner, CxA or the A/E team discover deficient or incomplete work, or due to the non-attendance of required contractor or supplier personnel, the contractor or Subcontractor responsible for the termination shall also be responsible for paying reasonable costs of time and travel expenses of any or all of the following representatives who were physically present for the purpose of witnessing the start-up or the FPT: the CxA, A/E team and the Owner. The Owner may provide a statement to the General Contractor identifying the specific activity that was terminated, the scheduled date, and a list of those in attendance, along with their reasonable time and travel expense costs.

3.2.1 SUBCONTRACTOR RESPONSIBILITIES

All the Subcontractors shall cooperate with the commissioning authority (CxA), and other commissioning team members, to facilitate the successful completion of the commissioning process.

The Subcontractors shall assign a representative to the commissioning team, and submit the person's name to the commissioning agency, within one (1) month of the award of the contract. The representative shall have the authority to make decisions on behalf of the subcontractor as they relate to the organization and scheduling of commissioning. The representative shall ensure communications between Subcontractors and Vendors and all other Commissioning Team members, and shall foster the necessary cooperative action. One specific responsibility shall be to attend commissioning meetings, and ensure action items arising from them are attended to as required to allow the commissioning process to proceed on schedule.

All Subcontractors, Vendors and 3rd Party Testing Agencies shall cooperate with the CxA in carrying out the commissioning process. In this context, the Subcontractor shall:

1. Each Subcontractor in this division shall include in their quotes the cost of participating in the commissioning process as specified herein.
2. Provide instruction and demonstrations (training) for the Owner's designated operating staff, in conjunction with the participation of qualified technicians from major equipment suppliers and the controls contractor.

3. Include requirements for submittal data, start-up data documented for each piece of equipment in the project, alignment testing, vibration testing, operational testing, O&M data, and training.
4. Ensure cooperation and participation of Subcontractors, Vendors and 3rd Party Testing Agencies such as sheet metal, piping, refrigeration, vibration, NETA and water treatment as applicable.
5. Ensure participation of major equipment Vendors in review of the commissioning documents and appropriate start-up, testing and training activities.
6. Attend commissioning meetings scheduled by the General Contractor.
7. Notify the CxA a minimum of two weeks in advance of scheduled equipment and system start-ups, so that the CxA may witness system verifications, and equipment and system start-ups, if the CxA desires.
8. Provide sufficient personnel as required during system verification and functional performance testing.
9. Prior to start-up, inspect, check and confirm the correct and complete installation of all equipment and systems for which system verification checklists are included in the commissioning plan. Document the results of all inspections and checks on the checklists and sign them. If deficient or incomplete work is discovered, ensure corrective action is taken and re-check until the results are satisfactory and the system is ready for safe start-up.
10. Notify the CxA a minimum of two weeks in advance, of the time for start of the TAB work. Attend the initial TAB meeting for review of the TAB procedures. Cooperate with the TAB Firm.
11. Provide equipment and systems start-up resources as specified and required. If during an attempted equipment or system start-up, deficient or incomplete work is discovered that would preclude safe operation, the start-up shall be aborted until corrective action has been taken. Ensure such action is taken and verified before re-scheduling a new start-up. Those responsible for deficient or incomplete work shall be responsible for costs in accordance with 3.2 in this section.
12. Carry out and document performance checks to ensure that all equipment and systems fully functional and ready for the CxA to witness formal Functional Performance Tests (FPTs).
13. Operate equipment and systems for FPTs in accordance with the Commissioning Plan and as directed by the CxA. If improper functionality, incomplete work, or other deficiencies affecting system performance are discovered, the FPTs shall be stopped by the CxA. Those responsible for deficient or incomplete work shall be responsible for costs in accordance with 3.2 in this section. Ensure that all corrections necessary for full and complete system operation as specified are completed; applicable subcontractors carry out functional performance checks to confirm correct operation before applying to the CxA to reschedule the FPTs for the system in question.
14. Attend initial O&M staff training session.
15. Update drawings to as-built condition and review to verify all as-builts are accurate before submission.

16. Gather O&M data on all equipment, and assemble in binders as required by the Specifications. Submit to CxA prior to the completion of construction.
17. Participate in, and schedule Vendors and Subcontractors to participate in the O&M staff training sessions as determined by the General Contractor with coordination from the Owner and CxA.
18. Provide a complete set of as-built drawings and O&M manuals to the CxA for use during the project.
19. Provide the necessary equipment, ladders, computers, software, hardware, test instruments, etc. to demonstrate all system and perform all commissioning duties.
20. Provide support and coordination on all interfaces for the building systems. Provide to the Owner and CxA all devices, such as portable operator's terminals and all software and hardware for the owner representatives to have direct access to the entire systems to be used in completing the commissioning services.

3.3 TAB FIRM RESPONSIBILITIES

With respect to HVAC commissioning, the TAB firm shall:

1. Include costs for HVAC commissioning requirements in the proposed price.
2. Attend commissioning meetings scheduled by the CxA prior to, and during, on-site TAB work being done.
3. Attend the TAB planning meeting scheduled by the General Contractor. Be prepared to discuss the procedures that shall be followed in testing, adjusting and balancing the HVAC system.
4. At the completion of the TAB work, submit the final TAB report to the Owner, CxA and Design A/E Team.

SECTION 01 99 60
ENERGY CONSERVATION CODE REVIEW

PART 1 - GENERAL

1.1 DESCRIPTION

- A. General:
1. ComCheck Energy Conservation Code Review
 2. See attached forms.

END OF DOCUMENT



DIVISION 02

EXISTING CONDITIONS



SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Demolition, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Conduct work in accordance with OSHA and EPA requirements.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 241 Standards for Safeguarding Construction, Alteration, and Demolition Operations.
- C. Design, engineering, and construction of shoring, bracing and supports are responsibility of Contractor.
 - 1. Employ a Registered Engineer, licensed to practice structural engineering in state in which project is located.
 - 2. Design to support dead, live, and lateral, wind or seismic loads required by code or as otherwise indicated, along with construction loads during demolition until permanent construction is in place.

1.3 DESCRIPTION

- A. Work Includes:
 - 1. Demolition of portions of structures indicated.
 - 2. Removal of demolition debris.
 - 3. Protection of construction to remain, including:
 - a. Utilities.
 - b. Other items indicated.
- B. Condition of Existing Structures to be demolished:
 - 1. Owner assumes no responsibility for actual condition of structures to be demolished.
 - 2. Owner will maintain building conditions existing at time of inspection for bidding purposes insofar as practicable.
- C. Standpipes:
 - 1. Maintain in operable condition and available for use by fire department.
 - 2. Do not demolish standpipe more than one floor below floor being demolished.

1.4 JOB CONDITIONS

- A. Perform preliminary investigations to ascertain extent of work.
 - 1. Conditions apparent by investigation shall not be allowed as claim for extra cost.
- B. Obtain and pay for permits required by authorities having jurisdiction and notify interested utilities companies prior to commencement of activities.
- C. Obtain approval of authorities having jurisdiction for work affecting existing means of egress.
 - 1. Review with and obtain approval of authorities for temporary construction which affects such areas.
 - 2. Obtain approval of fire authorities.
- D. Separate, store and dispose of hazardous materials and toxic wastes in accordance with local and EPA regulations and criteria listed below:

1. Disposal of fluorescent light tubes in open containers is not permitted.
2. Disposal of ballasts and other building elements containing PCBs in open containers is not permitted.
3. Disposal of building elements containing mercury in open containers is not permitted.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL DEMOLITION PROCEDURES

- A. Demolition of Structures:
 1. Demolish completely and remove from site.
 2. Use such methods as required to complete work within limitations of governing regulations.
 3. Coordinate with Owner and utility suppliers for shut-off of utilities serving each building.
 4. Disconnect and seal utilities before commencement of demolition.
- B. Structural Demolition:
 1. Demolish concrete and masonry in small sections.
 2. Perform removal to avoid excessive loads on supporting walls, floors or framing.
- C. Existing Utilities to Remain.
 1. Keep in service and protect against damage during demolition.
 2. Do not interrupt existing utilities serving occupied or facilities in use, except as authorized by Owner.
 3. Provide temporary services during interruptions to existing utilities, as acceptable to Owner.
- D. Conduct operations to ensure minimum interference with roads, walks, entrances, exits, and adjacent facilities.
 1. Do not close or obstruct private drives, walks or other facilities unless approved in writing.
 2. Do not close or obstruct exits from existing facilities or obstruct public thoroughfares and walks without approval of authorities having jurisdiction.
 3. Provide alternate routes around closed or obstructed traffic ways.
- E. Provide covered passageways to ensure safe passage of persons in or near areas of work.
- F. Provide barricades and safety lights as required.

3.2 PROTECTION OF FACILITIES TO REMAIN

- A. Protect Property to Remain:
 1. Conduct operations to prevent damage by falling debris or other cause to adjacent buildings, structures, and other facilities as well as persons.
 2. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures.
- B. Protect occupants from injury and discomfort.
- C. Provide temporary dustproof partitions between demolition areas and occupied areas.
 1. In public areas use clean, painted 1/2 IN thick plywood.
 2. Utilize fire rated construction where required by Authorities Having Jurisdiction,.
- D. Provide temporary weather protection and insulation to prevent damage to existing facilities and discomfort to persons in occupied areas.
 1. Insulation value: R 19.

3.3 CLEAN-UP AND DISPOSAL OF DEMOLITION MATERIALS

- A. Remove debris, rubbish, and materials resulting from demolition operations.
 1. Remove and legally dispose of off-site.
 2. Do not burn materials on site.

- B. Dispose of items and materials not designated for Owner salvage or reuse.
 - 1. Promptly remove from site.
 - 2. Do not store or sell Contractor salvaged items or materials on site.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations.
- D. Return adjacent areas to condition existing prior to start of work.

END OF SECTION



DIVISION 03

CONCRETE



SECTION 03 05 00
CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete, as indicated, in accordance with provisions of Contract Documents.
- B. Coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM designated specifications for material quality and test methods appear throughout this specification.
- B. Standards for concrete work: Comply with applicable provisions of latest editions of American Concrete Institute (ACI) publications except as otherwise indicated.
 - 1. ACI 301 Specifications for Structural Concrete.
 - 2. ACI 302.2R 06 Guide for Concrete Slabs that Receive Moisture Sensitive Flooring Materials.
 - 3. ACI 347R Guide to formwork for Concrete.
 - 4. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- C. Concrete Mixture Proportioning:
 - 1. Employ and pay for testing agency acceptable to Architect and Owner to perform materials evaluation, testing and design of concrete mixes.
 - 2. Certificates, signed by material producer and Contractor, may be submitted in lieu of material testing when approved by Architect.
- D. Concrete Testing:
 - 1. Owner will employ a testing laboratory to perform routine testing and evaluation of concrete delivered to jobsite.
 - 2. Contractor to assist with related communication and temporary storage of test cylinders at jobsite.

1.3 DEFINITIONS

- A. Lightweight Concrete:
 - 1. Concrete made with low density, lightweight aggregate ASTM C330 or mixture of lightweight and normal weight aggregate.
 - 2. Usually having a dry unit weight less than 115 PCF.
- B. Normal Weight Concrete:
 - 1. Concrete for which density is not a controlled attribute.
- C. Formwork:
 - 1. Total system of support for freshly placed concrete including mold or sheathing which contacts concrete as well as supporting members, hardware, and necessary bracing.
- D. Exposed Construction:
 - 1. Concrete surface seen by the public from eye level from walking surface in a public location after completion of building.
- E. Public Location:
 - 1. Building areas routinely accessible to public and employees not responsible for maintenance.
 - a. Storerooms, unfinished space and large mechanical rooms are considered public locations.

- b. Equipment closets, elevator and mechanical penthouses are not considered public space.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Reinforcing drawings showing sufficient detail to permit placement in the field without reference to Contract Drawings.
- B. Product Data:
 - 1. Concrete Mix Designs for each proposed concrete mix.
 - a. Proportions of materials.
 - b. Slump.
 - c. Air content.
 - d. 7-day and 28-day compression test results of trial mixes or standard deviation analysis of an established mix.
 - 2. Source and certification or proof of quality and compatibility of admixtures for each of the constituents of the proposed concrete mixes.
 - a. Cement.
 - b. Aggregate including gradation.
 - c. Water.
 - d. Admixtures:
 - 1) Air Entraining Admixture.
 - 2) High-Range Water Reducer.
 - 3) Other.
 - 3. Vapor retarder.
 - 4. Joint filler.
 - 5. Curing compound.
 - a. Interior slabs: Include floor covering manufacturer's written approval for use.
 - 6. Waterstop.
- C. Samples:
 - 1. Joint filler.
 - 2. Waterstops.
 - 3. Vapor Retarder and sealing products.
- D. Project Information:
 - 1. Testing Agency qualifications.
 - 2. Production sample test reports:
 - a. Include same data as required for mix design reports.
 - 3. Reports of Contractor optional tests.
 - 4. Test reports for in-place testing, if such testing is performed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement:
 - 1. ASTM C150, Type I or Type III.
 - 2. Cement Color: Natural gray.
- B. Aggregates:
 - 1. General:
 - a. Regard fine and coarse aggregates as separate ingredients.
 - b. Each size of coarse aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of applicable ASTM specifications.
 - 2. Normal Weight Concrete:
 - a. ASTM C33 – Standard Specification for Concrete Aggregates.

- b. Aggregate approved by the local State Highway Department for use in concrete for state bridges.
- C. Potable Water:
 - 1. Conforming to ASTM C 1602.
- D. Admixtures:
 - 1. Use only when specifically required or permitted by Contract Documents, otherwise must be approved by Architect.
 - 2. Prepare trial mixes and tests with job materials, including admixture, to demonstrate effect on strength and durability of hardened concrete.
 - 3. Calcium chloride or admixtures containing more than 0.05 PCT chloride ions are not permitted.
 - 4. Air-entraining Admixtures:
 - a. ASTM C260.
 - 5. Mid-Range Water Reducer:
 - a. ASTM C494, Type A.
 - 6. High-Range Water Reducer:
 - a. ASTM C494, Type F or G.
 - b. Daracem – 100 or Adva Flow Series by Grace Construction Products.
 - c. MasterRheobuild 1000 , MasterGlenium Series or PS 1466 by BASF Master Builders Solutions.
 - d. Eucon 37 or Eucon SPJ by Euclid Chemical.
 - e. PSP-N, PSP-N2, PSP-R, and PSP-L by Procrete Industries. .
 - 7. Water-reducing, Retarding, and Accelerating Admixtures:
 - a. ASTM C494.
 - 8. Calcium-nitrite Corrosion Inhibitor:
 - a. DCI and DCI S by Grace Construction Products.
 - b. Rheocrete CNI by BASF Master Builders Solutions.
 - c. Eucon CIA by the Euclid Chemical Company
 - d. Incorporate at a rate of ___ GAL/YD3 IN the areas identified
 - 9. Supplementary Cementitious Materials, including Fly Ash:
 - a. Fly Ash:
 - 1) ASTM C618, Class C or Class F.
 - 2) Obtain, prepare and test samples in accordance with ASTM C311.
 - b. Ground Granulated Blast Furnace Slag:
 - 1) ASTM C989, Grade 100 or 120.
 - 10. Synthetic Macro Fibers
 - a. ASTM C1116 Type III
 - b. Fiber Reinforced concrete shall provide equivalent reinforcing to WWR indicated in both direct tension and bending capacity for thickness indicated
 - c. Testing per ASTM C1018 and/or ASTM C1399 shall indicate a minimum residual flexural strength of 170 PSI. Submit manufacturers data verifying conformance
 - d. Minimum Dosage rate 4 LBS/CY.
 - e. Acceptable manufacturers
 - 1) W.R.Grace Co, Strux 90/40
- E. Curing Compounds:
 - 1. Strippable Curing Compound:
 - a. The compound shall conform to ASTM C309, VOC Compliant, 350 g/l.
 - 1) For use on slabs receiving subsequent applied finishes and where noted on drawings.
 - 2) Install in accordance with manufacturer's recommendation and supervision.
 - b. Acceptable Manufacturers:
 - 1) Kurez DR VOX or Kurez W VOX
 - 2) Horncure WB Horncure WB 30 by the Euclid Chemical Company.
 - 2. Chemical Curing Compound:

- a. Base:
 - 1) L&M Construction Chemicals.
 - b. Optional:
 - 1) Dayton Superior.
 - 2) Euclid.
 - 3) Sonneborn.
 - 4) WR Meadows..
- F. Granular Fill:
- 1. See Section 31 23 00.
- G. Formwork Materials:
- 1. Exposed concrete surfaces: Acceptable panel type to provide continuous, straight, smooth finish. Use largest practical sizes to minimize form joints.
 - 2. Unexposed concrete surfaces: Suitable material, dressed on edges and sides for tight fit.
- H. Reinforcing Materials:
- 1. Reinforcing bars: ASTM A615, Grade 60
 - 2. Welded wire reinforcing: ASTM A1064

2.2 UNDERSLAB VAPOR RETARDER

- A. Underslab Vapor Retarder, Class A:
- 1. Meet ASTM E1745 Class A and:
 - a. Maximum Water Vapor Permeance: 0.04 Perm.
 - b. Minimum Tensile Strength: 45 FT-LB/IN.
 - c. Minimum Puncture resistance: 4000 Grams.
 - 2. Base Product:
 - a. Perminator 15 MIL by WR Meadows.
 - 3. Optional Products:
 - a. Vapor Block 15 by Raven.
 - b. Moistop Ultra 15 by Fortifiber.
- B. Tape as recommended by vapor retarder manufacturer.
- C. Other manufacturers desiring approval comply with requirements of Section 00 26 00.

2.3 WATERSTOPS

- A. Self-Expanding Rubber Strip Waterstops:
- 1. Bentonite-free hydrophilic polymer modified chloroprene rubber, suitable for adhesive bonding to concrete.
 - 2. Profile: Rectangular or trapezoidal strip unless otherwise indicated.
 - 3. Minimum Dimensions: 3/8 IN by 3/4 IN thick
 - 4. Provide in maximum practicable length to minimize end joints.
 - 5. Butt splice joints at intersections and at ends of pieces in accordance with manufacturer's instructions.
 - a. Make joints to develop effective water tightness fully equal to that of continuous waterstop material, to permanently develop not less than 50 PCT of mechanical strength of parent section, and permanently retain flexibility.
 - 6. Base Products: Hydrotite by Greenstreak; Ultra Seal by Adeka (Mitsubishi); Swellseal by Deneef Construction Chemicals; Superstop by Progress Unlimited, Inc

2.4 PROPORTIONING CONCRETE MIXES

- A. General:
- 1. Contractor and concrete supplier are responsible to provide concrete, in-place, which satisfies requirements listed in following table.
 - 2. Contractor and concrete supplier are responsible to adjust concrete mixes, as needed, to:
 - a. Correct for non-conformance.
 - b. Correct for a variation in the quality of a constituent.

c. Compensate for extreme conditions in the field.

B. Establish concrete material proportions by proportioning methods described in ACI-301 guidelines.

Concrete Properties Table – IP Units							
Use	28-day Strength (KSI)	Dry Unit Weight (PCF)	Max Aggregate Size (IN)	Air percent	Max. W/C Ratio	Slump (IN)	Cement Type
Footings ,Grade Beams	3.5		1-1/2	4.5	0.60	4	I
Caissons	4.0		1 1/2		0.45	6	I
Walls	4.0		1	4.5	0.50	5	I
Slabs-on-grade	3.5		1 1/2		0.45	3	I
Structural floors, girders, slabs, columns	4.0		3/4		0.45	9	I
Post-tensioned slabs & beams	5.0		3/4 or 1	6	0.40	9	I
Columns	6.0		3/4		0.35	9	I
Radiology Shield, Wall, and Roof	3.0	147	1		0.70	4	I
Lt. Wt. Slabs on composite metal deck	3.5	115	3/4		0.50	6	I
Norm. Wt. Slabs on composite metal deck	3.5		3/4		0.50	6	I
Lt. Wt. Slabs, beams, girders	4.0	112	3/4		0.45	6	I
All other uses	4.0		3/4	6	0.50	4	I

C. Instructions for use of Table:

1. Provide concrete mixes with properties indicated in locations identified in Use column.
2. 28-day Strength:
 - a. Installed concrete must meet or exceed the minimum 28-day compressive strength indicated.
 - b. Laboratory mix design strengths must exceed this strength by the appropriate amount per ACI 301.
 - c. Determine strength in accordance with ASTM C192 and ASTM C39.
3. Dry Unit Weight:
 - a. If no value is listed, assume normal weight.
 - b. Dry unit weight of light weight mixes shall be maximum air dry unit weight permitted.
 - c. Correlate fresh weight with air dry of same mix to use as basis of acceptance on job site. Test in accordance with ASTM C567.
 - d. Dry unit weight for concrete for Radiation Shielding shall be minimum air dry unit weight permitted. Use heavy aggregate if necessary.
4. Maximum Aggregate Size:
 - a. Maximum size of coarse aggregate determined in accordance with:
 - 1) ASTM C33 for normal weight concrete.
 - b. Some mixes are designated 3/4 IN or 1 IN, permitting contractor / supplier option.
5. Air Content:
 - a. Required percentage of air as measured by ASTM C231, ASTM C173, or ASTM C138 as appropriate.
 - b. Tolerance of air content as delivered is plus or minus 1-1/2 PCT for normal weight and plus or minus 2 PCT for lightweight concrete.

6. Water Reducer:
 - a. Mid-range water-reducer or high-range water-reducer shall be provided as necessary to achieve slump indicated.
 - b. Contractor, as option, may elect to use water reducers in other mixes to improve workability or permit pumping.
 7. Maximum W/C Ratio:
 - a. Maximum ratio of pounds of water to pounds of cementitious material allowed in the concrete mix.
 8. Maximum Slump:
 - a. Mixes without Water Reducers:
 - 1) Slump tolerance: Up to 1 IN above maximum indicated is allowed, provided the average of 5 consecutive batches does not exceed the indicated amount by more than a 1/2 IN.
 - b. Mixes with Water Reducers:
 - 1) Slump indicated is after dosing.
 - 2) Slump tolerance after dosing: +1-1/2 IN and -1 IN is permitted for each batch.
 - 3) Slump tolerance prior to dosing: +1/2 IN and -1 IN from design mix slump.
 - c. Determine slump in accordance with ASTM C143.
 - d. Where slump is not specified, provide concrete with slump in accordance with approved mix designs
 9. Cement:
 - a. Provide cement type indicated.
 - b. Fly Ash or Ground Blast Furnace Slag is acceptable for partial replacement of cement.
 - 1) For each unit of cement removed, replace with two (2) units of Class F fly ash or one (1) unit of Class C fly ash.
 - 2) For each unit of cement that is removed, replace with one (1) unit of Ground Blast Furnace Slag
 - 3) Maximum amount of cement replaced shall not exceed that specified in table 4.2.2.9 of ACI 301.
 - 4) W/C Ratio shall be based on total cementitious material content.
- D. Admixtures:
1. Use admixtures in accordance with manufacturer's instructions.
 2. Use only approved admixtures.

PART 3 - EXECUTION

3.1 STORAGE OF MATERIALS

- A. Store cement in weather tight buildings, bins, or silos which will exclude moisture and contaminants.
- B. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.
 1. Perform test to determine conformance to requirements for cleanliness and grading on samples secured from aggregates at point of batching.
 2. Do not use frozen or partially frozen aggregates.
- C. Allow sand to drain until it has reached relatively uniform moisture content before use.
- D. Store admixtures in manner to avoid contamination, evaporation, or damage.
 1. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure uniform distribution of ingredients.
 2. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics.

3.2 MIXING AND DELIVERY

- A. Batch, mix and transport concrete in accordance with ASTM C94/C94M.

- B. Batch and mix admixtures in accordance with manufacturer's instructions. If two or more admixtures are used, verify compatibility with manufacturers
- C. When adding water at job site is planned, deliver concrete to job site with a slump of 2 to 4 IN.
 - 1. Limit water additions at job site to comply with W/C Ratio requirements.
- D. Following addition of high range water reducer, mix for a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.
- E. Reduction of required average strength:
 - 1. During construction, and after sufficient data becomes available, laboratory strength of mixes may be reduced in accordance with Section 4.2.3.6a of ACI 301, subject to approval by the Architect.

3.3 UNDERSLAB VAPOR RETARDER

- A. Place continuous vapor retarder over granular fill.
 - 1. Installation as recommended by manufacturer.
 - a. Comply with ASTM E1643.
 - 2. Lap vapor retarder at ends and edges of sheets and seal with vapor retarder tape.
 - 3. Extend to extremities of area.
 - 4. Turn up at perimeter walls, to form bond breaker, and continuously seal in place.
- B. Protect vapor retarder.
- C. Repair punctures, tears and other damage using vapor retarder tape.
- D. Trim excess material after slab is placed.
- E. Vapor retarder installation must be approved prior to concrete placement.
- F. Place concrete directly on vapor retarder per ACI 302.1R-8 flow chart.

3.4 FORMWORK AND REINFORCEMENT

- A. Rough form finish may be provided for concrete surfaces covered with earth and not exposed to public view.
 - 1. Ordinary form facing material may be used for rough form work.
- B. Use smooth forms for interior and exterior concrete surfaces exposed to view.
 - 1. Interior surfaces may be painted.
 - 2. Use a plastic coated plywood or plastic liner to produce a hard, smooth uniform finish on concrete.
 - 3. Arrange form joints and snap-tie holes to produce a repeating, orderly pattern with number of seams kept to practical minimum.
 - 4. Seal seams to prevent leakage of mortar.
 - 5. Support form facing with framing and backing capable of preventing visible form deflection.
- C. Layout and measurement of concrete forms and embedment's, required for work, performed by a licensed surveyor, employed by contractor.
- D. Clean, adjust and seal forms prior to concrete placement.
- E. Remove excess form release materials to avoid visible residue on concrete surface.
- F. Tighten forms to eliminate mortar leaks.
- G. Accurately position, support and secure reinforcement and other cast-in items against displacement when placing concrete.
- H. Locate and support with chairs, runners, spacers and hangers, as required.
- I. Set wire ties so ends are directed into concrete.
- J. Install welded wire reinforcement in maximum practicable sizes.

- K. Lap sides and ends at least one mesh square plus 2 IN.
- L. Provide construction, isolation, and control joints as indicated or required.
- M. Place construction joints so as to not impair strength and appearance of structure in locations approved by Architect.
- N. Locate isolation and control joints in slabs-on-grade to stabilize differential settlement and random cracking.
- O. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.
- P. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to concreting.
 - 1. Give Contractors whose work is related to concrete or supported by it ample notice and opportunity to introduce and furnish embedded items before concrete placement.
 - 2. Position expansion joint material, waterstops, and other embedded items accurately and support against displacement.
 - 3. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete.
- Q. Use setting diagrams, templates and instructions for locating and setting.

3.5 PLACING CONCRETE

- A. Place concrete in compliance with recommendations of ACI 304.
- B. Place in a continuous operation within planned joints or sections.
- C. Begin placement when work of other trades affecting concrete is completed.
- D. Consolidate concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into parts of forms.
- E. Protect concrete from physical damage or reduced strength due to weather extremes.
 - 1. In hot weather comply with recommendations of ACI 305.
 - 2. In cold weather comply with ACI 306.

3.6 CURING

- A. Begin curing as soon as free water has disappeared from exposed surfaces.
- B. Keep moist for 72 HRS.
- C. Continue curing by use of moisture retaining cover or strippable membrane forming curing compound for a period of 14 days.
- D. Cure formed surfaces by moist curing until forms are removed.
- E. Provide protection as required to prevent damage to concrete.

3.7 PATCHING AND FINISHING

- A. Rough form finish:
 - 1. Patch defects and tie holes.
 - 2. Chip or rub off fins exceeding 1/4 IN in height.
 - 3. Leave surfaces with texture imparted by forms.
- B. Smooth form finish:
 - 1. Remove forms and perform following work on walls and beam sides within day after placement.
 - 2. Painted surfaces:
 - a. Remove fins completely and grind smooth. Bush hammer and grind misaligned joints.

- b. With grout colored to match adjacent concrete, patch tie holes and areas of poor consolidation or mortar leakage and rub with carborundum bricks until uniform color and texture is produced.
- 3. Unpainted surfaces:
 - a. Perform work as outlined for painted surfaces. In addition, provide a smooth rubbed finish over entire concrete surface no later than a day following form removal.
 - b. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.
 - c. Use no cement grout other than cement paste drawn from concrete itself by rubbing process.
- C. Slab trowel finish:
 - 1. Apply steel trowel finish to monolithic slab surfaces exposed to view or covered with resilient flooring or other thin film coating.
 - 2. Consolidate concrete surface by troweling, free of trowel marks, uniform in texture and appearance.
 - 3. Finish concrete to maximum tolerance of 1:500.
 - 4. Finishing tolerances:
 - a. For shored construction, measurements for conformance with finishing tolerances shall be made as soon as slab can tolerate foot traffic, and before shores are removed.
 - 5. Thoroughly consolidate surface by hand troweling.
 - 6. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to an F125/F120 tolerance.
 - 7. On surfaces intended to receive floor coverings, grind off defects which would indicate through floor covering or burnished-over finished surfaces which inhibit adhesion of flooring adhesives.
 - 8. On surfaces intended to receive waterproofing membranes grind off defects that might tear or otherwise damage membrane.

3.8 CLEANING OF CONCRETE

- A. Clean cast-in-place concrete walls which will remain exposed to view.
 - 1. Include walls which are scheduled for painting.
 - 2. Areas: _____.

END OF SECTION

SECTION 03 08 13
CONCRETE TESTING AND EVALUATION - OWNER

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Testing and Evaluation - Owner, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in Field
 - 2. ASTM C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - 3. ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection and/or Testing
- B. American Concrete Institute (ACI):
 - 1. ACI 318 Building Code Requirements for Structural Concrete and Commentary
- C. Testing Agency:
 - 1. Acceptable to Architect.
 - 2. Recent evidence of inspection by Cement and Concrete Reference Laboratory of National Institute of Standards and Technology, with cited deficiencies corrected.
 - 3. Meet requirements of ASTM E329.
 - 4. Agency and its representatives are not authorized to revoke, alter, relax, enlarge or release requirements, nor approve or accept portion of Contract Documents.

1.3 SUBMITTALS

- A. Project Information:
 - 1. Testing Agency qualifications.
 - 2. Production sample test reports, when required:
 - a. Include same data as that required for mix designs.
 - 3. Reports of Contractor option tests.
 - 4. Test reports on in-place testing, if such testing is performed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 DESCRIPTION

- A. Test concrete materials and inspect operations as work progresses.
- B. Failure to detect defective work or material shall not prevent later rejection when such defect is discovered nor shall it obligate Architect for final acceptance.
- C. Payment for Testing:
 - 1. Pay for testing services required in paragraph Article 3.2, following.
 - 2. Routine testing of concrete furnished to job site for compliance with Contract Documents will be performed by Owner's testing agency at Owner's expense.
 - a. Test for compressive strength, slump, air content, temperature and unit weight.

- b. Perform tests every 75 CU YD or fraction thereof, for each mixture design placed in one day.
- c. Obtain composite samples in accordance with ASTM C172.
 - 1) Obtain each sample from a different batch of concrete on a random basis.
 - 2) Select test batch at random before commencement of concrete placement.
- d. Mold and cure sufficient specimens from each sample in accordance with ASTM C31 and report deviations from requirements, if any.
- e. Coordinate number of specimens with test specification requirements and construction operations.
- f. Test specimens in accordance with ASTM C39.

3.2 RESPONSIBILITIES AND DUTIES OF CONTRACTOR

- A. Provide testing services performed by Testing Agency for qualification of proposed materials and establishment of mix designs.
- B. Submit concrete materials and concrete mix designs.
 - 1. Include results of testing performed to qualify materials and establish mix designs
- C. Place no concrete until Contractor has received approval.
- D. Use of testing service shall not relieve Contractor of responsibility to furnish materials and construction in compliance with Contract Documents.
- E. Testing and Inspection:
 - 1. Furnish labor to assist Owner's Testing Agency in obtaining and handling samples or other materials at site.
 - 2. Advise Owner's Testing Agency in advance of operations.
 - 3. Provide and maintain facilities for storage and curing of concrete compressive strength test specimens on site for first 24 HRS or until strength is achieved as required by ASTM C31.
- F. Pay for following additional testing services performed by Owner's testing agency when:
 - 1. When changes in materials or proportions are requested by Contractor Additional testing and inspection.
 - 2. When specimens fail to meet specification requirements, by test or inspection.
 - 3. Testing services needed or required by Contractor.
 - a. Field-cured test specimens as needed for control of stripped, reshored, unshored, post-tensioned concrete work.

3.3 EVALUATION AND ACCEPTANCE OF COMPRESSIVE STRENGTH TEST RESULTS

- A. Evaluate test results for standard molded and cured test cylinders separately for each concrete mix design.
 - 1. Evaluate each mix design for strength and uniformity by a minimum of five tests.
- B. Strength level of concrete shall be considered acceptable when average of three consecutive strength test sets equal or exceed specified strength ($f'c$) and no individual strength test result is less than specified strength ($f'c$) by more than 500 PSI.

3.4 TESTING CONCRETE IN PLACE

- A. Test concrete in place when compressive strength tests indicate potential strength deficiency to evaluate actual strength.
 - 1. Pay for concrete tests and engineering time and analysis required to evaluate in-place concrete strength as result of deficient cylinder strength tests.
- B. Testing by rebound hammer, ultrasonic, or other non-destructive device.
 - 1. Tests shall be used to determine relative strengths at various locations in structure to determine areas to be cored.
 - 2. Calibrated and correlated tests with other test data shall be used as basis for acceptance or rejection.

- C. Core Tests:
 - 1. Obtain and test largest practical diameter cores, 2 IN minimum, in accordance with ASTM C42.
 - a. Test dry if concrete in structure will be dry under service conditions,
 - 1) Air dry cores at 60 DEGF to 80 DEGF, relative humidity less than 60 PCT for 7 days before test.
 - b. Test cores after moisture conditioning if concrete in structure is more than superficially wet under service conditions.
 - 2. Take three cores from area of concrete or member considered deficient in strength.
 - a. Location as selected by Architect.
 - b. Replace cores damaged prior or during removal from structure prior to testing.
 - 3. Concrete core test shall be considered acceptable if average strength of cores is equal to at least 85 PCT of, with no single core less than 75 PCT of specified strength (f'c).
 - 4. Fill core holes with low slump patching compound per Section 03 35 00.

3.5 ACCEPTANCE OR REJECTION OF CAST-IN-PLACE CONCRETE

- A. General:
 - 1. Completed concrete work which conforms to requirements of Contract Documents will be accepted without qualification.
 - 2. Concrete work which fails to conform to one or more requirements of Contract Documents shall be rejected and will not be accepted until repaired and proven adequate by concrete testing.
 - 3. Contractor pays costs incurred in providing remedial work necessary to change rejected work to accepted work.
 - 4. Remedial work includes, but is not necessarily limited to, applicable repairs, replacement, reinforcement, engineering, and testing.
 - 5. Repair or replacement of concrete in an approved manner and in conformance with Contract Documents constitutes acceptance.
- B. Dimensional Tolerances:
 - 1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances shall be considered potentially deficient in strength and subject to confirmation of safety by structural analysis or load test.
 - a. When deficiencies are confirmed, replace or reinforce structure as directed.
 - 2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances will be rejected if strength or finish of structure is not acceptable, or function is adversely affected.
 - a. If removal of excess material is permitted, repair of surfaces constitutes acceptance.
 - b. If removal of excess material is not permitted, replacement of surfaces constitute acceptance.
 - 3. Concrete members cast in wrong location will be rejected if: strength or finish is not acceptable, function is adversely affected, and /or interference is encountered with other construction.
 - 4. Inaccurately formed concrete surfaces exceeding tolerances and exposed to view will be rejected.
- C. Finish:
 - 1. Architectural concrete with surface exceeding limitations will be rejected.
 - 2. Concrete exposed to view with defects which adversely affect appearance of specified finish may be repaired only by approved methods.
 - 3. Slabs:
 - a. Finished slabs exceeding tolerance limits specified in Section 03 35 00 will be rejected if finish is not acceptable and function is adversely affected.
 - 1) If rejected, repair of finished surfaces or replacement of slab in an approved manner and in conformance with Contract Documents will constitute acceptance.
 - b. Repair may involve removing high spots by grinding, filling low spots with patching compound, or remedial measures as permitted.
 - 4. Formed surfaces:

- a. Concrete exposed to view with defects which adversely affect appearance of specified finish will be rejected.
 - 1) Repair surface defects in conformance with Section 03 35 00.
 - 5. Concrete not exposed to view is not subject to rejection for defective finish.
- D. Strength of Structure:
- 1. Concrete in place which control strength of structure will be rejected if it fails to comply with requirements of Contract Documents, including but not necessarily limited to:
 - a. Deficient concrete strength based on compressive strength tests.
 - b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with requirements on reinforcement.
 - c. Concrete which differs from required dimensions or location.
 - d. Curing less than that specified.
 - e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
 - f. Mechanical injury, construction fires, accidents or premature removal of formwork.
 - g. Substandard workmanship.
 - 2. When strength of structure is considered potentially deficient, it will not be accepted until one of following is completed and submitted to Architect for approval prior to action by Contractor.
 - a. Confirmation of safety of structure by structural analysis.
 - b. Core tests shall be performed only when safety of structure is not confirmed by structural analysis.
 - c. Confirmation of safety of structure by load tests performed and evaluated in accordance with ACI 318.
 - d. Replacement of structure deficient in strength.
 - e. Reinforce structure with supplement supports as directed by Architect and approved by Owner.

END OF SECTION

SECTION 03 11 00
CONCRETE FORMWORK

PART 1- GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Formwork, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Design, engineering, and construction of formwork are responsibility of Contractor.
 - 1. Design, engineer, and construct formwork for applicable gravity and lateral loads and pressures as well as other design considerations or applicable requirements of legal local building code.
 - 2. Develop shoring and re-shoring pattern and sequence so as not to exceed safe structural capacity of supporting structural systems. Confer with Architect, if there is any question, regarding the capacity of the structural system.
- B. Design, prepare formwork drawings and construct formwork in accordance with ACI 347, Guide to Formwork for Concrete.
- C. Layout and measurement of concrete forms and embedment's, required for work, performed by a licensed surveyor employed by the contractor.

1.3 DESCRIPTION

- A. Definitions:
 - 1. Formwork: Total system of support for freshly placed concrete including mold or sheathing which contacts concrete as well as supporting members, hardware, and necessary bracing.
 - 2. Exposed construction: Exposed to view.
 - 3. Exposed to view: Concrete surfaces seen by the public from eye level from any walking surface in a public location after completion of building.
 - 4. Public location: Building areas accessible to public and employees not responsible for maintenance. Storerooms, unfinished space and large mechanical rooms are considered public locations. Equipment closets, elevator and mechanical penthouses are not public space.
- B. Use forms, wherever necessary, to confine concrete and shape it to required dimensions. Use forms of sufficient strength to withstand pressure resulting from placement and vibration of concrete, with sufficient rigidity to maintain specified tolerances.
- C. See concrete finish requirements in Section 03 35 00.
- D. Use earth side forms for spread footings, pile caps and unfinished grade beams where earth can be shaped to a straight and true surface. Do not use earth cuts as forms for other vertical surfaces unless permitted.

PART 2 - MATERIALS

2.1 MATERIALS

- A. Form facing materials: As indicated under description of finishes required.
- B. Form accessories, partially or wholly embedded in concrete, such as ties and hangers: Shall be of a commercially manufactured type. Do not use non-fabricated wire. Use form ties constructed so ends or end fasteners can be removed without causing appreciable spalling of

concrete faces. After ends or end fasteners of form ties have been removed, embedded portion of ties shall terminate not less than 2 diameters or twice minimum dimension of tie from formed faces of concrete to be permanently exposed to view, but in no case less than 3/4 IN. When formed face of concrete is not to be permanently exposed to view, form ties may be cut off flush with formed surfaces. Use ties with 3/4 IN diameter cones on both ends for water retaining structures.

2.2 FABRICATION OF FORMS

- A. Make forms sufficiently tight to prevent loss of cement fines. Place chamfer strips in outside corners of forms to produce 45 degree beveled corners on permanently exposed surfaces. Interior corners on such surfaces and edges of formed joints will not require beveling.
- B. To maintain specified finish tolerances, camber formwork to compensate for anticipated formwork deflections prior to hardening of concrete.
- C. Provide positive means of adjustment (wedges or jacks) of shores and struts and take up settlement during concrete placing operation. Securely brace forms against lateral deflection.
- D. Provide temporary openings at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.
- E. At construction joints, contact surface of form sheathing for flush surfaces exposed to view shall overlap hardened concrete in previous placement minimum 1 IN. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain a true surface.
- F. Construct wood forms for wall openings to facilitate loosening, if necessary, to counteract swelling.
- G. Fasten wedges (used for final adjustment of forms prior to concrete placement) in position after final check.
- H. Anchor formwork to shores or other supporting surfaces or members so upward or lateral movement of any part of formwork system is prevented during concrete placement.
- I. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.

2.3 TOLERANCES

- A. Construct formwork so concrete surfaces will conform to tolerance limits listed: Tolerances non-cumulative. Most restrictive tolerance governs. Tolerance limits noted are maximum deviations (plus or minus) on each side of intended line.
 - 1. Deviation from plumb:
 - a. In lines and surfaces of columns, piers, walls, and in arrises:
 - 1) In any length: 1 IN 500 but not less than 1/8 IN.
 - 2) In any story: 3/8 IN.
 - 3) Maximum for entire length: 3/4 IN.
 - b. For exposed corner columns, control-joint grooves, and other conspicuous vertical lines:
 - 1) In any length: 1 IN 1000 but not less than 1/8 IN.
 - 2) In any story: 3/16 IN.
 - 3) Maximum for entire length: 1/2 IN.
 - 2. Deviation from level or from grades specified:
 - a. In slab soffits, ceilings, beam soffits and in arrises, measured before removal of supporting shores:
 - 1) In any length: 1 IN 750 but not less than 1/8 IN.
 - 2) In any bay: 3/8 IN.
 - 3) Maximum for entire length: 1/2 IN.
 - b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous horizontal lines:
 - 1) In any length: 1 IN 1000, but not less than 1/8 IN.

- 2) In any bay: 1/4 IN.
- 3) Maximum for entire length: 1/2 IN.
- 3. Deviations from true plane of concrete surface exposed to view caused by bulging of form facing material between supports:
 - a. 3/16 IN or 1/300 of span between supports whichever is smaller.
- 4. Deviation from established position in plan of linear building lines, columns, walls:
 - a. In any length: 1 IN 500, but not less than 1/8 IN.
 - b. In any bay: 1/2 IN.
 - c. Maximum for entire length: 3/4 IN.
- 5. Deviation in sizes and location of sleeves, floor openings, and wall openings: 1/4 IN.
- 6. Deviation in cross-sectional dimensions of columns and beams and in thickness of slabs and walls:
 - a. Minus: 1/4 IN.
 - b. Plus: 1/2 IN.
- 7. Footings:
 - a. Deviations in dimensions in plan:
 - 1) Minus: 1/2 IN.
 - 2) Plus: 2 IN.
 - b. Misplacement or eccentricity:
 - 1) 2 PCT of footing width in direction of misplacement but not more than 2 IN.
 - c. Thickness:
 - 1) Decrease in specified thickness: 5 PCT.
 - 2) Increase in specified thickness: No limit (except that which may interfere with other construction).
- 8. Deviation in steps:
 - a. In flight of stairs:
 - 1) Rise: 1/8 IN.
 - 2) Tread: 1/4 IN.
 - b. In consecutive steps:
 - 1) Rise: 1/16 IN.
 - 2) Tread: 1/8 IN.
 - c. Deviation from level for any step or landing: 1 IN 1000 but not more than 1/8 IN.
- B. Formwork Classifications:
 - 1. Concrete formwork shall meet the following classification requirements:
 - a. Concrete noted as "Architectural Exposed Concrete: Class A."
 - b. Concrete exposed to view or to receive membrane waterproofing: Class B.
 - c. Footings: Class D.
 - d. All other concrete: Class C.
- C. Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items, except where specifically noted otherwise.
- D. Establish and maintain in undisturbed condition and until final completion of project, sufficient control points and bench marks to be used for reference purposes to check tolerances.
- E. Regardless of tolerances listed allow no portion of building to extend beyond property line of project.

PART 3 - EXECUTION

3.1 PREPARATION OF FORM SURFACES

- A. Clean form surfaces and embedded materials of mortar, grout and foreign material before concrete is placed.
- B. Before placing of reinforcing steel or concrete, treat surfaces of forms as follows:

1. Unless otherwise noted, cover surfaces of forms with nonstaining, biodegradable, form release agent to prevent absorption of moisture and prevent bond with concrete,
2. Form release agent VOC content no greater than 250 g/L.
 - a. Bio-Nox by Nox-Crete Products Group, or equal.
3. Do not allow excess release agent to collect in forms or contact hardened concrete against which fresh concrete is placed.
4. Factory applied non-absorptive liner may be used.

3.2 REMOVAL OF FORMS

- A. When repair of surface defects or finishing is required at early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations.
- B. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Perform needed repairs or treatment required on such sloping surfaces at once, followed by specified curing.
- C. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete.
- D. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.
- E. Where no re-shoring is planned, leave forms and shoring used to support weight of concrete in beams, slabs and other concrete members in place until concrete has attained its specified strength. Where re-shoring is planned, supporting formwork may be removed when concrete has reached 70 PCT of specified strength, provided re-shoring is installed immediately.
- F. When shores and other vertical supports are arranged so non-load-carrying form-facing material may be removed without loosening or disturbing shores and supports, facing material may be removed at earlier age as permitted.

3.3 RE-SHORING

- A. When re-shoring is permitted or required, plan operations in advance. Follow sequence indicated on formwork drawings as directed by forming system design engineer. While re-shoring is underway, allow no live load on new construction.
- B. During re-shoring do not subject concrete in beam, slab, column or other structural member to combined dead and construction loads in excess of loads permitted by forming system design engineer for developed concrete strength at time of re-shoring. Place re-shores as soon as practicable after stripping operations are complete but in no case later than end of working day on which stripping occurs. Tighten re-shores to carry required loads without overstressing construction. Leave re-shores in place until:
 1. Tests representative of concrete being supported have reached specified strength.
 2. In-place concrete is at least 7 days old and/or meets the strength required by the forming system design engineer.
 3. Loads imposed by construction operations do not exceed design loads.
- C. For floors supporting shores under newly placed concrete leave original supporting shores in place or re-shore. Re-shoring system shall have capacity sufficient to resist anticipated loads and equal to at least one half of capacity of shoring system above. Locate re-shores directly under shore position above unless otherwise permitted.
- D. In multi-story buildings extend re-shoring over sufficient number of stories to distribute weight of newly placed concrete, forms, and construction live loads in such a manner that capacity of floors as determined by design load and developed concrete strength at time of stripping and re-shoring is not exceeded.

3.4 REMOVAL STRENGTH

- A. When removal of formwork or re-shoring is based on concrete reaching specified strength, concrete shall be presumed to have reached this strength when either of following conditions has been met.
1. When test cylinders, field cured along with concrete they represent, have reached specified strength.
 2. When concrete has been cured as specified for same length of time as age at test date of laboratory-cured cylinders which reached specified strength. Determine length of time concrete has been cured in structure by cumulative number of days or fractions thereof, not necessarily consecutive, during which temperature of air in contact with concrete is above 50 DEGF and concrete has been damp or sealed from evaporation and loss of moisture.

END OF SECTION

SECTION 03 11 31
VOID FORMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Void Forms, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Design, place, and maintain void forms or carton forms for cast-in-place concrete work in compliance with ACI 347 Guide to Form Work, for Concrete, unless otherwise shown or specified.

1.3 SUBMITTALS

- A. Project Information:
 - 1. Name of listed manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Void Forms:
 - 1. Base:
 - a. VoidForm Products, Inc.
 - 2. Optional:
 - a. Savway Carton Forms.
 - 3. Other manufactures desiring approval comply with Section 00 26 00.
- B. Backfill Retainers:
 - 1. Base:
 - a. SureRetainer, by Motzblock.
 - 2. Other Manufacturers desiring approval shall comply with section 00 26 00.

2.2 MATERIALS

- A. Void Forms:
 - 1. Natural kraft corrugated fiberboard with liners impregnated with polyethylene-wax blend, and laminated with waterproof adhesive, or asphalt impregnated corrugated fiber material, approximately 30 PCT asphalt by weight.
 - 2. Design and maintain void forms to maintain vertical and lateral loads applied until such loads can be supported by concrete structure. This includes, but is not limited to, live load, dead load, and weight of moving equipment, height of concrete drop, vibrator frequency, ambient temperature, soil pressures, and lateral stability.
 - 3. Provide depth as indicated in Drawings.
 - 4. Place 0.25 IN protective hardboard or plywood cover on top of slab void forms.
 - 5. Design form material to lose its strength upon prolonged contact with moisture.
 - 6. Sufficient deterioration to cushion uplift forces in soil shall take place within a maximum of 8 weeks after placement of concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Place Void Forms under grade beams and first floor slabs as detailed on Contract Drawings, and leave in place after concrete placement.
- B. Assemble forms, place and tape joints in accordance with manufacturer's directions.
- C. Provide end closures where required.
- D. Prefabricate fill pieces around stub columns, piers, or other openings.
- E. Vent closures to prevent cracking of concrete.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Reinforcing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM A36 Standard Specification for Carbon Structural Steel
 - 2. ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 3. ASTM A663 Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
 - 4. ASTM A675 Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
 - 5. ASTM A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - 6. ASTM A775 Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - 7. ASTM A884 Standard Specification for Epoxy-Coated Wire and Welded Wire Reinforcement.
 - 8. ASTM A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- B. American Concrete Institute (ACI):
 - 1. ACI 315 Details and Detailing Concrete Reinforcement.
- C. American National Standards Institute (ANSI) /American Welding Society (AWS):
 - 1. ANSI/AWS-D1.4 Structural Welding Code- Reinforcing Steel.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Shop drawings indicating size, number, dimensions and locations of reinforcing steel and accessories, in sufficient detail to permit installation of reinforcing without reference to Contract drawings.
 - a. Details of concrete reinforcement and accessories not indicated on Contract Documents shall be in accordance with ACI 315.
- B. Project Information:
 - 1. Certification that reinforcing to be welded conforms to ASTM A706.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. End Bearing Splice Couplers:
 - 1. Base:
 - a. Erico Products.
- B. Tension Splice Couplers:
 - 1. Base:
 - a. Erico Products.

- b. Dayton Metal Products.
 - c. Dextra America Inc.
- C. Epoxy Adhesive for Anchoring Reinforcing:
- 1. Base:
 - a. HIT System by Hilti.
- D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General Reinforcing:
- 1. Conform to ASTM A615, Grade-60.
- B. Welded Reinforcing:
- 1. Conform to ASTM A706.
- C. Welded Wire Reinforcement:
- 1. Smooth wire flat sheets.
 - 2. Conforming to ASTM A1064 and to wire size and spacing as indicated on Drawings.
- D. Smooth Dowel Bars for Construction Joints:
- 1. Conform to ASTM A663 or ASTM A675, Grade-60.
 - 2. Where indicated, provide a metal dowel cap at one end of dowel to permit longitudinal movement of dowel within concrete section.
 - 3. Provide for movement which equals joint width plus 1/2 IN.
 - 4. Unless otherwise indicated, use 5/8 IN diameter dowels spaced 18 IN on center.
- E. Slab on Grade Plate Dowels:
- 1. ASTM A36 steel.
 - 2. May be used as an equal substitute for smooth dowel bars at construction joints.
 - 3. Diamond Dowel System, by PNA Construction Technologies, size 1/4 IN x 4-1/2 IN dowels or equal .
 - 4. Locate plate dowels per smooth dowel bar requirements.
 - 5. Do not shear plates.
 - 6. Remove burrs at edges of plates.
- F. End Bearing Splice Couplers:
- 1. Erico Speed-Sleeve Splice by Erico Products.
- G. Tension Splice Couplers:
- 1. Minimum 125 PCT yield strength of bar.
 - 2. Where drawings indicate tension splice couplers, provide one of following:
 - a. Lenton threaded tension coupler by Erico Products.
 - b. Bar-Grip tension coupler by Dayton Metal Products.
 - c. Cadweld tension splice by Erico Products.
 - d. Bar-Lock lockshear bolt coupling sleeves by Dayton Superior
 - e. Barte Mechanical Couplers by Dextra America, Inc.
- H. Epoxy Coating for Reinforcing:
- 1. Conform to ASTM A775.
 - 2. Coat reinforcing specifically noted on Drawings in addition to splice couplers.
 - 3. Touch up damaged coating areas in field.
- I. Epoxy Anchored Reinforcing:
- 1. Install reinforcing anchored in concrete with epoxy adhesive, in accordance with epoxy manufacturer's instructions.

2.3 FABRICATION

- A. Bars for Concrete Reinforcement:
- 1. Sheared length: Plus or minus 1 IN.

2. Depth of truss bars: Plus 0, minus 1/2 IN.
 3. Overall dimensions of stirrups, ties, and spirals: Plus or minus 1/2 IN.
 4. Other bends: Plus or minus 1 IN.
- B. Bars with End Bearing Splice Couplers:
1. Terminate bar ends in flat surfaces within 1-1/2 DEG of right angle to axis of bars.
 2. Fit within 3 DEG of full bearing after assembly.

PART 3 - EXECUTION

3.1 WELDING

- A. Perform welding of reinforcing steel in conformance with AWS-D1.4.
- B. Use E70 electrodes.
- C. Each welder shall place an approved identifying mark near each completed weld.
- D. Cut out welds determined to be defective.
 1. Weld and retest at Contractor's expense.

3.2 PLACING REINFORCEMENT

- A. Provide minimum concrete covering for reinforcement as follows:
 1. Concrete deposited against earth: 3 IN.
 2. Formed surfaces exposed to weather or in contact with earth:
 - a. 2 IN for reinforcing bars No.6 or larger.
 - b. 1-1/2 IN for reinforcing bars less than No.6.
 3. Interior surfaces:
 - a. 1-1/2 IN for beams, girders, and columns.
 - b. 3/4 IN for slabs, walls and joists with No.11 bars or smaller, and 1-1/2 IN with No.14 and No.18 bars.
- B. Place bars to following tolerances:
 1. Clear distance to formed surfaces: Plus or minus 1/4 IN.
 2. Minimum spacing between bars: Minus 1/4 IN.
 3. Top bars in slabs and beams:
 - a. Members 8 IN deep or less: Plus or minus 1/4 IN.
 - b. Members between 8 and 24 IN deep: Plus/minus 1/2 IN.
 - c. Members more than 2 FT deep: Plus or minus 1 IN.
 4. Crosswise of members: Spaced evenly within 2 IN.
 5. Lengthwise of members: Plus or minus 2 IN.
- C. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items.
 1. If moved more than one bar diameter, or enough to exceed above tolerances, resulting arrangement of bars subject to approval.
- D. Assure that reinforcement, at time concrete is placed, is free of materials that may adversely affect or reduce bond.
 1. Reinforcement with rust, mill scale or a combination of both is acceptable provided dimensions and weights, including heights of deformations, of a cleaned sample is not less than required by ASTM.
- E. Support reinforcement and fasten together to prevent displacement by construction loads or placing of concrete beyond tolerances indicated.
 1. On ground, provide supporting concrete blocks or other approved method.
 2. Over formwork, use concrete, metal, plastic or other approved bar chairs and spacers.
 3. Where concrete surface will be exposed to weather in finished structure, furnish accessories within 1/2 IN of concrete surface of non-corrosive material or protect against corrosion.

- F. Overlap welded wire reinforcement not less than spacing of cross wires plus 2 IN.
 - 1. Unless shown otherwise, support welded wire reinforcement by methods of Paragraph E, above.
- G. Offset vertical bars in columns at least one bar diameter at lapped splices to ensure proper placement, furnish templates for column vertical bars and dowels.
- H. Splices not specifically indicated shall be subject to approval.
- I. Unless permitted by Architect/Engineer, do not bend reinforcement after embedding in hardened concrete.
- J. Unless permitted by Architect/Engineer, do not tack weld reinforcing.

END OF SECTION

SECTION 03 31 00
CONCRETE MATERIALS AND PROPORTIONING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Materials and Proportioning, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM C33 Standard Specification for Concrete Aggregates
 - 2. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - 3. ASTM C94 Standard Specification for Ready-Mixed Concrete
 - 4. ASTM C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
 - 5. ASTM C143 Standard Test Method for Slump of Hydraulic-Cement Concrete
 - 6. ASTM C150 Standard Specification for Portland Cement
 - 7. ASTM C157 Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
 - 8. ASTM C173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
 - 9. ASTM C192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
 - 10. ASTM C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
 - 11. ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete
 - 12. ASTM C311 Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
 - 13. ASTM C330 Standard Specification for Lightweight Aggregates for Structural Concrete
 - 14. ASTM C496 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
 - 15. ASTM C567 Standard Test Method for Determining Density of Structural Lightweight Concrete
 - 16. ASTM C595 Standard Specification for Blended Hydraulic Cements
 - 17. ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - 18. ASTM C989 Standard Specification for Slag Cement for Use in Concrete and Mortars
 - 19. ASTM C1399 Standard Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete
 - 20. ASTM C1602 Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
- B. American Concrete Institute (ACI):
 - 1. Comply with applicable provisions of following ACI publications, latest edition, except as otherwise indicated.
 - 2. ACI 301 Specifications for Structural Concrete for Buildings.
- C. Concrete Mixture Proportioning:
 - 1. Employ and pay for testing agency acceptable to Architect and Owner to perform materials evaluation, testing and design of concrete mixes.

2. Certificates, signed by material producer and Contractor, may be submitted in lieu of material testing when approved by Architect.
- D. Concrete Testing:
1. Specified in Section 03 08 13
 2. Contractor to assist with related communication and temporary storage of test cylinders at jobsite.
- E. Preinstallation Conference:
1. See Section 01 31 19.
 2. Minimum thirty-five (35) days prior to start of concrete construction schedule, conduct meeting to discuss approved mix designs and required methods and procedures to achieve required concrete construction.
 3. Send a Pre-Installation Conference agenda to attendees twenty (20) days prior to scheduled date of the conference.
 4. Invite responsible representatives, in addition to those listed in Section 01 31 19, including but not limited to following:
 - a. Ready-mix concrete producer.
 - b. Admixture manufacturer.
 - c. Concrete pumping equipment manufacturer
 - d. Laboratory responsible for the concrete design mix.
 - e. Owners Testing Agency responsible for field quality control.
 5. Record minutes of the meeting and distribute to attendees within five (5) days of conference.
 - a. Include statement by concrete contractor indicating proposed mix design, and placing, finishing and curing procedures produce concrete quality required by specifications.

1.3 SUBMITTALS

- A. Product Data:
1. Concrete Mix Designs:
 - a. Submit each Mix Design individually.
 - b. Do not combine multiple mix designs into a single submittal.
 - c. Submit following data for each concrete mix proposed:
 - 1) Intended use.
 - 2) Proportions of materials.
 - 3) Slump.
 - 4) Air content.
 - 5) 7-day and 28-day compression test results of trial mixes or those used for standard deviation analysis of an established mix.
 - a) Test records for use in standard deviation analysis must have been made within 24 months of the date of the submittal and represent a time span of production of not less than 45 days.
 - d. Submit source and certification or proof of quality (and compatibility of admixtures) for each of the constituents of the proposed concrete mixes. Compatibility of admixture must be certified.
 - 1) Cement.
 - 2) Aggregate.
 - 3) Water.
 - 4) Admixtures:
 - a) Air Entraining Admixture.
 - b) High-Range Water Reducer.
 - c) Other.
 - e. Submit concrete mix designs using the mix design submittal form included at the end of this specification:

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lightweight Concrete:
 - 1. Concrete made with low density, lightweight aggregate ASTM C 330 or mixture of lightweight and normal weight aggregate.
 - 2. Concrete having a density between 90 PCF and 115 PCF.
- B. Normal Weight Concrete:
 - 1. Concrete for which density is not a controlled attribute.
 - 2. Materials used in production must be of same quality, properties and proportion as indicated in approved concrete mix design as approved by Architect.
- C. Under-slab Vapor Retarder:
 - 1. Specified in Section 03 31 10.
- D. Cement:
 - 1. Portland cement conforming to ASTM C150 or blended cements conforming to ASTM C595.
 - 2. Color: Natural gray.
- E. Aggregates:
 - 1. General:
 - a. Regard fine and coarse aggregates as separate ingredients.
 - b. Each size of coarse aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of applicable ASTM specifications.
 - 2. Normal Weight Concrete:
 - a. ASTM C33, also aggregate shall be obtained from a source approved by the State Highway Department for use in concrete for state bridges.
- F. Potable Water:
 - 1. Conforming to ASTM C1602.
- G. Admixtures:
 - 1. Use only when specifically required or permitted by Contract Documents, otherwise must be approved by Architect.
 - 2. Trial mixes and tests shall be prepared with job materials, including admixture, to demonstrate that there will be no subsequent reduction in strength or durability of hardened concrete.
 - 3. Provide admixtures certified by manufacture to be compatible with other admixtures. Calcium chloride, thiocyanates, and admixtures containing more than 0.05 PCT chloride ions are not permitted.
 - 4. Air-entraining Admixtures: ASTM C260.
 - 5. Mid-Range Water Reducer: ASTM C494, Type A.
 - 6. High-Range Water Reducer :
 - a. ASTM C494, Type F or G. Subject to complying with these specifications, the following manufacturers of High Range Water Reducing Admixtures are approved:
 - 1) Daracem – 100 or Adva Flow Series by Grace Construction Products.
 - 2) MasterRheobuild 1000 , MasterGlenium Series or PS 1466 by BASF Master Builders Solutions.
 - 3) Eucon 37 , Eucon SPJ or Plastol Series by Euclid Chemical.
 - 4) PSP-N, PSP-N2, PSP-R, and PSP-L by Procrete Industries.
 - b. Other manufacturers desiring approval comply with Section 00 26 00.
 - 7. Water-reducing, Retarding, and Accelerating Admixtures: ASTM C494.
 - 8. Non-Chloride, Non-Corrosive Accelerating Admixture:
 - a. ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration)

- using an acceptable accelerated corrosion test method such as that using electrical potential measures. Acceptable products include:
- 1) Euclid Chemical Co; Accelguard (The) 80, 90 or NCA . www.euclidchemical.com
 - 2) BASF; Masterset AC 534. www.buildingsystems.basf.com
 - 3) W.R. Grace & Co; Daraset. www.na.graceconstruction.com
- b. Other manufacturers desiring approval comply with Section 00 26 00.
9. Viscosity Modifying Admixture (VMA):
 - a. Specialty admixture to reduce bleed and segregation in concrete
 - 1) Euclid Chemical Company (The); Viscrol.
 - 2) Boral Materials Technologies; Boral SL.
 - 3) BASF; MasterMatrix VMA Series
 - b. Other manufacturers desiring approval comply with Section 00 26 00.
 10. Calcium-nitrite Corrosion Inhibitor:
 - a. Base Products: DCI and DCI S by Grace Construction Products.
 - b. Rheocrete CNI by BASF Master Builders Solutions.
 - c. Eucon CIA by the Euclid Chemical Company
 - d. Incorporate at a rate of ___ G/YD³ in the areas identified.
 11. Supplementary Cementitious Materials:
 - a. Fly ash - ASTM C618, Class C or Class F.
 - 1) Samples shall be obtained, prepared, and tested in accordance with ASTM C311.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
 12. Synthetic Macro Fibers
 - a. ASTM C1116 Type III
 - b. Where permitted, fiber reinforced concrete shall replace and provide equivalent reinforcing to that indicated in both direct tension and bending capacity for concrete thickness indicated
 - c. Testing per ASTM C1018 and/or ASTM C1399 shall indicate a minimum residual strength of 170 PSI. Establish dosage rate required to meet performance specified.
 - 1) Submit manufacturers data verifying conformance
 - d. Minimum Dosage rate 4 LBS/CU YD.
 - e. Acceptable manufacturers
 - 1) W.R.Grace Co.; Strux 90/40
 - 2) Euclid Chemical Company Tuf-Strand SF

2.2 PROPORTIONING CONCRETE MIXES

- A. General:
 1. Contractor and concrete supplier are responsible to provide concrete, in-place, which satisfies requirements listed in following table.
 2. Contractor and concrete supplier are responsible to adjust the concrete mixes, as needed, to:
 - a. Correct for non-conformance.
 - b. Correct for a variation in the quality of a constituent.
 - c. Compensate for extreme conditions in the field.
- B. Establish concrete material proportions by any of the proportioning methods described in AC1-301 guidelines.

Concrete Properties Table – IP Units							
Use	28-day strength (KSI)	Dry Unit Weight (PCF)	Max Aggregate Size (IN)	Air percent	Max. W/C Ratio	Slump (IN)	Cement type
Footings ,Grade Beams	4.0		1-1/2	4.5	0.48		I
Drilled Piers	4.0		1 1/2		0.57		I
Walls	4.0		1	4.5	0.48		I
Slabs-on-grade	3.5		1 1/2		0.53		I

Concrete Properties Table – IP Units							
Use	28-day strength (KSI)	Dry Unit Weight (PCF)	Max Aggregate Size (IN)	Air percent	Max. W/C Ratio	Slump (IN)	Cement type
Structural floors, girders, slabs, columns	4.0		3/4		0.45		I
Post-tensioned slabs & beams	5.0		3/4 or 1	6	0.40		I
Columns	6.0		3/4		0.35	9	I
Radiology Shield, Wall, and Roof	3.0	147	1		0.70		I
Lt. Wt. Slabs on composite metal deck	3.5	115	3/4		0.50		I
Norm. Wt. Slabs on composite metal deck	3.5		3/4		0.50		I
Lt. Wt. Slabs, beams, girders	4.0	112	3/4		0.57		I
All other uses	4.0		3/4	6	0.48		I

C. Instructions for use of Table:

1. Provide concrete mixes with properties indicated in locations identified in Use column.
2. 28-day Strength:
 - a. Installed concrete must meet or exceed the minimum 28-day compressive strength indicated.
 - b. Laboratory mix design strengths must exceed this strength by the appropriate amount per ACI-301.
 - c. Determine strength in accordance with ASTM C192 and ASTM C39.
3. Dry Unit Weight:
 - a. If no value is listed, assume normal weight.
 - b. Dry unit weight of light weight mixes shall be maximum air dry unit weight permitted.
 - c. Correlate fresh weight with air dry weight of same mix to use as basis of acceptance on job site. Test in accordance with ASTM C567 and ASTM C138.
 - d. Dry unit weight for concrete for Radiation Shielding shall be minimum air dry unit weight permitted. Use heavy aggregate if necessary.
4. Maximum Aggregate Size:
 - a. Maximum size of coarse aggregate determined in accordance with:
 - 1) ASTM C33 for normal weight concrete.
 - b. Some mixes are designated 3/4 IN or 1 IN, permitting contractor option.
5. Air Content:
 - a. Required percentage of entrained and entrapped air as measured by ASTM C231, ASTM C173, or ASTM C138, as appropriate.
 - b. Tolerance of air content as delivered is +/- 1-1/2 PCT for normal weight and +/- 2 PCT for lightweight concrete.
 - c. When left blank, the required air content is not specified. All concrete exposed to freezing and thawing shall have air content between 4.5 PCT and 7.5 PCT. All interior slabs and all slabs to receive dry shake shall have a maximum air content of 3 PCT.
6. Water Reducer:
 - a. Mid Range Water Reducer or High Range Water Reducer shall be provided as necessary to achieve slump indicated.
 - b. Contractor, as option, may elect to use Water Reducers to improve workability or permit pumping.
7. Maximum W/C Ratio:

- a. Maximum ratio of pounds of water allowed to pounds of cementitious material used in the concrete mix.
8. Slump:
- a. Mixes without Water Reducers:
 - 1) Slump tolerance: Up to 1 IN above maximum indicated is allowed, provided the average of 5 consecutive batches does not exceed the indicated amount by more than a 1/2 IN.
 - b. Mixes with Water Reducers:
 - 1) Slump indicated is after dosing.
 - 2) Slump tolerance after dosing: +1-1/2 IN and -1 IN is permitted for each batch.
 - c. Determine slump in accordance with ASTM C143.
 - d. Where slump is not specified, provide concrete with slump in accordance with approved mix designs.
9. Cement:
- a. Type: Provide cement type indicated.
 - b. As option, the contractor/supplier may use Fly Ash or Ground Blast Furnace Slag for partial replacement of cement.
 - 1) For each unit of cement that is removed, replace with two units of Class F Fly Ash or one unit of Class C Fly Ash.
 - 2) For each unit of cement that is removed, replace with one unit of Ground Blast Furnace Slag.
 - 3) Maximum amount of cement replaced shall not exceed that specified in table 4.2.2.7.b.2 of ACI 301
 - 4) W/C ratio shall be based on total cementitious material content
- D. Admixtures:
- 1. Use admixtures in accordance with manufacturer's instructions.
 - 2. Use only approved admixtures.

PART 3 - EXECUTION

3.1 STORAGE OF MATERIALS

- A. Store cement in weather tight buildings, bins, or silos which will exclude moisture and contaminants.
- B. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.
 - 1. Perform tests for determining conformance to requirements for cleanliness and grading on samples secured from aggregates at point of batching.
 - 2. Do not use frozen or partially frozen aggregates.
- C. Allow sand to drain until it has reached relatively uniform moisture content before use.
- D. Store admixtures in manner to avoid contamination, evaporation, or damage.
 - 1. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure uniform distribution of ingredients.
 - 2. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics.

3.2 MIXING AND DELIVERY

- A. Batch, mix and transport concrete in accordance with ASTM C94.
- B. Batch and mix admixtures in accordance with manufacturer's instructions.
- C. Water added to concrete at the job site:
 - 1. Water additions at job site shall be limited to comply with W/C Ratio requirements.

2. Do not allow water to be added to the mix unless the amount allowed is clearly indicated on the truck delivery ticket.
- D. Following addition of High Range Water Reducer, mix for a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.
 - E. Reduction of required average strength:
 1. During construction, and after sufficient data becomes available, laboratory strength of mixes may be reduced in accordance with Section 3.11 of AC1-301, subject to approval by the Architect.

END OF SECTION

SECTION 03 31 10
CONCRETE MIXING, PLACING, JOINTING, AND CURING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Mixing, Placing, Jointing and Curing as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM C94 Standard Specification for Ready-mixed Concrete.
 - 2. ASTM C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - 3. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete.
 - 4. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 5. ASTM C567 Standard Test Method for Determining the Density of Structural Lightweight Concrete.
 - 6. ASTM D1751 Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
 - 7. ASTM D1752 Standard specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - 8. ASTM E1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
 - 9. ASTM E1745 Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- B. American Concrete Institute (ACI):
 - 1. ACI 302.1R Guide for Concrete Floor and Slab Construction
 - 2. ACI 305.1 Hot Weather Concreting.
 - 3. ACI 306.1 Cold Weather Concreting.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Placement plans: Indicate proposed locations of construction joints and placement sequence.
 - 2. Screeding and finishing plan.
- B. Product Data:
 - 1. Vapor Retarder.
- C. Project Information:
 - 1. Joint filler technical data.
 - 2. Strippable Curing compound technical data.
 - a. Interior slabs:
 - 1) Include floor covering manufacturer's written approval for use.
 - 2) Include procedures to be used for removing compound
 - 3. Waterstop technical data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Evaporation Retarder
 - 1. Base:
 - a. Euclid Chemical Company (The); Eucobar.
 - 2. Optional:
 - a. BASF; MasterKure ER50.
- B. Strippable Curing Compound:
 - 1. Base:
 - a. Kurez DR VOX or Kurez W VOX by Euclid Chemical Company.
 - b. L&M Cure R by L&M Construction Chemicals
 - c. Clear Resin Cure J11W by Dayton Superior
 - d. 1150 Clear by WR Meadows
 - e. SpecRez by SpecChem, LLC
- C. Curing Sheet Material
 - 1. Base
 - a. Hydracure M5 by PNA Construction Technologies, Inc.
 - 2. Optional:
 - a. Transguard 4000 by Reef Industries, Incorporated
- D. Self-Expanding Rubber Strip Waterstops:
 - 1. Base:
 - a. Greenstreak by Sika
 - 2. Optional:
 - a. Adcor by Grace Construction Products
 - b. Adeka by OCM, Inc.
- E. Vapor Retarders: As noted.
- F. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Concrete Materials and Proportioning: See Section 03 31 00.
- B. Premolded Expansion Joint Filler: Type required, conforming to ASTM D1751 or ASTM D1752.
- C. Evaporation Retarder
 - 1. Waterborne, monomolecular film forming, manufactured for application to fresh concrete designed to inhibit the loss of moisture before and during the finishing process.
- D. Curing Sheet Material:
 - 1. Provide where concrete is scheduled to be stained per section 09 67 75.
 - 2. Moisture-Retaining Cover Conforming to ASTM C171: Naturally colored, non-woven polypropylene fabric with a 4-mil non-perforated reflective (white) polyethylene coating.
 - 3. Fabric shall exhibit low permeability and high moisture retention.
- E. Strippable Curing Compound:
 - 1. Conform to ASTM C309 with VOC no greater than 350 g/l.
 - 2. Where used on slabs receiving subsequent applied finishes, compound must be removed completely after curing.
 - 3. Install in accordance with manufacturer's recommendation and supervision.
- F. Granular Fill: See Section 31 23 00.
- G. Underslab Vapor Retarder:

1. Meet ASTM E1745 Class A.
 2. Maximum Water Vapor Permeance: 0.01 Perms.
 3. Minimum Tensile Strength, ASTM E154: 55 FT-LB/IN.
 4. Minimum Puncture resistance: 2,200 grams, minimum.
 5. Base Product:
 - a. Perminator - 15 MIL by WR Meadows.
 6. Optional Products:
 - a. Barrier-Bac VB350 - 16 MIL by Inteplast.
 - b. Moistop Ultra - 15 MIL by Fortifiber.
 - c. Stego Wrap - 15 MIL by Stego Industries.
 - d. Vapor Block Plus - 20 MIL by Raven Engineered Films.
 - e. Viper VaporCheck II - 15 MIL by ISI Building Products.
 - f. Yellow Guard – 15 mil by Poly-America.
 7. Tape as recommended by vapor retarder manufacturer.
 8. Other manufacturers desiring approval comply with requirements of Section 00 26 00.
- H. Waterstops:
1. Self-Expanding Rubber Strip Waterstops:
 - a. Bentonite-free hydrophilic polymer modified chloroprene rubber, suitable for adhesive bonding to concrete.
 - b. Profile: Rectangular or trapezoidal strip unless otherwise indicated.
 - c. Minimum Dimensions: 3/8 IN by 3/4 IN thick.
 - d. Provide in maximum practicable length to minimize end joints.
 - e. Butt splice joints at intersections and at ends of pieces in accordance with manufacturer's instructions.
 - 1) Make joints to develop effective water tightness fully equal to that of continuous waterstop material, to permanently develop not less than 50 PCT of mechanical strength of parent section, and permanently retain flexibility.

PART 3 - EXECUTION

3.1 MIXING AND PRODUCTION OF CONCRETE

- A. Batch, mix and transport ready-mixed concrete in accordance with ASTM C94.
 1. Plant equipment and facilities shall conform to Check List for Certification of Ready Mixed Concrete Production Facilities of National Ready Mixed Concrete Association.
- B. Site batched and mixed concrete will be permitted only after ability to control quality has been demonstrated to satisfaction of Architect.

3.2 MIXING - CONTROL OF ADMIXTURES

- A. Incorporate admixtures in accordance with Manufacturers recommendations.
- B. Verify compatibility with manufacturers when more than one admixture is used.

3.3 MIXING - LIGHTWEIGHT CONCRETE

- A. Batch and mix lightweight aggregate concrete as recommended by producer of aggregate.
 1. Contact Architect for review and approval of procedures at variance with specified values.
- B. If lightweight aggregate absorbs less than 2 PCT water by weight within 1 HR, batch and mix concrete based on test of a sample from field conditioned supply.
- C. If absorption exceeds 2 PCT, batch and mix concrete as follows:
 1. Add aggregate to approximately 80 PCT of mixing water and mix for a minimum of 1-1/2 minutes (15 revolutions in a truck mixer).
 2. Then add admixtures, entire weight of cement, and withheld portion of mixing water in order named, and mix.

- D. Base acceptance of lightweight concrete in field on fresh unit weight measured in accordance ASTM C138.
1. Nominal fresh unit weight shall be that corresponding to specified maximum air-dry unit weight calculated from formula in ASTM C567.
 2. When nominal fresh unit weight varies more than 2 PCF from required weight, adjust mixture as promptly as conditions will permit to bring unit weight to desired level.
 3. Do not allow fresh unit weight of batch to vary more than 3 PCF from desired level.

3.4 MIXING - TEMPERING AND CONTROL OF MIXING WATER

- A. Mix concrete only in quantities for immediate use. Discard concrete which has set.
- B. When concrete arrives at project with slump below that suitable for placing, water may be added only if neither maximum permissible water-cement ratio nor maximum slump is exceeded.
1. Incorporate water by additional mixing equal to at least half of total mixing required.
 2. Do not add water after discharge commences

3.5 MIXING - WEATHER CONDITIONS

- A. Cold Weather:
1. Comply with ACI 306.
 2. In cold weather, temperature of concrete when delivered at site shall conform to following limitations:
 3. For sections with least dimension greater than 36 IN, comply with table 3.1 of ACI 306R

Minimum Concrete Temperature Required at Time of Pour		
Air Temperature at time of pour	For sections with least dimension less than 12 IN	For sections with least dimension 12 IN to 36 IN
Above 30 DEGF	60 DEGF	55 DEGF
0 to 30 DEGF	65 DEGF	60 DEGF
Below 0 DEGF	70 DEGF	65 DEGF

Minimum Concrete Temperature Required within 24 Hours of Pour		
Air Temp within 24 Hours of pour	For sections with least dimension less than 12 IN	For sections with least dimension 12 IN or greater
Below 32	60 DEGF	50 DEGF

4. If water or aggregate is heated above 100 DEGF, combine water with aggregate in mixer before cement is added.
 - a. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 100 DEGF.
 - b. Final temperature of combined mix shall not exceed 90 DEGF or be high enough to cause flash set or loss of slump or workability.
- B. Hot Weather:
1. Comply with ACI 305 when high temperature, low slump, flash set, or cold joints are encountered.
 2. Cool ingredients before mixing, or add flake ice or well-crushed ice of a size that will melt completely during mixing for all or part of mixing water. Account for water contribution by ice when calculating the quantity if mixing water and insure that specified W/C ration is not exceeded.

3.6 PREPARATION BEFORE PLACING

- A. Equipment:
1. Remove hardened concrete and foreign material from inner surfaces of conveying equipment.

2. Provide spare vibrator on job site during concrete placing operations.
 3. In cold weather, have protective blankets ready and heaters operational and in-place before placing concrete.
- B. Forms:
1. Complete formwork: Remove frost, snow, ice, water and foreign material; secure reinforcement in place, position expansion joint material, anchors, and other embedded items and have entire preparation inspected prior to concrete placement.
 2. In hot weather when temperature of reinforcing or forms is greater than 120 DEGF spray forms and reinforcement with water just prior to placing concrete.
- C. Screeds and Screenshot Rails:
1. Develop a screed system to accurately strike off fresh concrete to the surfaces defined on drawings.
 2. Anticipate deflection of formwork and support systems.
 - a. Provide and place extra concrete as necessary to produce finish surfaces with specified tolerances at designated elevations and contours at no additional cost to the Owner.
 3. When form work is cambered whether shored or un-shored and screeding is performed perpendicular (i.e., up and over) to crown of camber set screed rails to follow camber and provide a slab of uniform thickness.
 - a. When screeding parallel with the camber, set one screed at midspan along crown of camber and one along girder or support.
 - b. Two passes of the screed is necessary to cover one full bay.
 4. Other screeding methods may be used provided deflection of un-shored formwork is taken into consideration.
 5. On unshored steel framing systems, accurately strike off concrete to produce a level surface after steel supporting system has deflected due to dead weight of fresh concrete.
 6. Slab thickness on cambered steel shall not be less than that indicated on plan.
 7. If not required in documents and subjected to approval of Architect, Contractor as option may camber formwork.
 8. Concrete shall be struck off with a vibrating screed.
 9. Use of a wet screed system will not be permitted unless:
 - a. Concrete is struck with a pneumatically vibrated floater screed.
 - b. A highway straight edge is used to true the surface perpendicular to direction of screeding.
 - c. A satisfactory finish is produced on a trial slab.
 10. Submit a screeding and finishing plan for approval.
 - a. A representative trial slab pour shall be provided to demonstrate that the specified tolerances and a satisfactory surface can be provided by the proposed method of screeding and finishing.
- D. Subgrade for Slabs on Grade:
1. Subgrade shall be well drained and of adequate and uniform load bearing nature.
 - a. Keep in-place density of subgrade soils at least to minimum indicated.
 2. Keep subgrade free of frost before concrete placing begins.
 - a. If temperature inside a building where concrete is to be placed is below freezing, raise temperature and maintain above 50 DEGF long enough to remove frost from subgrade and reinforcing.
 3. Keep subgrade moist at time of concreting.
 - a. If necessary, dampen with water in advance of concreting.
 - b. Allow no free water standing on subgrade nor muddy or soft spots when concrete is placed.

3.7 UNDER-SLAB VAPOR RETARDER

- A. Place continuous vapor retarder over granular fill.
1. See Section 31 23 00.
 2. Installation as recommended by manufacturer.

- B. Comply with ASTM E1643 Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - 1. Lap vapor retarder at ends and edges of sheets and seal with vapor retarder tape.
 - 2. Extend to extremities of area.
 - 3. Turn up at perimeter walls to form bond breaker and tape in place.
 - 4. Detail sleeved or drilled penetrations as recommended by manufacturer.
 - a. Coordinate detailing at penetrations with subcontractors responsible for penetrations.
- C. Protect vapor retarder. Repair punctures, tears and other damage using vapor retarder tape.
- D. Trim excess material after slab is placed.
- E. Inspect and approve vapor retarder installation prior to concrete placement.
 - 1. See Section 01 45 23.

3.8 PROTECTION

- A. Unless adequate protection is provided and approval is obtained, do not place concrete when temperature is below freezing or during rain, sleet or snow.
- B. Do not allow rainwater to increase mixing water nor to damage surface finish.
- C. Concrete damaged by rain or weather and judged defective by Architect shall be removed and replaced by Contractor at no additional cost to Owner or corrected by procedures listed in Section 03 08 13 [Section 03 08 16].

3.9 CONVEYING

- A. Handle concrete from mixer to place of final deposit as rapidly as practicable by methods which prevent segregation or loss of ingredients and assure that quality is maintained.
- B. Use equipment conforming to ASTM C94.
- C. Use horizontal belt conveyors or mount at a slope which will not cause excessive segregation or loss of ingredients.
 - 1. Protect concrete against undue drying or rise in temperature.
 - 2. Handle to prevent segregation.
 - 3. Do not allow mortar to adhere to belt.
 - 4. Discharge long runs into a hopper or through a baffle.
- D. Use metal or metal-lined chutes with slope between 1 vertical and 2-3 horizontal.
 - 1. Chutes more than 20 FT long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.
- E. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity.
 - 1. Control pneumatic placement so that segregation is not apparent in discharged concrete.
 - 2. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 IN.
 - 3. Do not convey concrete through pipe made of aluminum or aluminum alloy.

3.10 DEPOSITING IN FORMS

- A. Work Includes:
 - 1. Deposit concrete continuously or in layers of such thickness that no concrete is deposited on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section.
 - 2. Place at such a rate that concrete which is being integrated with fresh concrete is still plastic.
 - 3. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
 - 4. Remove temporary spreaders in forms when concrete placing has reached an elevation rendering their service unnecessary.
 - 5. Temporary spreaders may remain embedded in concrete only if made of metal or concrete and if prior approval has been obtained.

- B. Do not start placing concrete in supported elements until concrete previously placed in columns and walls is no longer plastic and has been in place at least two hours.
- C. Deposit concrete as nearly as practicable in its final position to avoid segregation due to re-handling or flowing.
 - 1. Do not subject concrete to procedure which will cause segregation.
 - 2. Concrete shall not drop more than 6 FT unless approved by the Architect/Engineer. For greater heights, provide special mix design, chute, spout, tremie, or other approved method.
- D. Concrete buckets shall be equipped with rubber discharge tubes.
 - 1. Tube size shall be effective in directing flow of concrete directly downward between reinforcing.
 - 2. Unless it can be demonstrated, no segregation will occur with greater distances, maximum free fall distance of concrete below flexible tube is limited to 4 FT.
- E. Consolidation:
 - 1. Consolidate concrete by vibration, so that concrete is thoroughly worked around reinforcement, around embedded items and into corners of forms eliminating air or stone pockets which may cause honeycombing, pitting, or planes of weakness.
 - 2. Use internal vibrators having a minimum frequency of 8000 vibrations per minute to consolidate concrete effectively.
 - 3. Do not use vibrators to transport concrete within forms.
 - 4. Insert vibrators and withdraw at points approximately 18 IN apart.
 - 5. At each insertion allow duration sufficient to consolidate concrete but not sufficient to cause segregation; generally from 5 to 15 sec.
 - 6. Where concrete is to have an as-cast finish, bring a full surface of mortar against form by vibration process, supplemented if necessary by spading, to work coarse aggregate back from formed surface.

3.11 SLAB PLACEMENT

- A. Coordinate mixing and placing with finishing.
 - 1. Do not place concrete on subgrade or forms more rapidly than it can be spread, straight edged, and darbed or bull floated.
 - 2. Perform these operations before bleed water has an opportunity to collect on surface.
- B. Plan size of finishing crews to achieve good surfaces and avoid cold joints caused by temperature and atmospheric conditions.
 - 1. If construction joints become necessary, construct as required under joints and embedded items.
- C. Consolidation:
 - 1. Thoroughly consolidate concrete in slabs.
 - 2. Use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade.
 - 3. Obtain consolidation of slabs with vibrating screeds, roller pipe screeds, internal vibrators, or other approved means.

3.12 JOINTS AND EMBEDDED ITEMS

- A. Construction Joints - Other than Slab on Grade:
 - 1. Locate joints not indicated so as to least impair strength of structure.
 - a. Place joints in locations approved by Architect/Engineer.
 - 2. In general, locate near middle of spans of slabs, beams, and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice width of beam.
 - a. Locate joints in walls and columns at underside of floors, slabs, beams, or girders and at tops of footings or floor slabs.
 - b. Place beams, girders, brackets, column capitals, haunches, and drop panels at same time as slabs.

- c. Make joints perpendicular to main reinforcement.
 - 3. Continue reinforcement across joints.
 - 4. Clean surface of concrete at joints thoroughly and remove laitance.
 - a. Prior to placing adjoining concrete, dampen, but do not saturate, hardened concrete of construction joints.
- B. Joints – Slabs on Grade:
 - 1. Construction joints:
 - a. Place keyed dowelled or diamond plate construction joints as indicated on plans and at locations where a slab placement is terminated or interrupted.
 - b. Size of placements and sequence of slab placement is Contractor's option, except construction joints shall be located at a control joint location.
 - c. Construction joints act as control joints.
 - 2. Control joints:
 - a. Provide contraction (control) joints as indicated.
 - b. If not shown, provide along column centerlines.
 - c. Where column centerline spacing or spacing between column centerlines and walls exceeds 20 FT, provide an intermediate joint at intervals not exceeding 20 FT.
 - d. Locate joints to produce panels that are as square as possible with length not exceeding 1.5 times width.
 - e. Also provide joints where change in slab width occurs, such as at block-outs, pits, etc.
 - f. If saw cut joints are required or permitted, time cutting properly with set of concrete by one of the following methods:
 - 1) A conventional saw, cutting as soon as possible after final finishing when cutting action will not tear, ravel, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Cut to a depth of 1/4 slab thickness or 1/3 slab thickness if steel-fiber or structural synthetic macro fiber reinforcement is used.
 - 2) An early entry saw beginning immediately after final finishing when cutting action will not tear, ravel, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 - a) Remove debris in path of cut and under skid plate before cutting. Skid plate must remain flat on surface.
 - b) Use early entry saw blades and skid plates.
 - c) Install early entry joint protector at saw-cut intersection prior to cross-cut.
 - d) Remove dry powder without disturbing finish.
 - e) Avoid traffic across saw cut until sufficient strength is gained to protect joint edges.
 - 3. Complete before shrinkage stresses become sufficient to produce cracking.
 - 4. Isolation joints:
 - a. Provide isolation joints around columns, and between slab on grade and walls.
 - b. Also provide isolation joints around equipment or machinery isolation pads, pits, pipes, etc., unless detailed otherwise.
- C. Expansion Joints:
 - 1. Do not permit reinforcement or other embedded metal items bonded to concrete, except dowels in floors bonded on only one side of joints, to extend continuously through expansion joint.
 - 2. Locate expansion joints as indicated.
- D. Acoustic Isolation Joint:
 - 1. Do not permit any reinforcing or other bonded items to extend through joint.
 - 2. Remove forming material and clean joint thoroughly prior to cover installation. Locate as indicated.
- E. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to placement of concrete.

1. Give Contractors whose work is related to concrete or supported by it ample notice and opportunity to introduce and/or furnish embedded items before concrete placement.
2. Position expansion joint material, waterstops, and other embedded items accurately and support against displacement.
3. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete.

3.13 BONDED JOINTS

- A. At construction joints indicated as bonded, obtain bond by one of following methods:
 1. Roughen surface of concrete in an approved manner which will expose aggregate uniformly and not leave laitance, loosened particles of aggregate or damaged concrete at surface.
 - a. Dampen (but do not saturate) hardened concrete of joints in exposed work; joints in middle of beams, girders, joists, and slabs; and joints in work designed to contain liquids.
 - b. Thoroughly cover with a coat of cement grout of similar proportions to mortar in concrete.
 - c. Use grout as thick as possible on vertical surfaces and at least 1/2 IN thick on horizontal surfaces.
 - d. Place fresh concrete before grout has attained its initial set.
 2. Prepare joints receiving an adhesive and apply adhesive in accordance with manufacturer's recommendations prior to placing of fresh concrete.
 3. Prepare surfaces of joints which have been treated with a chemical retarder in accordance with manufacturer's recommendations prior to placing of fresh concrete.

3.14 SLAB FINISHING

- A. See Section 03 35 00.

3.15 CURING AND PROTECTION

- A. Work Includes:
 1. Beginning immediately after placement, protect concrete from premature drying, hot or cold temperatures, and mechanical injury, and maintain with minimal moisture loss at relatively constant temperature for period necessary for hydration and hardening of concrete.
 2. Materials and methods of curing subject to approval.
- B. Preservation of Moisture:
 1. Preserve moisture in slab before and during finishing until slab is ready for application of final curing.
 2. When conditions warrant, apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 LB/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions one or more times after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Final curing:
 1. Interior slabs:
 - a. Application of sheet curing materials.
 - b. Application of strippable curing compound.
 - 1) Submit written approval from floor covering manufacturer prior to use.
 - 2) Apply in accord with recommendations of manufacturer immediately after water sheen, which may develop after finishing, has disappeared.
 - 3) Apply continuous film at manufacturer's specified rate.
 - 4) Completely remove prior to application of floor covering material.
 2. Other concrete surfaces not in contact with forms apply one of following procedures immediately after completion of placement and finishing:
 - a. Ponding or continuous sprinkling.
 - b. Application of absorptive mats or fabric kept continuously wet.
 - c. Application of sand kept continuously wet.

- d. Continuous application of mist spray, not exceeding 150 DEGF.
 - e. Application of sheet curing materials.
 - f. Application of other moisture-retaining covering as approved.
 - g. Application of strippable curing compound.
 - 1) Apply in accordance with recommendations of manufacturer immediately after water sheen has disappeared.
 - 2) Apply continuous film at manufacturer's specified rate.
 - 3) Remove after curing where cured surface is against which additional concrete or other material is to be bonded, unless it is proven that curing compound will not prevent bond.
 - 3. Minimize moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by sun by keeping forms wet until they can be safely removed.
 - a. After form removal cure concrete until end of time prescribed.
 - 4. Continue curing in accordance with ACI 301 and ACI 302. Seven days for most concrete.
 - a. If tests made of cylinders, kept adjacent to structure and cured by same methods, indicate average compressive strength has reached 70 PCT of specified strength, (f'c), moisture retention methods may be terminated.
 - b. If one of curing procedures indicated above is used initially, it may be replaced by one of other procedures indicated any time after concrete is 1 day old, provided concrete is not permitted to become surface dry during transition.
- D. Temperature, Wind and Humidity:
- 1. Cold weather:
 - a. When mean daily outdoor temperature is less than 40 DEGF maintain temperature of concrete between 50 and 70 DEGF for required curing period.
 - b. When necessary make arrangements for heating, covering, insulating, or housing concrete work adequate to maintain required temperature without injury.
 - c. Do not use combustion heaters during first 24 HRS unless precautions are taken to prevent exposure of concrete to exhaust gases which contain carbon dioxide.
 - 2. Hot weather:
 - a. When necessary make provision for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material.
 - b. Take such protective measures as quickly as concrete hardening and finishing operations will allow.
 - 3. Rate of temperature change:
 - a. Keep changes in temperature of air immediately adjacent to concrete during and immediately following curing period as uniform as possible.
 - b. Do not exceed 5 DEGF in any 1 HR or 50 DEGF in any 24-hour period.
- E. Protection from Mechanical Injury:
- 1. During curing period, protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration.
 - 2. Protect finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain or running water.
 - 3. Do not load self-supporting structures in such a way as to overstress concrete.
- F. Protection of Slabs on Grade from Frost:
- 1. Interior slabs exposed to freezing temperatures shall be adequately protected so that frost does not develop in supporting subgrade.

3.16 ELEVATOR DOOR FRAMES

- A. Elevator Door Frames in Concrete Shafts:
- 1. Block-out as required by Elevator Manufacturer to allow for door frames to be set.
 - 2. After door frames have been set, set forms across void between frame and edge of block-out.
 - 3. Fill in with concrete fill.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING AND REPAIR OF SURFACE DEFECTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Finishing and Repair of Surface Defects, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. ASTM E1155 Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers
 - 2. ACI 302.1R Guide for Concrete Floor and Slab Construction
- B. Floor Finish Tolerances:
 - 1. Follow F-Number System as defined in ASTM E1155.
 - a. Floor Flatness F-Number: F_F defines maximum floor curvature allowed over 24 IN computed on basis of successive 12 IN elevation differentials.
 - b. Floor Levelness F-Number: F_L defines relative conformity of floor surface to a horizontal plane measured over a 10 FT distance.
 - c. Above number pair to be stated in form: F_F/F_L .
 - d. Specified Overall Value (SOV) is enumerated and is based on composite of measured values in a placement.
 - e. Minimum Local Value (MLV) describes flatness or levelness below which repair or replacement is required. MLV is based on individual placement and applies to minimum local area not crossing construction or control joints.
- C. Trial Concrete Panels:
 - 1. Provide trial panels to permit evaluation of finishing properties and appearance of concrete proposed for use.
 - 2. Panels size: 8 x 8 FT, of specified thickness, and made with specified materials and proportions, using equipment and personnel comparable to those employed on work.
 - 3. Demonstrate concrete capable of being finished at a slump not exceeding that specified.
 - 4. Construct panels and secure approval prior to proceeding with finish in specified location.
 - 5. Approved panels shall serve as standards by which corresponding finishes in structure will be accepted or rejected.
 - 6. Construct panels at approved location, not as part of structure. Protect from construction operations, weather, and damage until acceptance of completed concrete work. Remove from site when directed.
 - a. Provide one ___ IN thick approved panel for each slab finish specified. Panel shall be on grade.
 - b. Provide one ___ IN thick approved panel for smooth form finish. Panel shall be vertical.
 - c. Provide one ___ IN thick approved panel for each rubbed finish specified. Panel shall be vertical.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Chemical Hardener:
 - 1. Base:

- a. BASF Master Builders Solutions.
2. Optional:
 - a. SpecChem, LLC
3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Bonding Agent:
 1. Approximately 1 part Portland cement to 1 part fine sand passing a No.30 mesh sieve.
 2. Mix to consistency of thick cream.
- B. Patching Compound:
 1. Same materials and approximately same proportions as used for concrete, except omit coarse aggregate.
 2. Shall consist of not more than 1 part Portland cement to 2-1/2 parts sand by loose volume.
 3. For exposed concrete, part of Portland cement shall be white to produce a color matching color of surrounding concrete, as determined by a trial patch.
 4. Add no more water than necessary for handling and placing.
 5. Mix compound in advance and allow to stand with frequent manipulation, without addition of water, until it has reached stiffest consistency that will permit placing.
- C. Grout Mix:
 1. Cleaned rubbed finish:
 - a. Mix 1 part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout with a consistency of thick paint.
 2. Cork floated rubbed finish:
 - a. Mix 1 part Portland cement and 1 part fine sand with sufficient water to produce a stiff grout.
- D. Proprietary Materials:
 1. Contractor's option: Proprietary compounds for adhesion, patching, or finishing may be used in lieu of or in addition to foregoing grouts.
 2. Use such compounds in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 FINISHING

- A. After removal of forms, repair and give surfaces of concrete finishes indicated.
 1. Top surface of slabs not included.
- B. Unspecified finish: If finish is not designated, use following finishes as applicable:
 1. Unpainted concrete surfaces not exposed to public view: Rough form finish.
 2. Unpainted concrete surfaces exposed to public view: Smooth form finish.
 3. Concrete surfaces to receive paint: Grout cleaned rubbed finish.
 4. Unformed surfaces (except slabs): As indicated.
 5. Concrete surfaces to be waterproofed in Section 07 14 13 and Section 07 14 16: Smooth form finish.

3.2 REPAIR OF SURFACE DEFECTS

- A. Repair surface defects immediately after form removal.
- B. Remove honeycombed and other defective concrete down to sound concrete.
- C. Chip if necessary to make edges perpendicular to surface or slightly undercut.
- D. No feather edges will be permitted.
- E. Dampen area to be patched and an area at least 6 IN wide surrounding it to prevent absorption of water from patching compound.

- F. After surface water has evaporated from area to be patched, brush bonding agent into surface.
- G. When bonding agent begins to lose water sheen, apply patching compound.
- H. Thoroughly consolidate compound into place and strike off so as to leave patch slightly higher than surrounding surface.
- I. To permit initial shrinkage, leave undisturbed for at least 1 HR before final finish. Keep patched area damp for 7 days.
- J. Do not use metal tools in finishing a patch which will be exposed.
- K. Tie holes:
 - 1. Unless stainless steel, non-corrosive, or acceptably coated ties are used, tie holes shall be filled.
 - 2. Clean and thoroughly dampen tie holes; fill solid with patching compound.

3.3 AS-CAST FINISHES

- A. Rough Form Finish:
 - 1. No selected form facing materials are specified for rough form finish surfaces.
 - 2. Concrete surfaces shall conform to tolerances in Section 03 11 00 Concrete Formwork.
 - 3. Patch defects and tie holes.
 - 4. Chip or rub off fins exceeding 1/4 IN in height.
 - 5. Leave surfaces with texture imparted by forms.
- B. Smooth Form Finish:
 - 1. Use form facing material to produce a smooth, hard, uniform texture on concrete.
 - 2. Arrange facing material orderly and symmetrical, with number of seams kept to practical minimum.
 - 3. Support by studs or other backing capable of preventing excessive deflection.
 - 4. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surface.
 - 5. Patch tie holes and defects.
 - 6. Remove fins completely.
 - 7. When surface textures are impaired and form joints misaligned by more than 1/8 IN grind bush hammer, or otherwise correct affected concrete.
 - 8. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete.
 - 9. Repair major mortar leakage as a defective area.
- C. Special Architectural Finish:
 - 1. Produce finish in accord with requirements of Section 03 33 00, Architectural Concrete.
- D. Unformed Surface Finish:
 - 1. Strike smooth tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces after concrete is placed.
 - 2. Float to a texture reasonably consistent with that of formed surfaces.
 - 3. Continue final treatment on formed surfaces uniformly across unformed surfaces.
 - 4. Not intended for slabs.

3.4 RUBBED FINISHES

- A. General:
 - 1. Form and repair concrete surfaces to receive rubbed finishes, in accordance with requirements for smooth form finish.
 - 2. Remove forms and perform necessary patching as soon after placement as possible without jeopardizing structure.
- B. Smooth:
 - 1. Produce smooth rubbed finish on newly hardened concrete no later than day following form removal.

2. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.
 3. Use no cement grout other than cement paste drawn from concrete itself by rubbing process.
- C. Grout Cleaned:
1. Undertake no cleaning operations until contiguous surfaces are completed and accessible.
 2. Wet surface of concrete sufficiently to prevent absorption of water from grout and apply grout uniformly.
 3. Immediately after applying grout, scrub surface vigorously with a cork float or stone to coat surface and fill air bubbles and holes.
 4. While grout is still plastic, remove excess grout by working surface with a rubber float, sack, or other means.
 5. After surface whitens from drying, rub vigorously with clean burlap.
 6. Keep finish damp for at least 36 HRS after final rubbing.
- D. Cork Floated:
1. Remove forms at an early stage, within 2 to 3 days of placement where possible.
 2. Remove ties.
 3. Remove burrs and fins.
 4. Dampen wall surface.
 5. Apply grout with firm rubber float or with trowel, filling surface voids.
 6. Compress grout into voids.
 7. If grout surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with a fog sprayer.
 8. Produce final texture with a cork float using a swirling motion.

3.5 SLAB FINISHING

- A. General:
1. Place slabs to finish tolerances specified.
 2. Slab finish: Use following finishes at building locations noted.
 - a. Scratched finish: Surfaces intended to receive bonded applied cementitious applications, such as setting beds, grout, etc.
 - b. Floated finish (magnesium):
 - 1) Surfaces intended to receive roofing, waterproofing membranes, or sand bed terrazzo.
 - 2) Surfaces of ramps, docks, stairs in which no other covering is specified.
 - c. Broom or Belt finish: Parking garage floors.
 - d. Troweled finish:
 - 1) Floors intended as walking surfaces or to receive floor coverings.
 - e. Non-slip finish (interior and exterior): Ramps, docks, stairs specifically noted on drawings.
- B. Finishing tolerances:
1. For shored construction, measurements for conformance with finishing tolerances shall be made as soon as slab can tolerate foot traffic, and before shores are removed.
 2. The F_L levelness tolerance is not applicable to unshored form work such as cast in place topping on prestressed tees, slabs on unshored steel and metal deck, or unshored, post-tensioned slabs on steel beams.
 3. Horizontal finishes will be accepted provided:
 - a. Applicable specification requirements are satisfied.
 - b. Water does not pond in areas sloped to drain.
 - c. Floor finish tolerances F_F/F_L conforms to that specified for particular finish and Minimum Local Values are not less than 75 PCT of the floor finish tolerance specified.
 4. Accumulated deviation from intended true plane of finished surface does not exceed 1 IN.
 5. Accuracy of floor finish does not adversely affect installation and operation of movable equipment, floor supported items or items fitted to floor.

C. Finishes:

1. Scratched finish:
 - a. After concrete has been placed, consolidated, struck off, and leveled to a F_F15/ F_L13 tolerance, roughen surface with stiff brushes or rakes before final set.
2. Floated finish:
 - a. After concrete has been placed, consolidated, struck off, and leveled, do not work further until ready for floating.
 - b. Using a magnesium float, begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation.
 - c. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two different angles.
 - d. Cut down high spots and fill low spots during this procedure to produce a surface within F_F20/ F_L15 tolerance throughout.
 - e. Refloat slab immediately to a uniform sandy texture.
3. Troweled finish:
 - a. Sequence:
 - 1) Float finish
 - 2) Power trowel
 - 3) Hand trowel
 - b. First troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still indicate some trowel marks.
 - c. Final trowel when a ringing sound is produced as trowel is moved over surface.
 - d. Thoroughly consolidate surface by hand troweling.
 - e. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to F_F25/ F_L20 tolerance.
 - f. On surfaces intended to receive floor coverings, grind off defects which would indicate through floor covering.
 - g. On surfaces intended to receive waterproofing membranes grind off defects that might tear or otherwise damage membrane.
4. Broom or belt finish:
 - a. Immediately after concrete has received float finish, give it a coarse scored texture by drawing a broom or burlap belt across surface transverse to slope or traffic flow.
5. Non-slip slab finish:
 - a. Aggregate: Crushed, ceramic bonded aluminum oxide particles. Apply at 25 LB per 100 SQFT.
 - b. Blend aggregate with Portland cement in proportions recommended by manufacturer of aggregate.
 - c. Give surface a float finish.
 - d. Apply approximately two-thirds of blended material for required coverage to surface by a method that ensures even coverage without segregation.
 - 1) Begin floating immediately.
 - e. After material has been embedded by floating, apply remainder of blended material to surface at right angles to previous application.
 - f. Make second application heavier in areas not sufficiently covered by first application. Follow with second floating immediately.
 - g. After selected material has been embedded by two floatings, complete operation with a broomed finish.

END OF SECTION



DIVISION 04

MASONRY



SECTION 04 05 05
COLD AND HOT WEATHER MASONRY PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Cold and Hot Weather Masonry Procedures, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. International Building Code, Chapter 21: Masonry.
- B. Local Building Code.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. As required to achieve desired results.

PART 3 - EXECUTION

3.1 PROCEDURES

- A. ACI 530.1/ASCE 6/TMS 602: Specification for Masonry Structures.
- B. Brick Industry Association (BIA), Technical Note 1: Hot and Cold Weather Construction
- C. National Concrete Masonry Association (NCMA), TEK 03-01C: All Weather Concrete Masonry Construction.

3.2 GENERAL

- A. At end of each day or at shutdown, cover tops of walls not enclosed or sheltered.
- B. Do not use frozen or ice coated materials.
- C. Remove and replace frozen or damaged masonry to satisfaction of Architect.

3.3 TEMPORARY FACILITIES

- A. Construct and maintain temporary protection required to permit continuous and orderly progress of work.
- B. Provide temperature conditioning sufficient for indicated temperatures.
- C. Provide sufficient temporary lighting to permit work to be correctly performed.

END OF SECTION

SECTION 04 05 10
MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Masonry Cleaning in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Project Information:
 - 1. Name of proposed product and manufacturer.
 - 2. Certification that the proposed products are compatible with materials on subject project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Cleaners:
 - 1. Base:
 - a. ProSoCo.
 - 2. Optional:
 - a. EaCo Chem.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Use only products which are recommended by manufacturer of material to be cleaned.
- B. Concrete Masonry (CMU) Cleaners:
 - 1. Clean CMU which will remain exposed to view (including CMU walls which are scheduled for painting).
 - 2. Lightweight and Normal Weight CMU:
 - a. Base Product: Sure Klean Custom Masonry Cleaner by ProSoCo.
- C. Cast-in-Place Concrete Cleaner:
 - 1. Clean Cast-in-Place concrete walls which will remain exposed to view (including CIP walls which are scheduled for painting).
 - 2. Clean with most effective products which are appropriate for texture and color specified.
 - 3. Abrasive blasted, Etched, and Exposed-aggregate Textures:
 - a. Base Product: Sure Klean Custom Masonry Cleaner or Heavy-duty Concrete Cleaner both by ProSoCo.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces to be cleaned.
 - 1. If necessary point with mortar.
- B. Waiting Time before cleaning:
 - 1. Mortar Type N: Allow mortar to cure for 14 to 28 days prior to cleaning.
 - 2. Mortar Types M and S: Allow mortar to cure for 7 to 14 days prior to cleaning.
 - 3. Colored Mortar: Allow mortar to cure for 28 days prior to cleaning.

- C. Remove excess mortar using wooden paddles and scrapers.
- D. Do not proceed with cleaning until unsatisfactory conditions have been corrected.
- E. Test 4 x 4 FT area of each surface type for compatibility with cleaner, using recommended dilutions, prior to full scale cleaning operations.
- F. Cleaning indicates acceptance of surfaces and responsibility for performance.

3.2 PREPARATION

- A. Protect adjacent surfaces, not scheduled for cleaning.
- B. Prepare surfaces as recommended by manufacturer.

3.3 CLEANING

- A. Clean surfaces as recommended by manufacturer.
- B. Do not use wire brushes.
- C. Thoroughly rinse and pre-soak walls.
- D. Flush loose mortar and dirt from surface.
- E. Wet to prevent runoff streaking.
- F. Apply solution using fibered wall washing brush or low-pressure spray.
 - 1. Maximum Pressure: not to exceed 400 PSI .
 - 2. Tip spray angle: Not less than 25 DEG.
 - 3. Maximum rate of flow: 4 to 6 GPM .
 - 4. Tip shall be held at least 12 IN from surface of masonry.
 - 5. Comply with manufacturer's recommendations, where more restrictive.
- G. Scrape off mortar and re-apply cleaning solution.
- H. After scrubbing, clean thoroughly with low pressure water.
 - 1. Comply with low-pressure spray criteria listed above.

END OF SECTION

SECTION 04 05 13
PORTLAND CEMENT - LIME MORTAR AND GROUT

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Portland Cement - Lime Mortars and Grout, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM C143 Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - 2. ASTM C144 Standard Specification for Aggregate for Masonry Mortar.
 - 3. ASTM C150 Standard Specification for Portland Cement.
 - 4. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purposes.
 - 5. ASTM C270 Specification for Unit Masonry.
 - 6. ASTM C404 Standard Specification for Aggregates for Masonry Grout.
 - 7. ASTM C476 Standard Specification for Grout for Masonry.
- B. American Concrete Institute (ACI):
 - 1. ACI 530.1 Building Code Requirements and Specification for Masonry Structures.
- C. Brick Industry Association (BIA):
 - 1. Technical Notes.
- D. Cold Weather Procedures:
 - 1. Specified in Section 04 05 05.
- E. Hot Weather Procedures:
 - 1. When ambient temperature is 100 DEGF , or 90 DEGF with a wind over 8 MPH :
 - a. Monitor mortar temperature and maintain it between 70 to 120 DEGF .
 - b. Limit spreading of bed mortar to 4 FT , maximum, and place masonry units within 1 minute of spreading.
- F. Definitions:
 - 1. PCL Mortar: Portland Cement-Lime Mortar.
 - 2. PCL Grout: Portland Cement-Lime Grout.
 - 3. Use of masonry cement alone, or in combination with PCL mixes, is prohibited.
 - 4. Pre-Blended: Factory blend mortar mix dry ingredients including; sand, cement, lime, pigments, etc.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Material certificates for each material used in proposed mix designs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Factory Pre-blended PCL Mortar:
 - 1. Base:
 - a. Spec Mix
 - 2. Optional:
 - a. Amerimix (Bonsal)
 - b. Ash Grove Cement Company

- c. U-Mix
 - d. US Mix Company
- B. Site Mixed PCL Grout:
- 1. Base:
 - a. Products as indicated.
- C. Integral Waterproofing Mortar admixture, for mortar mixes used with Glass Unit Masonry Units at Exterior and/or Interior wet areas:
- 1. Base:
 - a. Sonneborn Building Products; Hydracide Powder.
 - 2. Optional:
 - a. Master Builders; MasterPel 235.
 - b. Laticrete 8510.
- D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Factory Pre-blended Mortar Mix:
- 1. Use approved mix designs which comply with ASTM C270, Property Method.
 - 2. Blend cementitious materials, aggregate and admixtures in factory under controlled conditions, which requires only addition of water at project site.
 - 3. Oven-dry aggregates prior to measuring and include in pre-blended mix.
- B. Portland Cement: ASTM C150, Type I, II or III.
- 1. Air-entraining cement is not permitted.
 - 2. Portland Cement Color: As indicated below for each application.
 - 3. Maximum percent of alkalis: 0.60.
- C. Hydrated Lime:
- 1. ASTM C207, Type S.
- D. Mortar Aggregate:
- 1. ASTM C144.
 - 2. Aggregate Color: As indicated below for each application.
- E. Water: Potable.
- F. Do not use the following ingredients:
- 1. Do not use antifreeze additives.
 - 2. Do not use calcium chloride, thiocyanates, or other materials containing chloride ions.
 - 3. Other admixtures: Not permitted without prior approval by Architect.
 - 4. Do not use ready mix mortar.
 - 5. Do not use masonry cement.
- G. PCL mortar mixes to comply with ASTM C270, property specification using component materials listed above:
- 1. Limit air content to 10 PCT, maximum.
 - 2. Use appropriate type as indicated by following Table 4110A, for each condition.
 - 3. Four types of mortar - only three are typically used:

TABLE 4110A - Basic Mortar Type Selection		
Location	Building Segment	Mortar Type per ASTM C270
Exterior Masonry at or below grade	Foundation walls Retaining walls Sewers & manhole, and paving	M
Exterior Masonry above grade	Reinforced or Load Bearing brick / block walls Glass Unit Masonry	S

TABLE 4110A - Basic Mortar Type Selection		
Location	Building Segment	Mortar Type per ASTM C270
	Veneer Masonry, Parapets, and Chimneys >30 FT above grade	
	Other areas with severe exposure	
	Non-load bearing brick/block walls	N (or S)
	Veneer Masonry, where <30 FT above grade	
	Parapets and chimneys where <30 FT above grade	N
Interior Masonry	Load bearing brick/block walls	N
	Non-load bearing brick/block walls	
	Glass Unit Masonry	
	Brick/block veneers	

H. Use following mortar colors in conjunction with Table 4110A to determine mixes of appropriate combinations of type and color for each project condition.

1. Mortar Color MC-2:
 - a. Location used:
 - 1) CMU walls. See Section 04 22 00.
 - b. Method:
 - 1) Factory pre-blended mortar.
 - c. Mortar Color:
 - 1) Natural Grey, no pigment.
 - d. Portland Cement Color:
 - 1) Natural.
 - e. Aggregate Color:
 - 1) Natural.

I. Grout:

1. Site Mixed PCL Grout:
 - a. Use approved mix designs.
 - b. Mix on-site using approved materials as indicated.
 - c. Factory pre-blended dry grout mixes may be used at contractor's option.
 - d. Ready-mixed product, delivered to site for direct placement in walls, may be used at contractor's option.
2. Factory pre-blended PCL grout mix:
 - a. Use approved mix designs.
 - b. Blend cementitious materials, aggregate and admixtures in factory under controlled conditions, which requires only the addition of water at the project site.
 - c. Oven-dry aggregates prior to measuring and include in the pre-blended mix supplied to the site.
3. PCL Grout Mixes:
 - a. Comply with ASTM C476.
 - b. Portland Cement: ASTM C150, Type I, II or III.
 - 1) Air-entraining cement is not permitted.
 - 2) Maximum percent of alkalis: 0.60.
 - c. Grout aggregate: ASTM C404.
 - 1) Maximum Aggregate Size: 3/8 IN .
 - 2) The use of blast furnace slag is not permitted.
 - d. Hydrated lime:
 - 1) ASTM C207, Type S.
 - e. Water: Clean and potable.
 - f. Other admixtures: Not permitted without prior approval by Architect.
 - g. Compressive Strength: As indicated by GROUT MIX SCHEDULE, below, for each type.
 - h. Slump for Grout Measured in accordance with ASTM C143:

- 1) Minimum: 8 IN .
- 2) Maximum: 10 IN .
4. Grout Mix GM-1:
 - a. Site mixed grout.
 - 1) Redi-mixed or factory pre-blended may be used at contractor's option.
 - 2) Gypsum is not allowed in grout mixtures.
 - b. Compressive strength, 28-day:
 - 1) Minimum 2000 PSI .
 - c. Location used:
 - 1) Fill for CMU walls.
 - 2) Hollow metal door frames.
 - 3) Elevator frames and sills.
 - 4) Other indicated locations.
 - d. Grout color: Natural grey, no pigment.
 - e. Portland cement color: Natural.
 - f. Aggregate color: Natural.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.

3.2 MORTAR INSTALLATION

- A. Mix materials minimum of 5 minutes, but not more than 10 minutes.
- B. Adjust consistency to satisfaction of mason subject to compliance with specified criteria.
- C. Comply with BIA Standard MI-72.
- D. Install in accordance with BIA Standards.
- E. Strike joints to create a uniformly concave final joint.
- F. If mortar begins to stiffen, it may be re-tempered in accordance with ASTM C270, Subparagraph 7.4.
- G. Use mortar within 2-1/2 HRS of initial mixing.
- H. Remove units which are disturbed after laying. Clean off original mortar and reset with fresh mortar.

3.3 GROUT INSTALLATION

- A. Mix materials minimum of 5 minutes, but not more than 10 minutes.
- B. Use grout within 1-1/2 HRS after initial mixing.
- C. Use coarse grout in spaces larger than 2 IN in both directions.
- D. Use fine grout in spaces with least dimension is less than 2 IN .
- E. Grout Installation – Frames:
 1. Use fine grout for hollow metal door frames.
 - a. Grout frames of elevator hoistway openings.
 - b. Grout hollow metal door frames where the net opening is 4 FT and greater.
- F. Grout installation – Walls:
 1. See Section 04 22 00.

END OF SECTION

SECTION 04 05 23
MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Masonry Accessories, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Design Responsibility:
 - 1. Assume responsibility for design, manufacturing and installation of masonry accessories:
 - a. Comply with Section 01 71 21, Specialty Engineering requirements.
 - b. Load combinations as specified by the building code.
 - c. Where special loads only are shown, combine with typical loads or capacities.
- B. ASTM International (ASTM):
 - 1. ASTM A240 Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for General Applications.
 - 2. ASTM A580 Stainless Steel Wire.
 - 3. ASTM A641 Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 4. ASTM A615 Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 5. ASTM D226 Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- C. Brick Industry Association (BIA):
 - 1. Technical Notes.
- D. TMS 402/ACI 530/ASCE 5 – Building Code Requirements for Masonry Structures
- E. American Welding Society (AWS):
 - 1. AWS Structural Welding Code D1.1.
- F. Movement Joints:
 - 1. Expansion Joints per BIA Technical Notes 18A.
 - 2. Control Joints by NCMA Tek 10-2B.

1.3 SUBMITTALS

- A. Samples:
 - 1. Provide samples of materials where specified.
- B. Project Information:
 - 1. Manufacturer literature for products proposed for use.
 - 2. Engineering calculations anchors with special loading or connection requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Masonry Anchors:
 - 1. Base:
 - a. Hohmann & Barnard, Inc.
 - 2. Optional:
 - a. Wire-Bond
- B. Adjustable Wall Ties:
 - 1. Base:

- a. Hohmann & Barnard, Inc.
 - 2. Optional:
 - a. Wire-Bond
- C. Through-Wall Flashing:
- 1. Base:
 - a. Hohmann & Barnard, Inc.
 - 2. Optional:
 - a. Prosoco
 - b. York Manufacturing
- D. Metal Drip Plate:
- 1. Base:
 - a. Hohmann & Barnard, Inc.
- E. Termination Bars:
- 1. Base:
 - a. Tru-Fast Corporation.
 - 2. Optional:
 - a. Heckmann Building Products, Inc.
 - b. Hohmann & Barnard, Inc.
- F. Cavity Protection Material:
- 1. Base:
 - a. Mortar Net Solutions
- G. Horizontal Reinforcing:
- 1. Base:
 - a. Hohmann & Barnard, Inc.
 - 2. Optional:
 - a. Wire-Bond
 - b. Heckmann Building Products, Inc.
- H. Pre-molded Control Joint Strips:
- 1. Provide at control joints in CMU walls:
 - 2. Base:
 - a. Hohmann & Barnard, Inc.
 - 3. Optional:
 - a. Williams Products, Inc.
 - b. Wire-Bond
 - c. Heckmann Building Products, Inc.
- I. Galvanizing Repair Paint:
- 1. Base:
 - a. ZRC Worldwide
 - 2. Optional:
 - a. Tnemec, Inc.
- J. Compressible Filler:
- 1. Base:
 - a. Hohmann & Barnard, Inc.
- K. Air Barrier: Specified in Division 07.
- L. Loose Lintels: Specified in Section 05 50 10.
- M. Structural Steel Lintels and Shelf Angles: Specified in Section 05 12 00 or Section 05 12 10.
- N. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN CRITERIA

- A. Design anchorage to meet Design Loads.
 - 1. Wind Loads: Use the greater of the following:
 - a. Wind Pressures as required per local building code based on wind speed, exposure factor and importance factor noted in Structural Drawings.
 - b. 30 PSF minimum
 - 2. Earthquake Loads:
 - a. Wall and wall components shall be designed to satisfy requirements of Building Code and ASCE 7 Chapter 13 Seismic Design Requirements for Nonstructural Components based on the Seismic Design Category, and Importance Factor listed on the structural drawings.
 - 3. Deflection Values: Use the greater of following:
 - a. Limit deflection to values specified for Uniform Design Load Test.
 - b. Limit deflection to comply with Building Code as locally adopted and amended.
 - c. Limit deflection as follows:
 - 4. Structural movements of building structure:
 - a. Inter-story drift caused by wind or earthquake forces.
 - 1) $h/400$ or 1/2 IN maximum for wind
 - b. Live load deflection of the supporting members
 - 1) Live Load $L/600$ or 3/8 IN maximum
 - 2) Post Composite Super imposed Dead Load + Live Load $L/500$ or 1/2 IN maximum.
 - c. Load Transfer Limitations:
 - 1) Building structural frame is designed for gravity loads of wall system to be transferred to frame, floor by floor.
 - 5. Develop details defining method of fastening throughout system.
 - 6. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of Contract Documents.

2.3 MATERIALS

- A. Masonry Veneer Anchors:
 - 1. Lateral movement, out-of-plane:
 - a. Maximum free play: 1/16 IN .
 - b. Maximum deflection: 0.05 IN when exposed to a load of 100 LBS inward or outward.
 - 2. Select wire ties to span cavity and provide a minimum embedment of 2 IN in masonry facing.
 - 3. Stainless steel ties: Type 304.
 - 4. Masonry veneer anchors for metal stud back-up:
 - a. Tape Seal:
 - 1) Use with Strap Anchors.
 - 2) Peel-n-stick, self-healing where screws or prongs penetrate Air Retarder and Sheathing.
 - 3) Apply to substrate wall in continuous vertical strips prior to installation of strap anchors.
 - 4) Base Product: X-Seal Tape by Hohmann & Barnard, Inc.
 - b. Offset Strap-type Anchor:
 - 1) Base Product: X-Seal Anchor by Hohmann & Barnard, Inc.
 - 2) 14 GA type 304 stainless steel
 - 3) Depth of prongs: As required for application.
 - 4) Minimum vertical movement: 3-1/2 IN total.
 - 5) Wire Ties:
 - a) Base Product: Vee Byna-Tie by Hohmann & Barnard, Inc.
 - b) Type 304 stainless steel
 - c) Diameter:
 - (1) 3/16 IN

- d) Length: As required for application.
 - 6) Fasteners:
 - a) Base Product: Hohmann & Barnard, Inc.
 - b) Self-drilling
 - c) Type 304 stainless steel
 - d) Hex head, with washer flange
 - e) Neoprene sealing washer
- 5. Masonry Veneer Anchors – CIP Concrete Backup:
 - a. Utilize following type of anchor devices where masonry veneer is scheduled over cast-in-place concrete back-up, including:
 - 1) Cast-in-place concrete walls, columns, footings, spandrel beams.
 - b. Dovetail Anchor Slots:
 - 1) Base Product: 305 by Hohmann & Barnard, Inc.
 - 2) Type 304 stainless steel
 - 3) Material Thickness: Minimum 22 GA .
 - 4) Nominal Size: 1 x 1 x 5/8 IN throat with foam filler.
 - 5) Wire Ties:
 - a) Base Product: 315-BT by Hohmann & Barnard, Inc.
 - b) Compatible with width and depth of dovetail slots
 - c) 12 GA type 304 stainless steel
 - d) Dovetail thickness:
 - (1) Diameter: 3/16 IN .
 - (2) Length: As required for conditions.
 - c. Strap-type Anchor:
 - 1) Base Product: DW10HS by Hohmann & Barnard, Inc.
 - 2) Mechanically attached
 - 3) Installed to face of conventionally reinforced, cast-in-place concrete structural elements including sheer walls, spandrel beams, and columns
 - 4) 12 GA type 304 stainless steel
 - 5) Size: 3/4 IN x 7 IN
 - 6) 4 IN of vertical adjustability
 - 7) Wire Ties:
 - a) Type 304 stainless steel
 - b) Diameter: 3/16 IN .
 - c) Length: As required for conditions.
 - d) Base Product: Vee Byna-Tie by Hohmann & Barnard, Inc.
 - 8) Fasteners:
 - a) Power-driven or expansion type
 - b) Type 304 stainless steel
 - c) Diameter: 1/4 IN
 - d) Embedment: 2 IN
 - e) Pull-out: 120 LBS per fastener
 - f) Minimum of 2 fasteners per anchor strap
- 6. Masonry veneer anchors – Steel columns and spandrel beams:
 - a. Use following anchor devices where masonry veneers bypass steel columns and spandrel beams.
 - b. Offset Strap Anchor:
 - 1) Base Product: 359FH by Hohmann & Barnard, Inc.
 - 2) Type 304 stainless steel
 - 3) Mechanically attach to steel column/beams.
 - 4) Wire Ties:
 - a) Base Product: Vee Byna-Tie by Hohmann & Barnard, Inc.
 - b) Type 304 stainless steel
 - c) Diameter: 3/16 IN
 - d) Length: As required for conditions.
- 7. Masonry wall anchors:

- a. Use the following type of anchor devices where terminal ends of masonry walls abut steel columns:
 - b. Offset Strap anchor:
 - 1) Base Product: 359FH by Hohmann & Barnard, Inc.
 - 2) Type 304 stainless steel
 - 3) Mechanically attach to steel column.
 - 4) Wire tie:
 - a) Type 304 stainless steel
 - b) Width: As required for width of CMU.
 - c) Length: 12 IN .
 - d) Diameter: 3/16 IN .
 - e) Base Product: 302W by Hohmann & Barnard, Inc.
 - 8. Rigid Steel Anchors (where CMU walls intersect other CMU walls):
 - a. 1/8 IN x 1 IN x 12 IN
 - b. Galvanized G90
 - c. Ends bent 90 DEG in opposing directions.
 - 1) Length of end prongs: 2 IN .
- B. Horizontal Reinforcing:
- 1. In interior walls:
 - a. Cold drawn steel wire, mill galvanized, Class 3.
 - 2. In walls surrounding wet areas with humidity over 70 PCT:
 - a. Type 304 stainless steel
 - 3. In exterior walls:
 - a. Type 304 stainless steel
 - 4. Free standing, single-wythe CMU walls:
 - a. Horizontal reinforcing composite:
 - 1) Width as required
 - b. Base Product: 220 Ladder Mesh by Hohmann & Barnard, Inc.
 - c. Base Product: 120 Truss Mesh by Hohmann & Barnard, Inc.
 - 5. CMU walls serving as back-up wall for masonry veneers:
 - a. Horizontal reinforcing pattern for CMU back-up, with projecting wire loops to accommodate vertically adjustable veneer wire ties.
 - 1) Length of projection as required for cavity width indicated.
 - 2) Include compatible wire ties for masonry veneer.
 - b. Interlock veneer anchor wire ties with the ladder/truss reinforcing.
 - 1) Base Product: 270 Ladder Adjustable Eye Wire by Hohmann & Barnard, Inc.
 - 2) Eye and pintle or similar design which permits vertical movement while restraining lateral movement
 - 3) Ties to allow for vertical adjustability during and movement after installation
 - 4) Eye Wire:
 - a) Type 304 stainless steel
 - b) Diameter: 3/16 IN .
- C. Vertical Reinforcing:
- 1. Reinforcing Bars:
 - a. Grade 60 carbon steel
 - b. Size: No. 4 bars minimum, or as indicated
 - c. Refer to Section 03 20 00, and Drawings
- D. Miscellaneous Anchorages:
- 1. Include miscellaneous anchorages as required or indicated to secure stone, architectural precast concrete copings and sills and like components.
 - 2. Type:
 - a. As indicated.
 - 3. Material: Same as indicated for veneer anchors above.
- E. Through Wall Flashing System:

1. Flexible Stainless Steel Flashing:
 - a. Polymeric fabric laminated to type 304 or 316 stainless steel.
 - b. Membrane Thickness: 40 MIL
 - c. Stainless Steel Thickness: 3 MIL
 - d. Width as required.
 - e. Non-asphaltic adhesive.
 - f. Base Product: Mighty-Flash SA by Hohmann & Barnard, Inc.
 - g. Corners and end dams:
 - 1) 26 GA type 304 stainless steel
 - 2) Provide at ends of runs, inside and outside corners.
 - 3) Base Product: Corners & End Dams by Hohmann & Barnard, Inc.
 2. Stainless Steel Drip Plate:
 - a. Base Product: DP-FTSA by Hohmann & Barnard, Inc.
 - b. Termination Bar:
 - 1) Base Product: TB-100 Series by Trufast, LLC
 - 2) Use to secure top edge of Flexible Membrane flashing to back-up wall.
 - 3) Stainless steel or rigid plastic.
 - 4) 1/8 IN x 1 IN x 10 FT .
 - c. Flashing Adhesive:
 - 1) As recommended by manufacturer for bedding, sealing laps, and sealing to vertical surfaces.
- F. Cavity Vents and Weeps:
1. Head Vent:
 - a. Base Product: QV – Quadro-Vent by Hohmann & Barnard, Inc.
 - b. Polypropylene honeycomb vent/weep for head joints
 - c. Provides ventilation of cavity and weeping of cavity moisture while restricting ingress of insects and debris.
 - d. Standard size: 3/8 x 2-1/2 x 3-3/8 IN
 - e. Color: Gray
- G. Cavity Protection Materials:
1. Base Product: Mortar Net.
 2. Non-directional nylon or polyester fiber:
 3. Thickness:
 - a. Provide thickness to fill cavity.
 4. Height: 10 IN high.
- H. Galvanizing Repair Paint:
1. Zinc rich paint for re-galvanizing welds and abrasions in galvanized steel.
 2. Base Product: ZRC Galvilite by ZRC Worldwide.
 3. Optional: Organic Zinc Coating 90-93 by Tnemec.
- I. Compressible Filler:
1. Closed cell neoprene sponge
 2. Thickness: 1/4 IN
 3. Thickness: 3/8 IN
 4. Base Product: NS by Hohmann & Barnard, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Keep vertical joint behind weeps free of mortar.
- B. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.
- C. Anchoring Masonry Veneers to Back-up:

1. Attach offset anchor straps to back-up wall.
 - a. Use types suitable for condition.
 - b. Apply flexible membrane flashing to walls prior to attachment of strap anchor.
 - c. Where masonry walls bypass concrete or steel structural elements including shear walls, columns, and spandrel beams, anchor thereto with specialized anchors types indicated.
 2. Select wire ties of length to span cavity and provide a minimum embedment of 2 IN in masonry facing.
 - a. Where cavity width exceeds 4-1/2 IN , increase wire ties to 1/4 IN diameter.
 3. Provide minimum of one (1) anchor per 1.77 SQFT of wall area with vertical and horizontal spacing not to exceed 16 IN OC.
 - a. Where stud spacing is less than 16 IN OC, stagger ties in alternating courses.
 4. Where 2 IN thick masonry facing units are used as furring against columns or walls, anchor furring units to backing with adjustable metal ties designed for condition.
- D. Anchor CMU walls to building structure and intersecting CMU walls.
- E. Provide specialized anchors types where masonry walls abut concrete or steel structural elements including shear walls, columns, and spandrel beams.
- F. Where bearing walls meet or intersect erect walls separately and anchor together with rigid steel anchors spaced not more than 24 IN 600 MM apart vertically.
 1. Embed end bends of anchors in cores of masonry units filled with mortar or grout.
- G. Where non-bearing walls meet or intersect other walls, erect walls separately and anchor together with wire mesh ties spaced not more than 16 IN 400 MM apart vertically.
 1. Embed ties centered in mortar within joint.
- H. Fill solid with mortar or grout masonry unit cells within vertical planes of anchors, or use solid masonry units above and below anchors.
- I. Dovetail Anchors:
1. Coordinate anchor type to permit vertical differential movement and resist movement perpendicular to wall plane.
 2. Provide dovetail anchors in cast-in-place concrete at locations including but not limited to:
 - a. Concrete Shear walls
 - b. Concrete Columns
 - c. Concrete Spandrel Beams
 - d. Intersection of CMU walls and concrete walls
 - e. Intersection of CMU walls and concrete columns or structural elements
 - f. Elements where indicated.
 3. Masonry Veneer Spacing:
 - a. Provide minimum of one (1) anchor per 1.77 SQFT of veneer wall area with vertical and horizontal spacing at 16 IN OC maximum.
 4. Horizontal Spacing of slots:
 - a. Concrete Walls and Spandrel Beams:
 - 1) Locate at 16 IN on center maximum.
 - 2) Start first vertical row 4 IN of external corners.
 - 3) Start first vertical row 8 IN of internal corners.
 - b. Concrete Columns:
 - 1) Column width less than 24 IN : Locate vertical row 6 IN from each corner.
 - 2) Column width greater than 24 IN : Locate vertical row 6 IN from each corner.
 5. Vertical Positioning of Slots:
 - a. Terminate bottom and top edges of dovetail slots 4 IN from sills, heads, lintels, parapets, shelf angles, through-wall flashing and similar horizontal elements.
 6. Edge Condition Spacing:
 - a. Locate horizontally 8 IN from corners, control joints, expansion joints, jambs of doors, jambs of windows, and other similar edges of masonry veneer walls.

- J. Reinforcing for CMU Walls:
 - 1. See Section 04 22 00.
- K. Through-Wall Flashing:
 - 1. Install to provide positive drainage of cavity moisture.
 - 2. Coordinate with built in items and brick ledges.
 - 3. Drip Plate:
 - a. Adhere to ledge angle or brick ledge with drip flange extending past face of masonry.
 - 4. Flashing membrane:
 - a. Extend bottom edge of flashing over top surface of drip plate.
 - 1) Terminate rubberized flashing membranes 1/2 IN from exterior face of wall.
 - 2) Bond flashing to drip plate
 - 3) Lap and bond flashing ends minimum 6 IN .
 - b. Extend top edge of flashing membrane up face of wall minimum 8 IN 6 IN above the top of Cavity Protection.
 - c. Termination of top edge:
 - 1) Metal stud with gypsum sheathing:
 - a) Bond flashing membrane directly to face of sheathing
 - b) Mechanically secure top edge with termination bar.
 - c) Lap air retarder 6 IN over flashing membrane
 - 2) Masonry:
 - a) Install upper edge of flashing using a termination bar
 - b) Reglet may be used in lieu of termination bar
 - 3) Cast-in-place concrete:
 - a) Secure upper edge of flashing with termination bar
 - b) Reglet may be used in lieu of termination bar
 - 4) Caulk top edge of termination bar to wall.
 - d. Provide end dams.
 - 5. Seal gap below ledge angles with backer and sealant.
 - 6. Seal gap below relieving angles with compressible filler
 - 7. Seal items penetrating through-wall flashing system
 - 8. End Dams:
 - a. Configuration:
 - 1) Extend ends of flashing beyond openings.
 - 2) Return flashing up into head joints
 - 3) Bond to face of masonry units
 - 4) Install sill after end dam is in place.
 - 5) Minimum height at sides: 4 IN
 - 6) Comply with BIA Tech Note 21B and 7
 - b. Provide end dams at following locations:
 - 1) Jamb edges of sills for doors, windows, louvers and similar openings.
 - 2) Jamb edges of lintels for doors, windows, louvers and similar openings.
 - 3) Step flashing where flashing follows grade.
 - 4) Terminal ends of masonry veneer walls.
 - 9. Head Vents and Rope Wick combination:
 - a. Rope Wicks:
 - 1) Minimum Length: 16 IN .
 - 2) Set outer end of ropes flush with exposed face of masonry veneer.
 - 3) Loose-lay inner end of ropes at bottom of cavity, running parallel to back face of masonry veneer.
 - 4) Leave rope wicks in place after mortar has set.
 - b. Locations:
 - 1) Base of brick masonry cavity wall and through-wall flashings:
 - a) Rope Wicks:
 - (1) Locate in first brick course above through-wall flashing at base of wall.
 - (2) Space 16 IN O.C. horizontally.

- b) Head Vent:
 - (1) Locate in second brick course above through wall flashing at base of wall.
 - (2) Install head vent at 24 IN O.C. horizontally.
 - 2) Brick masonry cavity walls at shelf angles and through-wall flashing:
 - a) Rope Wicks:
 - (1) Locate in first brick course above shelf angle and through-wall flashing.
 - (2) Space 16 IN apart horizontally.
 - b) Head Vent:
 - (1) Locations:
 - (a) Locate in second brick course above shelf angle and through-wall flashing.
 - (b) Locate in third brick course below shelf angle and through-wall flashing:
 - (2) Install head vent at 24 IN apart horizontally.
 - (3) Align head vents installed above and below shelf angle and through-wall flashing with each other.
 - 3) Brick masonry cavity walls at continuous lintel angles and through-wall flashing:
 - a) Rope Wicks:
 - (1) Locate in first brick course above continuous lintel angle and through-wall flashing.
 - (2) Space 16 IN apart horizontally.
 - b) Head Vent:
 - (1) Locate in second brick course above continuous lintel angle and through-wall flashing.
 - (2) Install head vent at 24 IN apart horizontally.
 - 4) Brick masonry joints at top of brick cavity wall:
 - a) Head Vent:
 - (1) Locate in second brick course below coping and through-wall flashing, or metal cap flashing.
 - (2) Install head vent at 24 IN apart horizontally.
- L. Cavity Protection Material:
 - 1. Install per manufacturer's recommendations at ledge angles and bottom of wall.
- M. Galvanizing Repair Paint:
 - 1. Apply at welds of galvanized masonry accessories or where galvanic coating is missing or damaged.

END OF SECTION

SECTION 04 22 00
CONCRETE MASONRY (CMU)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Masonry (CMU), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Test results performed to qualify materials and establish mix designs
- B. Mock-up:
 - 1. Use materials and procedures accepted for the work.
 - 2. Minimum sample panel size is 4 FT square.
 - 3. Acceptable standard for the work is established by accepted sample panel.
 - 4. Retain sample panel at site until Work has been completed.
 - 5. Include a grouting demonstration panel if grouting operations planned exceed or vary from limitations set forth in ACI 530.1-05 - Section 3.5

1.3 SUBMITTALS

- A. Product Data:
 - 1. Certification of level of fire resistance provided by units used in fire rated walls.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Units to be used in fire resistive wall assemblies:
 - 1. Where units are used in assemblies with fire resistive rating:
 - a. Provide units with aggregate type, and equivalent thickness that yield fire-resistances indicated for each wall assemblies.
 - b. Acceptable calculation methodologies for determining equivalent thickness:
 - 1) ASTM C140.
 - 2) NCMA TEK 7-1B.
 - 3) ACI 216.1 / TMS 0216.
 - c. Units tested per ASTM E119 are also acceptable.
 - 2. Provide solid units, or grouted hollow units, under lintels.
 - 3. Provide matching concrete bricks as required.
 - 4. Do not use chipped, cracked, spalled units exposed in finish work.
 - 5. Provide reinforced concrete masonry lintels fabricated from precast or site cast load bearing masonry units, filled and reinforced as indicated.

2.2 CONCRETE MASONRY UNITS - GENERAL PURPOSE

- A. Concrete Masonry Units (CMU):
 - 1. Modular units complying with ASTM C90.
 - 2. Aggregate:
 - a. Normal Weight: In accordance with ASTM C33.
 - 3. Sizes and shapes as indicated or required for conditions.
 - 4. Face shell and web thickness: Table 3, ASTM C90.
- B. Corner Units:
 - 1. Exposed to view: Use bullnose units at external corners and jambs of openings.

2. Not Exposed to view: Square-nosed units may be used where corners will not be visible in completed wall.

2.3 CONCRETE LINTELS AND SILLS

- A. General:
 1. Fabricate concrete lintels and sills in plant or site cast.
 2. Use concrete having minimum 28 day compressive strength of 3000 PSI .
 3. Exposed surfaces to have surface texture and color to match adjacent concrete masonry units.
 4. Fabricate lintels to modular sizes to match coursing.
 5. Mark tops of lintels with lintel schedule number.
- B. Fabricate lintels by one of following methods:
 1. Use masonry lintel units and reinforced concrete fill.
 2. Cast lintels monolithically with reinforcement.
 3. Provide vertical dummy joints matching pattern of vertical joints and scoring in concrete masonry walls in which installed.

2.4 REINFORCING

- A. Horizontal Reinforcing products including wire ladder truss: Specified in Section 04 05 23.
- B. Reinforcing Bars (vertical and horizontal): Specified in Section 03 20 00.

2.5 ACCESSORY ITEMS

- A. Masonry Accessories: See Section 04 05 23.
- B. Mortar and Grout: See Section 04 05 13.
- C. Firestopping: See Section 07 84 00 for rated wall penetrations.
- D. Sealants: See Section 07 92 13 and Section 07 92 16 for non-rated wall penetrations.
- E. Grout Fill: See Section 04 05 13.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept work.
- B. Verify that anchors and flashings are correct.
- C. Installation constitutes acceptance of substrate and responsibility for performance.

3.2 INSTALLATION

- A. General:
 1. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of Contract Documents.
 2. Perform cutting with masonry saws.
 3. Cut as required to provide pattern indicated.
 4. Use solid units where cutting or laying would expose holes.
 5. Do not install damaged units.
 6. Do not wet concrete masonry units.
 7. Avoid use of less than half size units.
 8. Build chases and recesses as indicated and required for work of other trades.
- B. Install in running bond unless otherwise indicated.

3.3 FIRE AND SMOKE WALL IDENTIFICATION

- A. Identify walls indicated on Drawings as having a required fire or smoke rating.

1. Follow guidelines set in Chapter 7 of International Building Code.
2. Permanently identify rating and type of barrier with stencil and paint in contrasting, 3 IN high letters in a manner acceptable to authority having jurisdiction.
3. Text for fire and smoke barriers: “X HOUR FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS”.

3.4 LAYING AND TOOLING

- A. Lay out walls in advance for uniform and accurate spacing of bond patterns and joints.
- B. Properly locate openings, movement joints and offsets.
- C. Lay masonry units with face shells of bed joints fully mortared.
 1. Mortar webs in courses of piers, columns, and pilasters, in starting course on foundations and when necessary to confine grout or loose filled insulation.
 2. Mortar head joints a minimum distance from each face equal to face shell thickness.
 3. Align vertical cells and maintain openings unobstructed to be grouted.
- D. Maintain nominal 3/8 IN joint widths.
 1. Cut joints flush where concealed.
 2. Tool exposed joints.
 3. Compress mortar in below ground joints.
- E. Enlarge voids or holes, except weep holes, and fill with mortar during tooling.
- F. Point up joints at corners, openings and adjacent work to provide neat, uniform appearance.
- G. Remove masonry disturbed after laying.
 1. Clean and relay in fresh mortar.
 2. Do not pound units to fit.
 3. If adjustments are required, remove units, clean, and reset in fresh mortar.
- H. Where work is stopped and later resumed, rake back 1/2 masonry unit length in each course; do not tooth.
 1. Remove loose units and mortar prior to laying fresh masonry.
- I. Protect against weather, when work is not in progress.
 1. Cover top of walls with waterproof sheeting, extend at least 4 FT down both sides of walls; anchor in place.
 - a. Do not use adhesives on surface of brick.
 - b. Do not set sheeting in joint.
 2. Provide cold weather protection; Section 04 05 05.
- J. Build in items indicated and specified.
 1. Fill with mortar around built-in items.
 2. Grout fill space between metal frames and masonry.
 3. Where built-in items are to be embedded in cores of hollow masonry units, place layer of metal lath in joint below and fill core with grout.
- K. Remove masonry protrusions extending 1/2 IN or more into cells or cavities to be grouted.

3.5 REINFORCING

- A. General:
 1. In addition to the following general requirements, provide reinforcing size type and spacing as indicated on Drawings and Details.
- B. General Reinforcing Requirements:
 1. Reinforce masonry openings over 12 IN wide, where control and expansion joints are not provided, with horizontal joint reinforcing placed in 2 horizontal joints above lintel and below sill.
 - a. Extend reinforcing minimum of 24 IN beyond jambs of opening.

2. Embed horizontal reinforcing in bed joint mortar for entire length with minimum cover of 5/8 IN on exterior side of walls and 1/2 IN at other locations.
 - a. Provide same minimum cover for other embedded items.
 3. Minimum laps for horizontal reinforcing: 6 IN .
 4. Do not bridge Control Joints or Expansion Joints with horizontal reinforcing.
 - a. Install smooth dowels or other approved device across Control Joints which resist shear loads but allow in-plane expansion, contraction and linear shrinkage movements.
- C. Horizontal Reinforcing (wire ladders/trusses):
1. Provide continuous horizontal joint reinforcing concrete masonry walls.
 - a. See elsewhere for reinforcing requirements for anchored veneers.
 2. Unless otherwise indicated:
 - a. Install horizontal reinforcing with in 8 IN of first bed joint.
 - b. Running Bonds: Install horizontal reinforcing at 16 IN OC vertically thereafter.
 - c. Stacked Bonds: Install reinforcing 8 IN OC vertically thereafter where stack bond masonry is indicated.
 3. Make corners and wall intersections by use of prefabricated L and T sections.
 - a. Cut and bend as required.
 4. At intersecting load bearing walls install rigid steel anchors not over 24 IN OC vertically.
 - a. Embed ends in grout filled cores.
- D. Horizontal Reinforcing Bars:
1. Install where indicated.
 2. Sizes as indicated.
- E. Vertical Reinforcing Bars at CMU Walls other than Anchored Veneers:
1. Install vertical reinforcing bars as indicated.
 2. When not indicated, provide the following minimum vertical reinforcing:
 - a. Provide one No.4 continuous at 24 IN on center.
 - b. Provide one No.5 Continuous at each corner, at each side of each opening, at each side of each control joint, and at the ends of walls.

3.6 GROUT FILL

- A. Do not place grout until entire portion of wall to be grouted has attained strength to resist grout pressure.
- B. Use mechanical vibrator to remove voids and to consolidate fill.
- C. Grout walls incrementally as CMU is placed.
- D. Minimize lift heights to ensure walls remain safe and stable until grout has attained strength to resist overturning or collapse.
 1. Consider detrimental lateral loads which could be anticipated including storms, winds, seismic and soil conditions.
 2. Adequately brace.
- E. Where vertical or horizontal reinforcing bars are required, place and inspect prior to filling operation.
- F. Fill cores containing vertical reinforcing.
- G. Place in maximum 4 FT lifts.
- H. Leave lifts minimum 1-1/2 IN below top of course to form key with next lift.

3.7 CONTROL JOINTS (CJ)

- A. Provide control joints and other movement joints as indicated.
- B. Where not indicated:
 1. Locate control joints at natural planes of weakness in masonry wall such as:
 - a. Changes in wall height.

- b. Changes in wall thickness, such as at pipe and duct chases and pilasters.
 - c. At (above) movement joints in foundations and floors on which wall is bearing.
 - d. At (above) movement joints in roofs and floors that bear on wall.
 - e. Within 8 IN of one or both jambs of door, window, louver and similar openings:
 - 1) Place CJ at one side of openings less than 6 FT wide.
 - 2) Place CJ at both sides of openings greater than 6 FT wide.
 - f. Within 4 FT of corners on one leg, minimum.
 - 1) Opposing leg: No more than 20 FT from corner.
 - g. Intersections: Within 12 FT of wall intersections.
2. In addition to the above, locate control joints at no more than the following maximum (horizontal) distances:
- a. Walls greater than 16 FT - 8 IN tall: No more than 25 FT O.C.
 - b. Walls between 8 FT and 16 FT - 8 IN tall: Not more than 1-1/2 times wall height.
 - c. Walls less than 8 FT tall: 12 FT .
- C. Installation/construction of control joints:
- 1. Utilize sash blocks or similar shapes which have slotted end to accept gaskets.
 - a. Pre-molded Control Joint Strips: Specified in Section 04 05 23.
 - 2. Cut ladder/truss type horizontal reinforcing as it crosses control joints.
 - 3. While mortar is still fresh, rake out mortar from joint, leaving a completely clean joint.
 - 4. After wall has cured, install backer rod and sealant on both wall faces.
 - a. Sealant and Backer Rod: Specified in Section 07 92 13 and Section 07 92 16.

3.8 LINTELS, FLASHING AND SEALANTS

- A. Installation of flashing, weeps and similar masonry accessories: Specified in Section 04 05 23.
- B. Sealant installation requirements:
 - 1. Sealant and Backer Rod: Specified in Section 07 92 13 and Section 07 92 16.
 - 2. Remove mortar in joint under relieving lintel and at ends.
 - 3. Seal joints between CMU's and relieving lintels.
 - 4. Seal Expansion and Control Joints.
- C. Provide precast masonry lintels wherever openings more than 12 IN wide are indicated without other structural support or other supporting lintels.
 - 1. Thoroughly cure lintels before handling and installation.
 - 2. See lintel schedule for size and type required.

3.9 INSTALLATION TOLERANCES

- A. Maximum variation from plumb in vertical lines and surfaces of columns, walls and arises:
 - 1. 1/4 IN in 10 FT.
 - 2. 3/8 IN in a story height not over 20 FT.
 - 3. 1/2 IN in 40 FT or more.
- B. Maximum variation from plumb for external corners, control joints, expansion joints and other conspicuous lines:
 - 1. 1/4 IN in any story or 20 FT maximum.
 - 2. 1/2 IN in 40 FT or more.
- C. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
 - 1. 1/4 IN in any bay or 20 FT.
 - 2. 1/2 IN in 40 FT or more.
- D. Maximum variation from plan location of related portions of columns, walls and partitions:
 - 1. 1/2 IN in any bay or 20 FT.
 - 2. 3/4 IN in 40 FT or more.
- E. Maximum variation in cross section of columns and thicknesses of walls from dimensions indicated:

1. Minus 1/4 IN.
2. Plus 1/2 IN.

3.10 REPAIR, POINTING AND CLEANING

- A. Remove and replace loose, stained, or damaged units.
 1. Provide new units to match.
 2. Install in fresh mortar.
 3. Point to eliminate evidence of replacement.
- B. Clean in accordance with Section 04 05 10.

3.11 INSPECTION AND TESTING

- A. Comply with the requirements of ACI 530.1 Section 1.6C and facilitate the testing and inspection agency's needs.
- B. The Owner will provide testing and inspection services. This does not relieve the contractor of the responsibility to furnish materials and construction in full compliance of contract documents.

END OF SECTION



DIVISION 05

METALS



SECTION 05 12 10
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Structural Steel, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Structural steel work covered herein shall be fabrication and erection of steel framing and bracing members including connections and steel material either supporting or connected to steel members shown on structural plans and not specified in other sections.
- B. Quality standards latest edition of following standards plus any corresponding published revisions at time of bidding shall be applicable standard. The Local Building Code shall govern if conflicting.
 - 1. Local Building Code.
 - 2. American Institute of Steel Construction (AISC):
 - a. ANSI/AISC 360 "Specification for Structural Steel Buildings" (referred to herein as the AISC Specification).
 - b. Code of Standard Practice for Steel Buildings and Bridges (referred to as AISC Code of Standard Practice).
 - c. Quality Certification Program.
 - 3. American Welding Society:
 - a. Structural Welding Code - Steel ANSI/AWS-D1.1 (referred to herein as the AWS Code). AWS Code shall govern techniques and quality of welding and testing procedures. Statements contained in the AWS Code requiring information to Bidders and/or Contract Documents to define nondestructive testing or statements defining responsibilities and obligations for services and payment shall be disregarded.
 - 4. Research Council on Structural Connections: "Specifications for Structural Joints Using High Strength Bolts" (referred to herein as RCSC Specification).
 - 5. Steel Structures Painting Council (SSPC): Steel Structures Painting Manual Vol. 2, "System and Specifications", referred to herein as SSPC Specification.
- C. Fabricator Qualifications:
 - 1. Certified by AISC Quality Certification Program for Structural Steel Fabricators and is designated as AISC Certified Fabricator, Standard for Steel Building Structures.
 - 2. Fabricators not certified shall have minimum ten (10) years experience and shall employ an approved testing agency to inspect fabrication work performed off site.
 - 3. Testing agency shall furnish weekly inspection reports and a final report to Building Official and Architect certifying work was performed in accordance with specifications and approved shop drawings.
- D. Erector Qualifications:
 - 1. Minimum 10 years experience in erection of structural steel.
 - 2. Certified as Certified Steel Erector by AISC quality Certification Program.
 - 3. Certification by other equivalent programs subject to approval of the Structural Engineer.
- E. Source Quality Control:
 - 1. Provide access and facilities for testing agency during shop and field inspections.
- F. Testing and Inspection: Testing, (except testing to qualify welders and as needed for Contractor's own quality control), will be performed at no cost to Contractor by a

Testing/Inspection Agency employed by Owner. Owner's Testing/Inspection Agency may use nondestructive testing methods in addition to visual inspection to verify weld quality. Repair rejected welds as directed by Testing/ Inspection Agency at no additional cost to Owner.

- G. Provide testing and inspection agency with sufficient notification and access so that inspection and testing can be accomplished.
- H. Previous acceptance of material or finished members by testing and inspection agency or Architect/Engineer shall not prevent its rejection at later date if it does not comply with specifications.
- I. Tolerances:
 - 1. Rolling: ASTM-A6.
 - 2. Fabrication and Erection tolerances: AISC Code of Standard Practice.
- J. Complete final detailing of connections where details provided do not adequately reflect conditions.
 - 1. Connection arrangement and detail shall be consistent with details provided on Contract Documents.
 - 2. When applicable, use tables provided in AISC for selection. Arrangements shall match type and strength of connection detail provided.
 - 3. Identify in submittal connections that do not conform to details provided in contract documents.
 - 4. Final arrangement and details of connections subject to review and approval of Structural Engineer Of Record
- K. Provide final design of connections where requirement is indicated in contract documents.
 - 1. Design connections at each end of member for loads (in Kips) noted.
 - 2. Comply with section 01 71 21 Specialty Engineering Requirements.
 - 3. Connection design shall satisfy applicable Building Codes and shall use latest approach to design as offered by AISC.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate details including cuts, copes, connections, holes and welds. Indicate shop and field welds using AWS symbols. Indicate connections where high strength bolts are required.
 - 2. Headed stud placement drawings.
- B. Product Data:
 - 1. Source and certification of quality for high-strength bolts, nuts and washers.
 - 2. Technical data on base plate grout.
- C. Project Information:
 - 1. Fabricator's AISC Certification or name of independent testing agency for use by non-certified fabricator along with proof that fabricator has 10 years' experience in fabrication of structural steel for buildings.
 - 2. Inspection reports and certification of shop fabrication by independent testing laboratory for non-certified fabricator.
 - 3. Steel erector's AISC Certification or proof that steel erector has 10 years' experience in erection of structural steel.
 - 4. Connection design calculations signed and sealed by Specialty Structural Engineer.
 - 5. Welding Procedure Specification (WPS) for shop and field welds.
- D. Contract closeout information:
 - 1. Certificate by fabricator that steel was fabricated in accordance with the approved contract documents.
 - 2. Certificate by erector that steel was erected in accordance with the approved erection plans and specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel, Structural W-Shapes and Tee's:
 - 1. ASTM A992 (50 ksi yield point).
- B. Steel, Structural Angles and Channels:
 - 1. ASTM A36.
- C. Steel plate
 - 1. ASTM A572 (50 ksi yield point)
- D. Pipe, Round:
 - 1. ASTM A53, Grade-B.
- E. Tubing, Round, Square, or Rectangular:
 - 1. ASTM A500, Grade-C. (50 ksi yield point for square or rectangular; 46 ksi yield point for round)
- F. Bolts, Nuts, and Washers, High Strength.
 - 1. Conform to RCSC Specification.
 - 2. Twist off style, conform to ASTM F1852
 - a. Approved bolts:
 - 1) Tension control bolt by LeJeune Bolt Company, Burnsville, MN.
 - 2) Tru-Tension Fasteners by Nucor Fastener a Division of Nucor Corporation, St. Joe, Indiana.
 - 3) Lohr Fasteners by Lohr Structural Fasteners, Humble, TX.
- G. Bolts, Nuts and Washers, Standard Strength:
 - 1. Bolts: ASTM A307, Type A.
 - 2. Nuts: ASTM A563.
 - 3. Washers plain: ANSI/ASME-B18.22.1.
- H. Anchor Rods, High Strength:
 - 1. Bolts or rod for threading:
 - a. ASTM F1554-55 ksi meeting supplementary requirement S1. Pretension to load indicated on plans.
 - 2. Nuts, heavy hex: ASTM-A563.
 - a. Up to 1 1/2 IN diameter: Grade D hex
 - b. Over 1-1/2 IN diameter: grade DH Heavy Hex.
 - 3. Washers:
 - a. Hardened Steel: ASTM F436 type 1
 - b. Load indicator type: Direct Tension Indicating Washers as manufactured by TurnaSure LLC of Langhorne, PA or approved equal, Install per manufacturers recommendations
 - 4. Thread tolerance: ANSI/ASME-B18.1, Class 2A.
- I. Anchor Rods, Standard Strength:
 - 1. Bolts or rod for threading: ASTM A36 or ASTM F1554-36 ksi.
 - 2. Nuts and washers:
 - a. Nuts: ASTM A563.
 - b. Washers plain: ANSI/ASME-B18.22.1.
 - 3. Thread tolerance: ANSI/ASME-B18.1, Class 2A.
- J. Welding Electrodes:
 - 1. Shielded metal-arc: AWS A5.1 or AWS A5.5, E70XX
 - 2. Submerged-arc: AWS A5.17 or A5.23, F7X-EXXX.
 - 3. Gas metal-arc: AWS A5.18, ER70S-X.
 - 4. Flux cored-arc: AWS A5.20, E70T-X (except 2, 3, 10, GS).
- K. Headed Studs and Deformed Bar Anchors:

1. Headed studs (HS)
 - a. Fabricated form cold drawn bar stock conforming to ASTM A 108, grades 1010 through 1020.
 - b. AWS D1.1 type B.
 - c. Minimum yield strength: 51 ksi.
 - d. Minimum tensile strength: 65 ksi over 3/8 IN diameter.
 - e. Minimum tensile strength: 55 ksi 3/8 IN diameter and under.
 2. Deformed bar anchors (DBA): Straight, unless otherwise indicated.
 - a. ASTM A496.
 - b. Minimum yield strength: 70 ksi.
 - c. Minimum tensile strength: 80 ksi.
- L. Grout: Pourable.
1. Base: L&M Construction Chemicals, Duragrout.
 2. Minimum Strength : 4000 PSI at 7 days and 8000 PSI at 28 days.
- M. Expansion Anchors:
1. Expansion anchors shall be a single-end expansion shield anchor which complies with the descriptive part of Federal Specification FF-S325, Group II, Type 4, Class 1 for concrete expansion anchors. Anchors shall be Hilti Kwik Bolt TZ Expansion anchor by Hilti fastening systems of Tulsa, OK (ICC Report No. ESR-1917) or equal.
- N. Adhesive Anchors:
1. Threaded rods, bolts, etc., indicated as adhesive anchors into concrete or solid masonry:
 - a. HIT HY-200 adhesive by Hilti Fastening Systems of Tulsa, OK or equal.
 - b. Unless indicated otherwise, adhesive anchor bolt shall conform to HAS - E Standard ISO Class 5.8 by Hilti or equal. Do not field cut rods without engineer's approval.
- O. Slide Bearings at Expansion Joints:
1. Masticord with teflon slide plates as manufactured by JVI MC., Skokie Illinois, or equal. Size, thickness, and configuration as shown on the drawings.

2.2 FABRICATION

- A. General:
1. Fabricate and assemble material in shop to greatest extent possible.
 2. Use ASTM F1852 bolts, twist-off type, unless otherwise indicated.
 3. One sided or other types of eccentric connections not indicated, will not be permitted without prior approval.
 4. Bevels for field welds may be flame cut provided such cutting is done automatically. Leave free of burrs and slag.
 5. Grind flush web fillets at webs notched to receive backup plates for flange groove welds.
 6. Flame cut edges of stiffener plates at field or shop butt welds. Do not shear.
 7. Accurately mill bearing ends of columns.
 8. Trusses, beams and girders over 50 FT in length shall be cambered in an amount required by the Engineer. Members less than 50 FT in length shall be cambered when indicated on the drawings or otherwise fabricate such that after erection any natural camber due to rolling or assembly is upward.
 9. Cut, drill, or punch holes at right angles to surface of metal.
 - a. Do not make or enlarge holes by burning.
 - b. Make holes clean cut, without torn or ragged edges.
 - c. Remove outside burrs resulting from drilling or reaming operations with tool making 1/16 IN bevel.
 - d. Provide holes in members to permit connection of work of other trades.
 10. Make allowance for draw in of tension bracing.
 11. Make splices only as indicated.
 12. Headed stud type shear connectors (H.S.) and deformed bar anchors (D.B.A.), on Drawings: Automatically end welded in accordance with AWS Code.

- a. When headed stud type shear connectors are to be either shop or field applied, clean top surface of beam flanges in shop to remove oil, scale, rust, dirt and other materials injurious to satisfactory welding.
- b. Fillet welding of headed studs and deformed anchors is not allowed without prior approval.
- c. Do not weld studs when temperature is below 0 DEGF or surface is wet with rain or snow.
- d. After welding, remove ceramic ferrules and maintain clean and free from substances which would interfere with function as anchor or bond of deformed anchor bars.
- e. Quality control: Weld minimum of 2 studs at start of each production period to determine proper generator, control unit, and stud welder settings.
 - 1) These studs shall be capable of being bent 45 DEG from vertical without weld failure. These studs shall not be included as a part of the required construction.
 - 2) All production studs shall be sounded by a sharp blow with a hammer.
 - 3) If, after welding, a stud does not ring when struck by a hammer or visual inspection reveals that sound weld or full 360 degree fillet has not been obtained for a particular stud, that stud shall be struck with hammer and bent approximately 15 DEG off perpendicular to nearest end of beam.
 - 4) Studs meeting this test shall be considered acceptable and shall be left in this position.
 - 5) Studs bent beyond 15 DEG shall be considered ineffective and replaced.
 - 6) Studs failing under this test shall be replaced.

B. Welding:

1. Welding, techniques of welding employed, appearance and quality of welds, and methods used to correct defective work shall comply with AWS Code, and requirements indicated.
2. Test and qualify welding operators and tackers in compliance with AWS Code for position and type of welding to which they will be assigned.
 - a. Conduct tests in presence of approved testing agency.
 - b. Certification within last 12 months from a welding inspector will be acceptable provided samples of welder's work are satisfactory.
 - c. At discretion of testing agency, shop personnel continuously employed at welding process for which they have been qualified may be accepted from older qualification tests.
3. Qualify joint welding procedures or test in accordance with AWS qualification procedures.
4. Before start of welding work, meet with testing agency and welders to review and verify procedures.
5. Comply with AWS Code to minimize shrinkage and distortion stress.
6. Use back-up plates in accordance with AWS Code, extending minimum of 1 IN either side of joint. Make flange welds before making web welds.
7. For manual shielded metal-arc welding: Comply with Article 4.6 of AWS Code.
8. Low hydrogen electrodes: Dry and store electrodes in compliance with AWS Code.
9. Do not perform welding when ambient temperature is lower than 0 DEGF, or where surfaces are wet or exposed to rain, snow, or high wind, or when welders are exposed to inclement conditions.
10. Before starting welding:
 - a. Carefully plumb and align members.
 - b. Fully tighten bolts.
 - c. Assembly and surface preparation shall comply with AWS Code.
 - d. Preheat base metal to temperature stated in AWS Code.
 - 1) When no preheat temperature is given and base metal is below 32 DEGF, preheat base metal to at least 70 DEGF.
 - 2) Preheating shall bring surface of base metal within distance from point of welding equal to thickness of thicker part being welded or 3 IN, whichever is greater, to specified preheat temperature.
 - 3) Maintain temperature during welding.

- e. Each welder is to provide identifying mark at welds worked on.

2.3 SURFACE PREPARATION AND SHOP-APPLIED COATINGS

- A. Surfaces Not to be Coated:
 - 1. Do not coat following surfaces:
 - a. Surfaces to be fireproofed with spray-on material.
 - b. Machined surfaces, surfaces adjacent to field welds, contact surfaces of bolt connections where connection is specified as slip critical, and top of top flanges of beams.
 - c. Other members for which no coating is specified.
 - 2. Clean thoroughly before shipping; remove loose mill scale, rust, dirt, oil and grease.
- B. Hot Dip Galvanized (HDG) Members:
 - 1. Galvanize following members:
 - a. Members set in, or in contact with, exterior surface material, including:
 - 1) Brick ledge angles.
 - 2) Embedded items in exterior surfaces.
 - b. Exterior exposed structure not indicated to be shop otherwise shop finished.
 - c. Other members indicated.
 - 2. Clean thoroughly before galvanizing.
 - 3. Galvanize in accordance with ASTM A123.
- C. Exterior Surfaces to be Shop Primed for Finish Paint:
 - 1. Primer: As recommended by finish (top) coat manufacturer for substrate.
- D. Interior Surfaces to be Shop Primed for Finish Paint:
 - 1. As recommended by top coat manufacturer for substrate.

PART 3 - EXECUTION

3.1 ERECTION

- A. Safety:
 - 1. Contractor is solely responsible for safety. Construction means and methods and sequencing of work is the prerogative of the Contractor.
- B. Capacity of Partially Complete Construction:
 - 1. Consider that full structural capacity of many structural members is not realized until structural assembly is complete; that is, until slabs, decks and the permanent lateral resisting system is installed. Partially complete structural members shall not be loaded out of sequence without an investigation.
 - 2. Temporary lateral bracing for the partially complete structure will be required, until all elements of the permanent lateral resisting system are complete.
- C. Temporary Bracing:
 - 1. Provide adequate temporary bracing for stability and to resist loads to which the partially complete structure may be subjected including but not limited to, environmental conditions, construction activities and operation of equipment.
 - 2. If not obvious from the drawings, confer with Engineer to identify structural elements requiring completion before structure's permanent lateral resisting system is effective.
 - a. Design of temporary bracing system must consider sequence and schedule of placement of such elements and effects of loads imposed on structural steel frame by partially or completely installed work of other trades.
 - b. Do not remove temporary bracing until the permanent lateral resisting system is effective.
- D. General:
 - 1. Set base and bearing plates accurately and grout immediately as indicated.
 - a. Use metal wedges, shims or setting nuts as required.

- b. Pack grout solidly between plate and bearing surface.
- 2. Clean bearing and contact surfaces before assembly.
- E. Install A325SC bolts with washers. Install and tighten in accordance with the RCSC Specifications or in accordance with manufacturer's instructions when twist-off bolts are used.
- F. Use same requirements for field welding as for shop welding.
- G. Do not use gas cutting to correct fabrication errors on major members.
 - 1. Gas cutting on minor members may be permitted when members are not loaded, only after approval by Engineer.
- H. Tighten and leave in place erection bolts used in welded construction.
- I. Provide beveled washers to give full bearing to bolt head or nut where bolts are to be used on surfaces having slopes greater than 1:20 with a plane normal to bolt axis.
- J. After installation, touch up damaged or abraded areas of primed steel using same materials used for shop priming.
 - 1. Clean field welds, bolted connections and abraded areas before touching up.
- K. After installation, repair galvanized surfaces damaged or abraded using zinc rich paint in accordance with ASTM A780.
 - 1. Surfaces to be repaired with paint containing zinc dust shall be clean, dry, and free of oil, grease, preexisting paint, corrosion, and rust.
 - 2. Surfaces to be repaired shall be blast cleaned to the requirements of SPC SP10 (near white). Where circumstances do not allow blast or power tool cleaning to be used, then hand tools may be used. Cleaning shall meet the requirements of SSPC SP2 (removal of loose rust, mil scale, or paint to the degree specified by hand chipping, scraping, sanding and wire brushing)
 - 3. If areas /surfaces to be repaired include welds, remove weld flux residue and weld spatter by blasting, chipping, grinding, or power scaling.
 - 4. Spray or brush apply the paints containing zinc dust to the prepared surfaces/areas. Apply the paint in accordance with the manufacturer's recommendations in a single application employing multiple passes to achieve a dry film thickness equal to the original zinc coating thickness.

END OF SECTION

SECTION 05 21 10
STEEL JOISTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Steel Joists, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Assume responsibility for design, manufacturing and installation of steel joists and accessories
 - 1. Comply with Section 01 71 21, Specialty Engineering Requirements.
 - 2. Load combinations as specified by the building code. Where special loads only are shown, combine with typical loads or capacities for adjacent joists.
- B. Fabrication Standards for Joists and Accessories:
 - 1. Steel Joist Institute Standard Specification and Load Tables
 - 2. American Institute of Steel Construction (AISC) Specifications for Design, Fabrication and Erection of Structural Steel for Buildings.
- C. Standard for Welders and Welding Work:
 - 1. AWS Standard Qualification Procedure.
- D. Engineer reserves right to observe joists in manufacturer's shop during fabrication.
- E. Engineer reserves right to observe and require testing of joists welded in place.
 - 1. Remove and replace work found not to comply with Contract requirements.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Show complete details including layout, special connections, bridging, jointing and accessories.
- B. Project Information:
 - 1. Engineering calculations for joists or joist girders with special loading or connection requirements.
 - a. Comply with Steel Joist Institute requirements.
 - 2. Manufacturer's certification that steel joists comply with specified requirements and steel joist institutes standard load tables.
 - 3. Manufacturer's certification along with calculations that joists for special loads indicated on drawings have been designed and are capable of supporting design loads for the spans as shown on the drawings.
 - a. Certification and calculations submitted prior to or along with shop drawings.
 - b. Certification and calculations signed and sealed by the Specialty Structural Engineer

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel:
 - 1. Comply with SJI and AISC Specifications.
- B. Unfinished Threaded Fasteners:
 - 1. ASTM A307, Grade-A, regular hexagon type, low carbon steel, with ANSI B27.2, Type B, carbon steel washers.

- C. High-strength Threaded Fasteners:
 1. ASTM A325 or ASTM A490 as required, heavy hexagon structural bolts with nuts and hardened washers.
- D. Prime Paint:
 1. Comply with SJI and AISC, except asphalt type paint is not acceptable.
 2. Shop coat of rust-inhibitive paint standard with manufacturer.
 3. Comply with SSPC-15.
- E. Bedding Mortar:
 1. Portland cement and sand, mixed at a ratio of 1 part cement to 3 parts sand, measured by volume, with only enough water for placement and hydration.
 2. Shrinkage-resistant compound complying with Corps of Engineer's CRD-C588, Type M.

2.2 FABRICATION

- A. Fabricate in accord with SJI and AISC specifications and as follows:
 1. Do not splice principal tension members.
 2. Make shop connections and splices using either arc or resistance welding.
 3. Design and fabricate for maximum deflection of 1/360 of clear span under design live load.
 4. Shop holes, field holes, and enlargement of holes are not permitted without explicit approval.
 5. Fabricate bearing ends to provide following minimum bearing unless otherwise indicated.

Material	K-Series	LH and DLH Series	Joist Girders
Masonry or Concrete	4 IN	6 IN	8 IN
Steel	2-1/2 IN	4 IN	4 IN

- B. Where special or concentrated loads are indicated, reinforce joist and develop details as necessary for support.
- C. Provide extended bottom chords where indicated. Comply with SJI and AISC requirements and load tables.
- D. Provide extended top chords where indicated. Comply with SJI and AISC requirements and load tables.
- E. Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord.
 1. Provide either an extended bottom chord or a separate unit of sufficient strength to support ceiling construction.
 2. Extend ends to within 1/2 IN of wall surface.
- F. Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories.
- G. Apply one shop coat of steel joist primer paint to steel joists and accessories, by spray, dipping, or other method to provide continuous dry paint film thickness of not less than 0.50 MIL.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which steel joists are to be installed for conditions detrimental to proper and timely completion of Work.
- B. Do not proceed with Work until unsatisfactory conditions have been corrected.
 1. Do not start placement of steel joists until supporting work is in place and secured.

3.2 ERECTION

- A. Deliver, store and handle steel joists as recommended by SJI and AISC.
- B. Do not install damaged joists.
- C. Where not specifically indicated otherwise, place and secure steel joists in accordance with SJI and AISC Specifications and as specified. Secure joists along column centerlines in accordance with OSHA standards for erection safety
- D. Field weld joists to supporting steel framework in accordance with SJI and AISC specifications for type of joists used. Coordinate welding sequence and procedure with placing of joists.
- E. Secure joists resting on masonry or concrete bearing surfaces by bedding in mortar and anchoring to masonry or concrete construction as specified in SJI and AISC specifications for type of steel joist used.
- F. Place joists on supporting work, adjust and align in accurate location and spacing before permanently fastening.
 - 1. Provide end bearing and anchorages to secure joists to supporting members or walls in accord with SJI and AISC Specifications, unless otherwise indicated.
 - 2. When joists do not bear flush on supporting member or wall, take corrective measures to ensure full bearing.
- G. Provide bridging in accordance with SJI and AISC Specifications, where not specifically indicated otherwise, except as modified herein.
 - 1. Provide diagonal type bridging as indicated.
 - 2. Provide additional bridging at each line between exterior and first interior joist and then at every 12th joist space.
- H. Completely install bridging before loads are applied.
 - 1. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.
 - 2. Provide bridging connections at top and bottom chords capable of safely resisting a force of 500, 1000 and 1500 LB for open web, long span and deep long span joists respectively.
- I. Do not overload joists during construction.
- J. Remove or repair joisted damaged in place or other work.
- K. After installation, paint field bolt heads and nuts, welds and abraded or rusty surfaces on joists and steel supporting members.
 - 1. Wire brush surfaces and clean with solvent before painting.
 - 2. Use same type of paint as used for shop painting.

END OF SECTION

SECTION 05 31 23
METAL ROOF DECKING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Metal Roof Decking, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
- B. American Iron and Steel Institute (AISI):
 - 1. Specification for Design of Cold-Formed Steel Structural Members.
- C. American Welding Society (AWS):
 - 1. ANSI/AWS D1.3 Structural Welding Code – Sheet Steel.
- D. Steel Deck Institute (SDI):
 - 1. Steel Roof Decking Design Manual.
- E. Qualify welding processes and operations in accordance with AWS Standard Qualification Procedure.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Complete layout indicating types of deck panels, anchorage, supplementary framing, cut openings, accessories, and thicknesses.
- B. Product Data:
 - 1. Manufacturer's load tables for deck to be furnished on this project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Base:
 - 1. Vulcraft.
- B. Optional:
 - 1. ASC Steel Deck.
 - 2. Consolidated Systems, Metal Dek Group,
 - 3. Canam United Steel Deck.
 - 4. Verco Decking.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Metal roof decking:
 - 1. Rib type, sheet steel, 20 GA minimum, with minimum uncoated thickness of 0.0358 IN.
 - 2. $F_y = 33$ KSI, Structural Steel.

3. Galvanized decking: ASTM A653, G60 zinc coating.
 4. Painted decking: ASTM A1008, Grade-C.
- B. Welding rod: E-60XX or greater in accordance with AWS D1.3
- C. Mechanical Fasteners:
1. Corrosion-resistant, low-velocity fasteners.
 - a. Powder actuated:
 - 1) Base:
 - a) Hilti Inc., steel deck fastener.
 - b. Pneumatically driven:
 - 1) Base:
 - a) Pneutek, Inc.
 - c. Self drilling, self threading screws:
 - 1) Hexagonal washer head; carbon-steel screws, No. 10 diameter min size.
 - 2) Base:
 - a) Hilti, Inc
 - 3) Optional:
 - a) Elco Textron
 - b) Buildex
 - d. Other manufacturers desiring approval comply with Section 00 26 00.
- D. Steel shapes, miscellaneous: ASTM A36.
- E. Galvanizing for metal accessories: ASTM A653, G60.
- F. Galvanizing repair paint: High zinc dust content paint, Mil-P-21035 ships.
- G. Metal closure strips: Galvanized sheet steel, minimum 0.034 IN thick before coating, ASTM A653, G60 galvanized. See Part 3 - Execution for locations.

2.3 FABRICATION

- A. Form in lengths to span 3 or more support spacing, with flush, telescoped or nested 2 IN end laps.
 1. Use deck configurations complying with SDI Basic Design Specifications and as indicated.
- B. Form metal closure strips to configuration required to provide tight-fitting closures at open ends and sides of decking.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which deck units are to be installed for conditions detrimental to proper and timely completion of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Start of installation constitutes acceptance of responsibility for correct installation and performance.

3.2 INSTALLATION

- A. Do not overload supporting members.
- B. Install roof deck units and accessories as indicated.
- C. Do not start placement of roof deck units until supporting members are installed complete.
- D. Place each deck unit on supporting structural frame, adjust to final position, accurately align with ends bearing on supporting members.
 1. Lap units at ends no less than 2 IN.
 2. Do not stretch or contract side-lap interlocks.

3. Place deck units flat and square and secure to framing without warp or excessive deflection.
 4. Install deck ends over supporting frame with a minimum end bearing of 1-1/2 IN.
- E. Plug weld sizes specified are effective fusion diameter of welds.
1. Weld metal shall penetrate layers of deck material at ends laps and have good fusion to supporting members.
- F. Remove and replace decking which is structurally weak or unsound or which has burn holes due to improper welding or which Engineer declares defective.
- G. Cut and fit roof units and accessories around other work projecting through or adjacent to roof decking.
1. Make cutting and fitting neat, square and trim.
 2. Neatly and accurately install reinforcing at openings except:
 - a. Circular openings less than 6 IN diameter.
 - b. Rectangular openings having no side dimension greater than 6 IN.
 3. Reinforce openings between 6 IN and 12 IN with 20 GA flat steel sheet 12 IN greater in each dimension than opening. Place sheet around opening and fusion weld to top surface of deck at each corner and each side midway between each corner.
 4. For roof openings larger than 12 IN and at roof drains: Support deck edges as indicated on Drawings
- H. Install metal closure strips for support of roof insulation.
1. Provide where rib openings in top surface of roof decking occur adjacent to edge and openings.
 2. Weld closure strips into position.
- I. Install metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction.
1. Weld into position to provide a complete decking installation.

3.3 FASTENING OF ROOF DECKING

- A. Welded connection requirements:
1. Fasten roof deck panels to steel supporting members by arc spot welds 5/8 IN effective diameter or arc seam welds with an equal perimeter that is not less than 1-1/2 IN long.
 - a. Weld Spacing:
 - 1) Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support.
 - 2) Space welds: 18 IN apart, maximum.
 - b. Weld Washers: Install weld washers at each weld location.
 2. Side-Lap and Perimeter Edge Fastening:
 - a. Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 IN, and as follows:
 - b. Mechanically fasten with self-drilling, No.10 diameter or larger, carbon-steel screws.
 - c. Mechanically clinch or button punch.
 - d. Fasten with a minimum of 1-1/2 IN -long welds.
- B. Mechanical connection requirements
1. Mechanical fasteners, powder actuated or pneumatically driven steel pins may be used if the connection shear strength is equal to or greater than the welded connection shear strength.
 - a. Locate mechanical fasteners and install according to manufacturer's written instructions and as specified below.
 - b. Pin size, spacing, and accessories:
 - 1) Pin diameter and length per manufacturer's instructions for numbers of layers, deck gage, and steel flange thickness at a given condition.
 - 2) Connect edge and interior ribs of deck units with a minimum of two pins per deck unit at each support.
 - a) Space pins 18 IN apart, maximum.

- 3) Install steel washers or provide pins with integral washers at each pin location.
Washer size per manufacturer requirements.
2. Side-Lap and Perimeter Edge Fastening:
 - a. Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 IN, and as follows:
 - b. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - c. Mechanically clinch or button punch.

3.4 CLEANING

- A. Wire brush, clean and paint scarred areas, welds and rust spots on top surfaces of decking units and supporting steel members.
- B. Touch-up damaged galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
- C. Touch-up shop painted surfaces with same paint used in shop, as recommended by deck manufacturer.

END OF SECTION

SECTION 05 36 00
COMPOSITE METAL FORM DECK

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Composite Metal Form Deck, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. American Iron and Steel Institute (AISI):
 - 1. Specification for Design of Cold-Formed Steel Structural Members.
- B. American Welding Society (AWS):
 - 1. ANSI/AWS D1.3 Structural Welding Code – Sheet Steel.
- C. Steel Deck Institute (SDI):
 - 1. Floor Deck Manual.
- D. Qualify welding processes and welding operators in accordance with AWS qualification procedures.
- E. Minimum Thickness:
 - 1. Where gage of metal is indicated, provide following minimum uncoated steel thickness, unless following performance requirements require greater thickness.

Gage	Minimum Thickness
20	0.034 IN
19	0.040 IN
18	0.045 IN
17	0.051 IN
16	0.057 IN

- F. Performance Requirements:
 - 1. Provide form deck to act as bottom form for cast-in-place concrete slabs and which will become positive slab reinforcement through mechanical anchorage after concrete hardens.
 - 2. Provide deck thickness such that maximum deck stress shall not exceed 0.6 its yield strength under combined weights of wet concrete(including weight of additional concrete due to structural deflection), deck, and construction live loading of either 20 PSF uniform load or 150 LB concentrated load on a 1 FT wide section of deck.
 - 3. Provide deck with adequate thickness to limit maximum deflection relative to supporting structural members to 1/180 of clear span or 3/4 IN whichever is smaller, caused by combined weights of wet concrete and deck.
 - 4. Gage of deck furnished shall not be less than that indicated on the drawings.
 - 5. Provide deck units listed for Design No. _____ of Underwriter’s Laboratories “Fire Resistance Index,” current edition. Identify steel deck bundles with labels bearing UL mark.
 - 6. Configuration, physical and chemical properties and composite superimposed load carrying capacity of deck units furnished shall conform to manufacturer’s catalog current at time bids are received.

7. Provide accessories (pour stops, column closures, end closures, cover plates, and girder fillers) as needed to prevent concrete leakage.

1.3 SUBMITTALS

- A. Shop Drawings:
 1. Complete layout indicating types of deck panels, anchorage, supplementary framing, cut openings, accessories, deck thicknesses.
 2. Indicate areas requiring shoring on the shop drawings.
- B. Product Data:
 1. Manufacturer's load tables for deck to be furnished on this project.
- C. Product Information
 1. Manufacturers analysis of unshored span limits
 2. Shoring design and documentation prepared by a Licensed Structural Engineer

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable Manufacturers and Designations:
 1. Composite metal form deck, 2 IN:
 - a. Base:
 - 1) ASC Steel Deck; Type 2W.
 - 2) Consolidated Systems, Metal Dek Group; Type CFD-2.
 - 3) Canam United Steel Deck; Type 2 IN Lok Floor.
 - 4) Verco Manufacturing; Type W2 Formlok.
 - 5) Vulcraft; Type 2VLI.
 2. Composite metal form deck, 3 IN:
 - a. Base:
 - 1) ASC Steel Deck; Type 3W.
 - 2) Consolidated Systems, Metal Dek Group; Type CFD-3.
 - 3) Canam United Steel Deck; Type 3 IN Lok Floor.
 - 4) Verco Manufacturing; Type W3 Formlok.
 - 5) Vulcraft; Type 3VLI.
 3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Composite Metal Form Deck:
 1. Cold formed from steel sheets, conforming to ASTM A653, Structural Quality, Grade-40 with G60 coating.
- B. Accessories:
 1. Sheet steel closures, cover plates and other sheet steel accessories: Use same material and coating as for deck.

2.3 FABRICATION

- A. Extend deck over three or more spans with butted end laps.
- B. Form closures and cover plates to configuration required to form concrete and/or to prevent concrete leakage.
- C. Locate end laps and accessories to maintain capacity of field applied studs for composite beams.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which deck units are to be installed for conditions detrimental to proper and timely completion of work.
- B. Correct unsatisfactory conditions.

3.2 INSTALLATION

- A. General:
 - 1. Do not overload supporting members.
 - 2. Unless specifically noted otherwise, provide composite metal form deck for concrete slabs supported directly or indirectly by structural steel frame.
 - 3. Install deck units and accessories in accordance with final shop drawings and as specified herein.
 - 4. Do not start placing units before supporting members are completely installed in place.
 - 5. Bear deck units on supporting members minimum of 2 IN. Butt units tightly together at centerline of support. Place abutting units in accurate and close alignment for entire length of run.
 - 6. Neatly cut and fit deck units and accessories around columns, walls, and other objects projecting through or adjacent to deck. Install closures and cover plates as required to prevent concrete leakage.
 - 7. Install shoring where indicated on shop drawings
- B. Openings:
 - 1. Deliver deck to job site intact when openings in deck are indicated on drawings to be installed after concrete fill is cured. Openings installed in this manner shall be paid for by trade requiring opening.
 - 2. Where openings in floor are framed, deliver deck to job site cut to proper length.
- C. Fastening – Welded Connectors:
 - 1. For welding deck to supports, employ only welders, qualified under AWS qualification procedures, and experienced in welding light gauge metal.
 - 2. Minimum deck fastening requirements:
 - a. At end of each unit and at intermediate supports: Puddle welds at 12 IN on center with not less than two welds per support.
 - b. At exterior beam parallel to deck span: Puddle welds or 1-1/4 IN seam welds at 24 IN on center.
 - c. At male-female side laps, 1-1/2 IN long seam welds or button punching at 24 IN on center.
 - d. At lapped side laps, -1/2 IN long seam welds at 24 IN on center.
 - e. Sheet metal closures, cover plates: Self-drilling screws or tack welds at 24 IN on center.
 - 3. Verify that minimum deck fastening requirements are adequate for safely supporting material and construction loads placed on deck from time of deck placement to time of concrete placement. Additional fastening required to accomplish this shall be provided and paid for by Contractor.
 - 4. Puddle welds shall have effective fusion diameter not less than 5/8 IN. Weld metal shall penetrate layers of deck material at end laps and be thoroughly fused to supporting members.

END OF SECTION

SECTION 05 45 23
EQUIPMENT SUPPORT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Equipment Support System, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. *Manufacturer Qualifications:*
 - 1. Service office within 500 mile radius of project, functioning with full time personnel for minimum of five (5) years.
 - 2. Maintain quality assurance program.
 - 3. Submit mill test reports for material.
- B. *Installer Qualifications:*
 - 1. Trained and certified by manufacturer with minimum ten (10) years experience installing products comparable to those specified in this section.
- C. *American Iron and Steel Institute (AISI):*
 - 1. AISI S200 Series North American Standards for Cold-Formed Steel Framing
- D. *American Institute of Steel Construction (AISC):*
 - 1. Steel Construction Manual
- E. *American National Standards Institute (ANSI)/American Welding Society (AWS):*
 - 1. ANSI/AWS C1.1M/C1.1 Recommended Practices for Resistance Welding
 - 2. ANSI/AWS D1.3/D1.3M Structural Welding Code - Steel
- F. Provide Equipment Support System engineered to support dead, live, lateral and seismic loads indicated.
 - 1. Comply with Section 01 71 21, Specialty Engineering Requirements.
 - 2. Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.
- G. *Erection Tolerance:*
 - 1. Equipment support channels: Horizontal within 1/32 IN in 2 FT, and within 1/16 IN in 18 FT.
 - 2. Multiple equipment support channels: Horizontal in plane to each other within 1/32 IN.

1.3 SUBMITTALS

- A. *Shop Drawings:*
 - 1. Indicate plan layout, typical elevations, anchoring methods.
- B. *Product Data:*
 - 1. Manufacturers' product data sheets, details and installation instructions for Equipment Support System, properties of sections, components and accessories.
- C. *Project Information:*
 - 1. Address of nearest stocking dealer.
 - 2. Equipment manufacturer's design load data.
 - 3. Structural calculations for equipment support system indicating design conforms to specified design criteria, sealed by the Specialty Structural Engineer.
 - a. Submit concurrent with Shop Drawings.
 - 4. Manufacturer Certification of Installer Qualifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Equipment Support System:
 - 1. Base:
 - a. Unistrut Corporation
 - 2. Optional:
 - a. Cooper B-Line
 - b. Hilti Installation Systems
 - c. Thomas and Betts Superstrut
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN CRITERIA

- A. Universal Grid Support Structure:
 - 1. Provide continuous support channels of spacing indicated in direction noted for each space.
 - 2. Locate first and last support channels 6 IN from inside face of walls parallel with universal grid direction.
 - 3. Maximum Spacing:
 - a. 24 IN OC (unless otherwise indicated).
 - 4. Allow attachment of equipment support rails at any point without drilling or welding.
- B. Ceiling Anchorage:
 - 1. Attach to structure by means of embedded concrete inserts or by direct attachment to structural framing.
 - 2. Position expansion anchor with bolt loaded in shear where used to anchor metal framing to support structure.
 - a. Expansion anchors in tension are not permitted without Architect's approval.
- C. Design Load:
 - 1. Design support structure to support larger of proposed equipment load or minimum concentrated load of 1200 LBS at any point on each equipment track.
 - 2. Equipment load is maximum encountered by positioning of equipment at extent of maximum travel load configuration.

2.3 MATERIALS

- A. Equipment Support System:
 - 1. Parallel metal channels flush with ceilings which allow attachment of equipment at any point without drilling or welding.
 - 2. Locate channels perpendicular to equipment tracks, at 26 to 28 IN.
 - 3. Provide supports; attach to building structure indicated.
 - 4. Arrange framing members above ceiling to avoid conflict with ductwork, lighting fixtures and other equipment.
 - 5. Provide bracing to resist lateral design load.
 - 6. Provide removable flush cover strips painted white, for channels.
 - 7. Do not support any part of ceiling system on equipment support system.
- B. Framing Members:
 - 1. Formed steel sheet, ASTM A1011, Grade-33 or ASTM A653/A653M, Grade-A.
 - 2. Finish:
 - a. Framing members and fittings: Corrosion resistant acrylic paint.
 - b. Hardware: ElectroGalvanized, ASTM B633 Type-3-SC1
 - 3. Paint members exposed to view to match ceiling.
- C. Fittings and Fasteners:
 - 1. ElectroGalvanized, F.S.QQ-Z-325A, Type 1, Class 3.
- D. Bracing:

1. Provide bracing to resist lateral design load.
- E. Accessories:
1. Provide fittings, fasteners, clamps, and miscellaneous items to provide a complete and secure installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Field measure to assure support system installation without interference with structural framing, mechanical systems, plumbing, or other obstructions.
- B. Report conflicts and proposed modification to installation to Architect before proceeding.
- C. Install equipment support structure in accordance with approved shop drawings.
- D. Install under supervision of manufacturer.

END OF SECTION

SECTION 05 50 10
MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Miscellaneous Metal Fabrications, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM A27 Standard Specification for Steel Castings, Carbon, for General Application
 - 2. ASTM A36 Standard Specification for Carbon Structural Steel
 - 3. ASTM A47 Standard Specification for Ferritic Malleable Iron Castings
 - 4. ASTM A48 Standard Specification for Gray Iron Castings
 - 5. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 6. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 7. ASTM A148 Standard Specification for Steel Castings, High Strength, for Structural Purposes
 - 8. ASTM A197 Standard Specification for Cupola Malleable Iron
 - 9. ASTM A276 Standard Specification for Stainless Steel Bars and Shapes
 - 10. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 - 11. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - 12. ASTM A354 Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners
 - 13. ASTM A480 Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
 - 14. ASTM A484 Standard Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings
 - 15. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - 16. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 17. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 - 18. ASTM A668 Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
 - 19. ASTM A992 Standard Specification for Structural Steel Shapes
 - 20. ASTM B26 Standard Specification for Aluminum-Alloy Sand Castings
 - 21. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 22. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 23. ASTM B308 Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
- B. American Society of Mechanical Engineers (ASME):
 - 1. ANSI/ASME-A17.1 Handbook on Safety Code for Elevators and Escalators
- C. American Institute of Steel Construction (AISC)

1. Steel Construction Manual
- D. American Iron and Steel Institute (AISI):
 1. Specification for the Design of Cold-Formed Steel Structural Members.
- E. American Welding Society (AWS):
 1. ANSI/AWS C1.1M/C1.1 Recommended Practices for Resistance Welding
 2. ANSI/AWS D1.1 Structural Welding Code - Steel.
 3. ANSI/AWS D1.3 Structural Welding Code - Sheet Steel.
- F. National Association of Architectural Metals Manufacturers (NAAMM):
 1. Class 1, Architectural, per NAAMM AMP-555, Code of Standard Practice for the Architectural Industry.
- G. Provide Miscellaneous Metals Fabrications engineered to support dead, live, and lateral (wind or seismic) loads indicated.
 1. Comply with Section 01 71 21, Specialty Engineering Requirements.
 2. Include headers and reinforcing members around openings.
 3. Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.

1.3 SUBMITTALS

- A. Shop Drawings:
 1. Plans and elevations showing members and connections.
 2. Anchors and accessory items.
- B. Project Information:
 1. Structural calculations for Miscellaneous Metals Fabrications indicating design conforms to specified design criteria, sealed by the Specialty Structural Engineer.
- C. Submit concurrent with Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Materials Listed:
 1. Base: As noted.
- B. Galvanizing Repair Paint:
 1. Base:
 - a. Tnemec.
 2. Optional:
 - a. ZRC Worldwide.
 - b. Sherwin-Williams.
- C. Shop Primer:
 1. Base:
 - a. As recommended by finish coat manufacturer for substrate.
 2. Optional:
 - a. Sherwin-Williams.
 - b. Tnemec.
- D. Non-shrink Grout:
 1. Base:
 - a. Dayton Superior Corporation.
 2. Optional:
 - a. Sauereisen.
 - b. CGM Building Products.
- E. Decorative Bollard Covers:

1. Base:
 - a. Innoplast.
- F. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Structural Steel:
 1. Structural W and T shapes: ASTM A992, 50KSI yield point.
 2. Other steel shapes and plate: ASTM A36.
 3. Pipe: ASTM A53 Grade B.
 4. Tubing: ASTM A500, Grade B, 46KSI minimum.
- B. Cast Steel:
 1. ASTM A27, Grade-65-35; and ASTM A148, Grade-80-50.
- C. Steel Forgings:
 1. ASTM A668.
- D. Bolts:
 1. ASTM A307, ASTM A325, ASTM A354.
- E. Filler Metal:
 1. AWS Standards.
- F. Cast Iron:
 1. ASTM A48, Class 30, minimum 30,000 PSI tensile.
- G. Malleable Iron:
 1. ASTM A47 and ASTM A197.
- H. Aluminum:
 1. ASTM B308 for particular alloy in standard shapes and extrusions.
 2. ASTM B26 for castings.
- I. Stainless Steel:
 1. ASTM A484 and ASTM A276.
 2. Concealed: Type 302 or Type 304.
 3. Exposed: Type 316.
 - a. Finish: ASTM A480 AISI finish No. 4, unless otherwise indicated.
- J. Masonry Anchorage Devices:
 1. Standard manufactured items.
 2. Lead expansion shields for machine screws and bolts 1/4 IN and smaller: Head out embedded nut type.
 3. For machine screws and bolts larger than 1/4 IN : Manufacturers' standard.
 4. Bolt anchor expansion shields for lag bolts: Zinc alloy, long shield anchors.
 5. Bolt anchor expansion shields for bolts: Closed end bottom bearing type.
 6. Anchor to embed or set device in setting compound or epoxy grout where shown.
- K. Fasteners:
 1. Galvanized or stainless where built into exterior walls
 2. Select fasteners for type, grade and class required
 3. Bolts and Nuts: Regular hexagon head ASTM A307, Grade A
 4. Lag Bolts: Square or octagonal head type
 5. Machine Screws: Cadmium plated steel
 6. Wood Screws: Flat head carbon steel
 7. Plain Washers: Round carbon steel
 8. Lock Washers: Helical spring carbon steel
- L. Non-shrink Grout:
 1. Compressive strength: 9000 PSI at 7 days.

2. Base Product: 1107 Advantage Grout by Dayton Superior.
- M. Abrasive Warning Tape:
1. Self-adhering, tape with slip resistant mineral surface
 2. Color: Safety Yellow
 3. Width: 2 IN , except where noted otherwise
 4. Tape Type 2:
 - a. Base Product: Safety-Walk 530 Conformable by 3M
 - b. Backing: Aluminum foil
 - c. Thickness: 0.035 IN
 - d. Use Type 2 at top and bottom rungs of ladders

2.3 FABRICATION

- A. Form to shapes indicated with straight lines, sharp angles, and smooth curves.
- B. Shop fabricate in as large assemblies as practicable.
- C. Anchorage Accessories:
 1. Items required securing wood to metal, wood to masonry, metals to masonry or concrete, metal to metal or metal to other items.
- D. Drill or punch holes with smooth edges for temporary field connections and attachment of work by other trades.
 1. Conceal fastenings where practicable.
- E. Make permanent shop and field connections with continuous fillet type welds.
 1. Grind exposed welds smooth.
- F. Supply items required to complete construction and installation.
- G. Meet requirements specified under Structural Steel for fabricating items of structural nature or use.

2.4 FINISHES

- A. Items not to receive coatings:
 1. Surfaces scheduled to be fireproofed with spray-on material.
 2. Machined surfaces.
 3. Surfaces adjacent to field welds.
 4. Contact surfaces of bolt connections at slip connections.
 5. Top flanges of beams to receive shear connectors.
 6. Items for which no coating or field finish is specified.
- B. Shop Primer for Interior Non-wet Items:
 1. Primer: Coordinate with field applied finish systems specified in Section 09 91 23.
 2. Apply primer for interior finish paint to following surfaces not receiving other coating:
 - a. Surfaces exposed on interior.
 3. Clean thoroughly before priming; remove mill scale, rust, dirt, oil, and grease in accordance with SSPC-SP3.
 4. Apply in accordance with paint manufacturer's instructions.
 - a. Apply minimum 0.002 IN , dry film thickness.
- C. Hot-dip Galvanized (HDG) Coating for Exterior Items:
 1. Galvanize (HDG) the following items:
 - a. Items to be installed on site, roof or other areas that are outside of building enclosure walls. This shall include items attached to exterior walls of building.
 - b. Items to be installed in wet or humid (>70 PCT RH) areas of building.
 - c. Partial listing of items to receive HDG:
 - 1) Masonry lintels, ledge angles and shelf angles.
 - 2) Pipe Bollards.
 - 3) Exterior Ladders, Stairs and railings.

- 4) Exterior gratings and substructure.
 - 5) Exterior equipment supports.
 - 6) Similar items which are exposed to weather or built-in to Exterior walls.
 - 7) Other items indicated.
2. Clean thoroughly before galvanizing.
 3. Galvanize in accordance with ASTM A123.
- D. Galvanizing Repair Coating:
1. Tnemec Series 94-H20 Hydro-Zinc.
 2. ZRC Worldwide, Galvilite 221.
 3. Sherwin Williams Zinc Clad III HS 100.
- E. Finish Painting:
1. Exterior: See Section 09 91 13.
 2. Interior: See Section 09 91 23.

2.5 METAL FABRICATIONS

- A. Steel Support Angles, Support Frames, and Loose Lintel Steel Members:
1. ASTM A36 steel, Sizes and configurations as indicated.
 2. Items to be hot dip galvanized:
 - a. Items to be permanently exposed to weather, high-humidity, or wet conditions.
 - b. Items set into exterior walls.
 3. Shop Prime interior items (in non-wet areas).
- B. Miscellaneous Equipment Supports:
1. ASTM A36 steel, Sizes and configurations as indicated.
 2. Examples of items included:
 - a. Supports for Folding Partitions, Operable Walls, Coiling Doors and Grilles.
 - b. Supports for ICU Doors.
 - c. Support of Medical Equipment including Surgical Lights, Power Columns. And other items indicated.
 - d. Ceiling hung toilet partitions.
 - e. Other miscellaneous support items as indicated.
 3. Items to be hot dipped galvanized:
 - a. Items to be permanently exposed to weather, high-humidity, or wet conditions.
 - b. Items set into exterior walls.
 4. Shop Prime interior items (in non-wet areas).
- C. Bollards:
1. Provide where indicated.
 2. Supply items required to complete construction and installation.
 3. Minimum Workmanship Standards (unless noted otherwise): Class 1, Architectural, per NAAMM AMP-555, Code of Standard Practice for the Architectural Industry.
 4. Utility Bollards Type UB-1:
 - a. 6 IN nominal diameter extra strength, HDG (galvanized), steel pipe or round structural tube.
 - b. Length: Unless otherwise indicated; minimum 42 IN projection above ground and 36 IN embedment into concrete.
 - c. Fabricate with welded on anchors.
 - d. Fill bollard with 3000 PSI concrete with rounded top.
 - e. Field paint by Division 09.
 5. Steel Bollards with Decorative Cover Type DB-1:
 - a. Assembly including a concrete-filled steel pipe with a decorative cover sleeve.
 - b. Steel pipe bollard:
 - 1) 6 IN nominal diameter extra strength, hot dip galvanized steel pipe or round structural tube.
 - 2) Length: Unless otherwise indicated; minimum 42 IN projection above ground and 36 IN embedment into concrete.

- 3) Fabricate with welded on anchors.
- 4) Fill with 3000 PSI concrete, flush at top.
- c. Decorative Bollard Covers:
 - 1) Description: 1/8 IN thick, HDPE.
 - 2) Size as appropriate for steel bollard.
 - 3) Color: To be selected by Architect.
 - a) Five year warranty for color-fastness, cracking and UV-resistance.
 - 4) Dual reflective stripes near top of cover.
 - 5) Base Product: BollardGard by Innoplast.
- D. Slip Resistant Stair Nosings:
 - 1. Provide at exterior concrete steps.
 - 2. Abrasive type with cast-in anchors and recessed screws to allow replacement of units
 - 3. Use temporary insert during construction
 - 4. Space anchors not over 24 IN on center.
 - 5. Minimum 3 anchors per nosing.
 - 6. Furnish units full width of treads.
 - 7. Base Product: XH 330 by Balco Inc.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.
- C. Verify wall backing has been installed for wall-mounted items specified in this Section.
 - 1. See Section 09 22 16.

3.2 INSTALLATION

- A. General:
 - 1. Set work level, true to line, plumb.
 - 2. Weld field connections and grind smooth.
 - 3. Conceal fastenings where practical.
 - 4. Secure metal to wood with lag screws of adequate size with appropriate washers.
 - 5. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.
 - a. Use expansion bolts, toggle bolts, or screws for light duty service.
 - 6. Meet structural requirements for erecting items of structural nature.
 - 7. Do not field splice fabricated items unless size requires splicing.
 - 8. Weld splices.
 - 9. Provide fabricated items complete with attachment devices as required to install.
- B. Galvanic Repair:
 - 1. After galvanized units have been erected and anchored apply galvanizing repair paint in accordance with manufacturer's recommendations.
 - 2. Surface preparation: Remove contaminates in accordance with SSPC SP-1.
- C. Bollards:
 - 1. Direct buried:
 - a. Hole Depth: 6 IN deeper than embedment length specified for bollard.
 - b. Hole Diameter: 24 IN diameter for 6 IN diameter bollard.
 - c. Set bollards plumb and to the exposure height indicated.
 - 2. Surface bolted and other means of attachment: Install as detailed.
 - 3. Fill annular space with concrete fill having a compressive strength of at least 3000 PSI .
 - 4. Paint or cover with decorative sleeves as scheduled.

3.3 TOUCH-UP AND REPAIR

- A. Verify installations are neat and flush in appearance, and that there are no burrs, projections, or defects on exposed surfaces that might snag fingers or clothing. Correct deficiencies.
- B. Touch-up damage to powder coat finishes in manner satisfactory to Architect.
- C. Galvanic Repair:
 - 1. After galvanized units have been erected and anchored apply galvanizing repair paint in accordance with manufacturer's recommendations.
 - 2. Surface Preparation: Remove contaminates in accordance with SSPC SP-1.

END OF SECTION



DIVISION 06

WOOD, PLASTICS, AND COMPOSITES



SECTION 06 10 53
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Rough Carpentry, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Lumber Grading Rules and Species:
 - 1. US Department of Commerce (DOC):
 - a. PS 20 American Softwood Lumber Standard.
 - 2. Western Wood Products Association (WWPA).
 - 3. Southern Forest Products Association (SFPA).
- B. Plywood Grading Rules and Recommendations:
 - 1. US Department of Commerce (DOC):
 - a. Softwood plywood: PS1 Structural Plywood.
 - 2. American Plywood Association (APA).
- C. Preservative and Fire Retardant Treatment Standards:
 - 1. American Wood Protection Association (AWPA):
 - a. AWPA U1 Treated Wood.
 - b. AWPA P5 Standard for Waterborne Preservatives.
 - 2. Underwriters Laboratories (UL)
 - 3. ASTM International requirements:
 - a. ASTM E84 Standard Test Method for Surface Burning Characteristics
 - b. ASTM D2898 Standard Method of Accelerated Weathering of Fire Retardant Treated Wood for Fire Testing
 - c. ASTM D3201 Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products
- D. Factory Marking:
 - 1. Identify type, grade, moisture content, inspection service, producing mill, and other qualities.
 - 2. Mark each piece of fire retardant treated material with Underwriters Laboratory Classification mark and fire-retardant treatment for identification.
 - 3. International Building Code (IBC):
 - a. Requirements for identification and labeling.

1.3 SUBMITTALS

- A. Project Information:
 - 1. Certification of fire retardant treated material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fire-retardant Treated Dimension Lumber and Plywood:
 - 1. Base:
 - a. Hoover Treated Wood Products, Inc.
 - 2. Optional:
 - a. Lonza Group Limited

- b. Western Wood Preserving Company
- B. Preservative Treated Lumber:
- 1. Base:
 - a. Lonza Group Limited
 - 2. Optional:
 - a. Stella-Jones Incorporated
 - b. Western Wood Preserving Company

2.2 MATERIALS

- A. Dimensional Lumber and Plywood:
- 1. Thoroughly seasoned, non-treated, well-fabricated materials.
 - 2. Longest practical lengths and sizes.
 - 3. Application, except where treated types are indicated:
 - a. Non-structural framing, blocking, backing, nailers, grounds, and similar members.
 - b. Other locations where indicated.
- B. Fire-retardant Treated Lumber and Plywood (FRT):
- 1. Flame spread index: Less than 25.
 - 2. Smoke developed index: Less than 450.
 - 3. Free of halogens, sulfates, chlorides, arsenic, ammonium phosphate, formaldehyde, and urea formaldehyde.
 - 4. Kiln dried after treatment, (KDAT).
 - 5. FRT material for interior and above grade locations:
 - a. Base: Pyro-Guard by Hoover Treated Wood Products, Incorporated
 - b. Optional:
 - 1) Dricon FRT by Lonza Group Limited
 - 2) FirePro by Western Wood Preserving Company.
 - c. Natural wood products treated to add fire-retardant qualities.
 - d. Type A: not more than 28 PCT moisture when tested according to ASTM D3201.
 - e. Interior and above grade applications include but not limited to:
 - 1) Platforms and Stages.
 - 2) Wood in concealed spaces.
 - 3) Framing, blocking, cants and nailers within roof covering and waterproofing systems.
 - 4) Interior sleepers and sill plates in contact with concrete slabs-on-grade.
 - 5) Interior wood items in direct contact with exterior concrete and exterior masonry walls.
 - 6) Window frame blocking within exterior walls.
 - 7) Plywood backing panels for electrical, telecommunication equipment.
 - 8) Similar locations where wood products are indicated and building code does not permit non-fire-resistive treated products.
 - 9) Above grade dimensional lumber and plywood, unless indicated otherwise.
 - a) Exception: Upgrade to exterior grade where scheduled in the following article.
 - 6. FRT material for exterior and wet locations:
 - a. Base:
 - 1) Exterior Fire-X by Hoover Treated Wood Products, Incorporated
 - b. Optional:
 - 1) Dricon FRX by Lonza Group
 - c. Natural wood products treated to add fire-retardant qualities plus decay and termite resistance.
 - d. Non-leaching treatment under direct exposure to precipitation, sunlight, and effects of weather.
 - e. Exterior applications include but not limited to:
 - 1) Fire-treated wood that is directly exposed to weather.
 - 2) Fire-treated wood in areas of high-humidity, Greater than 80 PCT RH.

- 3) Other areas where indicated.
- C. Preservative Treated Lumber and Plywood:
1. Natural wood products treated to add decay and termite resistance.
 2. Base:
 - a. FrameGuard by Lonza Group Limited
 3. Optional:
 - a. Lumber Products by Stella-Jones Incorporated
 - b. Advance Guard by Western Wood Preserving Company
 4. Preservatives:
 - a. Compatible with direct exposure to precipitation, sunlight and effects of weather.
 - b. Authenticate by factory marking each piece with manufacturer's mark and applicable standards.
 - c. Acceptable treatments:
 - 1) Alkaline Copper Quaternary (ACQ).
 - 2) Copper Boron Azole (CBA).
 - 3) Borate based (BORON).
 5. Lumber Species:
 - a. Southern Pine.
 - b. Mixed Southern Pine.
 - c. Hem-Fir.
 - d. Spruce.
 - e. Pine.
 - f. Other species meeting requirements.
 6. Plywood:
 - a. Grading:
 - 1) PS1, B-C Grade.
 - 2) PS1, A-C Grade where exposed.
 - b. Veneers:
 - 1) Softwood species.
 - 2) Glue with waterproof adhesives.
 7. Application:
 - a. Below grade, or in contact with earth.
 - b. Where indicated in Drawings.
- D. Sill Sealing Gaskets:
1. Closed cell neoprene foam.
 2. Thickness: 1/4 IN .
 3. Match width of sill members indicated.
- E. Adhesives for bonding furring, sleepers, sills and similar items to concrete or masonry:
1. Approved for indicated use by adhesive manufacturer.
 2. Comply with ASTM D3498.
- F. Water-Repellent Preservative:
1. Treat of exposed ends of posts and beams.
 2. National Wood Window and Door Association (NWWDA) tested and accepted formulation.

2.3 FASTENERS

- A. General:
1. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture.
 2. Where rough carpentry is exposed to weather, in contact with earth, pressure-preservative treated, or in area of high relative humidity:
 - a. Use fasteners with hot dip zinc coating complying with ASTM A153.
 - b. Use fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.

- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: ASTM A307, Grade A steel bolts with ASTM A563 hex nuts and washers.
- G. Expansion Anchors:
 - 1. Tested in accordance with ASTM E488.
 - 2. Anchor bolt and sleeve assembly:
 - a. Masonry assemblies: Sustain load equal to 6 times load imposed when installed in unit.
 - b. Concrete assemblies: Sustain load equal to 4 times load imposed when installed in unit.
 - 3. Interior applications:
 - a. Carbon-steel components.
 - b. Zinc plated to comply with ASTM B633, Class Fe/Zn 5.
 - 4. Exterior and wet applications:
 - a. Stainless Steel components, ASTM F593 and ASTM F594 Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine conditions under which work is to be installed.
- B. Verify measurements, dimensions, and details before proceeding.
- C. Coordinate location of furring, nailers, blocking, grounds and similar supports.
- D. Correct unsatisfactory conditions.

3.2 INSTALLATION OF ROUGH CARPENTRY

- A. Form to shapes indicated.
- B. Cut and fit accurately.
- C. Set work to required levels and lines, plumb and true.
- D. Shim as required.
- E. Provide wood grounds or nailers as required for attachment of other work and surface applied items.
- F. Grounds:
 - 1. Dressed, key beveled lumber.
 - 2. Minimum 1-1/2 IN wide x thickness required to bring face of ground even with finish material.
 - 3. Remove temporary grounds when no longer required.
- G. Wall Blocking:
 - 1. Provide in-wall fire-treated wood blocking reinforcement where following items are required to be wall-mounted to interior walls:
 - a. Architectural casework, millwork, cabinets, shelving, wardrobes, and bookcases.
 - b. Handrails at stairwells.
 - c. Between studs at height of door stop, behind stop.
 - 2. Metal wall backing:
 - a. See Section 09 22 16.
- H. Anchor work to support applied loading.
 - 1. Provide washers under bolt heads and nuts.
 - 2. Fasten plywood in accordance with APA recommendations.
 - 3. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.

4. Predrill holes to avoid splitting wood with fasteners.
5. Do not drive threaded friction type fasteners.

3.3 INSTALLATION OF BLOCKING AND NAILERS FOR ROOFING AND PARAPETS

- A. Install in accordance with ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used With Low Slope Roofing Systems.
- B. Minimum Wood Member Size: 2 IN x 6 IN nominal.
- C. Fasteners:
 1. Corrosion resistant.
 - a. Hot dip galvanized: Comply with ASTM A153 or ASTM A653, Class G185.
 - b. Stainless steel: Types 304 or 316.
 2. Countersink heads of fasteners.
 3. Types required for substrate conditions.
 4. Fasteners of diameter and spacing required to resist forces indicated.
 5. Spacing:
 - a. Threaded anchor bolts; 3/8 IN or larger:
 - 1) Provide 5/8 IN OD washers or larger.
 - 2) Maximum spacing: 48 IN OC.
 - 3) Stagger 1/3 nailer width.
 - b. Other fastener types:
 - 1) Maximum Spacing:
 - a) Typical: 12 INOC.
 - b) Up to 16 IN OC where necessary to match spacing of structural members.
 - 2) Stagger 1/3 nailer width.
 - 3) Install 2 fasteners and within 6 IN of nailer ends.
- D. Anchor nailers to resist minimum vertical force of 300 LBS/LF in any direction.
 1. Locate fasteners approximately 4 IN from ends but not less than 3 IN .
 2. Use minimum of 3 anchors for each nailer.
 3. Where members are wider than 6 IN , stagger fasteners from side to side to avoid splitting of the wood member.
 4. Corner region enhancements:
 - a. Double the above listed vertical force which must be resisted.
 - b. Length and width of corners as prescribed by ANSI/SPRI RP-4:
 - 1) 40 PCT of the building height, but not less than 8-1/2 FT .
- E. Nailers used for perimeter securement of roofing membranes:
 1. Install nailers where indicated and where required to secure perimeter of membrane roofing.
 2. Match height of nailers to adjacent insulation.
 3. Where multiple layers are required to match depth of insulation:
 - a. Attach base layer as indicated in General Requirements above.
 - b. Apply a bead of construction adhesive between laminations.
 - c. Attach subsequent layers using fastener type which is appropriate for wood-to-wood securement.
 - d. Size and locate fasteners as required to resist uplift loading indicated.
- F. Install blocking as indicated for securement of sheet metal edge flashings, parapet copings, and similar items.

3.4 INSTALLATION OF FIRE RETARDANT TREATED WOOD

- A. Fire retardant treated lumber and plywood used in structural applications shall be applied according to lumber and plywood strength tables provided by manufacturer.
- B. Use only fasteners approved by the manufacturer of fire-retardant-treated or preservative treated wood.
- C. Field Cuts:

1. Dimensional Lumber: Do not rip or mill fire retardant treated lumber.
 - a. Cross cuts, joining cuts, and drilling holes are permitted.
2. Plywood: Fire retardant treated plywood may be cut in any direction.
3. Field treat cuts and holes in preservative and fire retardant treated material in accordance with AWPA M4.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Finish Carpentry in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Architectural Woodwork Standards (AWS), Premium Grade:
- B. American National Standards Institute (ANSI):
 - 1. ANSI 208.1 Particleboard
 - 2. ANSI 208.2 Medium Density Fiberboard (MDF) For Interior Applications

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Show materials, component profiles, fastening methods, jointing details, and accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lumber:
 - 1. AWS Premium grade suitable for transparent or opaque finish as indicated.
 - 2. Moisture content: between 5 and 10 PCT.
 - 3. S4S.
 - 4. Hardwood:
 - a. Species: Red Oak
 - b. Cut: Plain Sliced
 - 5. Softwood:
 - a. Commercial softwood species.
- B. Wood Molding:
 - 1. Kiln dried.
 - 2. In accordance with Architectural Woodwork Standards requirements for its use and Grade specified.
 - 3. Species: Red Oak
 - 4. Cut: Plain Sliced
- C. Sheet Materials:
 - 1. Manufactured without urea formaldehyde resins.
 - 2. Softwood plywood:
 - a. Determine types, grades, waterproof or water-resistive construction, and thickness by purpose and according to Guide to Plywood Grades under Product Standard PS 1, except as indicated.
 - b. Exposed faces, interior: Veneer Grade Ponderosa Pine.
 - c. Exposed faces, exterior: Medium Density Overlay.
 - 3. Hardwood faced panels:
 - a. MDF panel substrate.
 - b. Phenolic or paper face over surface to have veneer applied.
 - c. Hardwood Face Veneer:

- 1) Species: Red Oak
 - 2) Cut: Plain Sliced
 - 3) Match: Book
- 4. Lumber core plywood:
 - 1) Species:
 - 2) Cut:
 - 3) Match:
 - 5. Medium-density fiberboard (MDF):
 - a. Grade 230.
 - 6. Particleboard:
 - a. Medium density, Grade M-2
 - b. Density: 45 LBS/FT3 .
 - c. Thickness:
 - d. Exterior glue.
 - 7. Hardboard:
 - a. ANSI/AHA A135.4; compressed, interfelted cellulosic fiber.
 - b. Thickness: 3/4".
 - c. Tempered.
 - 8. Pegboard:
 - a. ANSI/AHA A135.4; compressed, interfelted cellulosic fiber.
 - b. Holes: 1 IN OC.
 - c. Thickness: 1/4".
 - d. Tempered.

2.2 HARDWARE

- A. Fasteners, Bolts, Nuts, Washers, Lags, Pins and Screws:
 - 1. Of size and type to suit application, except where specific types are shown.
- B. Closet Hardware:
 - 1. Chrome plated steel with matching end and intermediate supports.

2.3 SHOP FABRICATION

- A. Prepare woodwork to receive items specified in other Sections through use of templates.
- B. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes.
 - 1. Fit corners and joints hairline; secure with concealed fasteners.
- C. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.
- D. Shelving:
 - 1. 3/4 IN thick sheet material with 3/8 x 3/4 IN continuous hardwood edging.
 - a. Particleboard, type M-3.
 - b. Hardwood Face Veneer Plywood.
 - c. Support at 3 FT on center maximum.
- E. When necessary to cut and fit on site, provide materials with ample allowance for cutting.
 - 1. Provide trim for scribing and site cutting.

2.4 FINISHING

- A. Field applied transparent or opaque paint finish, including but not limited to shelving; wood stairs and handrails, cased openings, door and window frames; standing and running trim.
- B. Finish in accordance with AWS System Section 5, System-9, UV Curable, Acrylated Epoxy, Polyester or Urethane, Green Guard certified; Premium grade.
- C. Sand surfaces smooth and set exposed nails and screws.

- D. Apply wood filler in exposed nail and screw indentations.
- E. On items to receive transparent finishes, use wood filler to match surrounding surfaces and of types recommended for applied finishes.
- F. Finish to color and sheen selected.
- G. Seal, stain and varnish exposed and semi-concealed surfaces. Seal concealed surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine conditions under which work is to be installed.
- B. Verify measurements, dimensions, and drawing details before proceeding.
- C. Coordinate location of furring, nailers, blocking, grounds and similar supports for attached work.
- D. Installation indicates acceptance of substrates and responsibility for performance.

3.2 INSTALLATION

- A. Install work plumb, level, securely in place, and with tightly fitted joints.
- B. Scribe work abutting other surfaces.
 - 1. Maximum gap: 1/32 IN .
 - 2. Do not use additional overlay trim.
- C. For wall mounted components, use concealed attachments.
- D. Countersink anchors and conceal with solid plugs. Finish flush with adjacent surfaces.
- E. Use blind nailing where practicable.
- F. Where face nailing is required, set and fill with putty. Finish work smooth.
- G. Cope trim and moldings at returns and interior angles, and miter at external corners.
- H. Shoulder intersections of flat work to ease any inherent change of plane.
- I. Stagger, conceal, or space joints in inconspicuous locations.
- J. Minimize joints by using maximum length lumber available.

3.3 PREPARATION FOR FINISH

- A. Set nails.
- B. Fill holes.
- C. Sand smooth before application of finishes.
- D. Leave ready for finishing.

3.4 ADJUST AND CLEAN

- A. After installation, adjust operating parts.
- B. Install temporary coverings to protect installed work.

END OF SECTION



DIVISION 07

THERMAL AND MOISTURE PROTECTION



SECTION 07 16 04
CONCRETE FLOOR MOISTURE TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Floor Moisture Testing in accordance with provisions of Contract Documents.
- B. Completely coordinate with Section 07 16 05, Water Vapor Emission Control System, and work of other trades.
- C. Contractor's Responsibilities:
 - 1. Provide pre-installation coordination with concrete and space acclimatization trades upon building enclosure.
 - 2. Facilitate testing and inspection and furnish labor to assist Owner's testing agency at site.
 - 3. Advise Owner's testing agency sufficiently in advance of operations to allow for completion of routine testing and for assignment of personnel.

1.2 QUALITY ASSURANCE

- A. Section includes testing agency administrative and procedural requirements for quality assurance and quality control in performing concrete moisture testing for compliance with floor finishes.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated and do not relieve Contractor's responsibility for compliance with Contract Document requirements.
- C. Testing Agency Qualifications:
 - 1. Firm experienced in field of concrete floor moisture testing for projects similar in scope, material, design, and extent indicated for this Project.
 - 2. International Concrete Repair Institute (ICRI) Certified in moisture and pH testing, conducting ASTM tests, and interpretation of results.
- D. ASTM International (ASTM):
 - 1. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - 2. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in situ Probes

1.3 SUBMITTALS

- A. Project Information:
 - 1. Prepare schedule of tests and inspections in tabular form to include following:
 - a. Specification Section number and title.
 - b. Description of test and inspection method.
 - c. Identification of applicable standards.
 - d. Identification of test and inspection methods.
 - e. Number of tests and inspections required.
 - f. Time schedule or time span for tests and inspections.
 - g. Entity responsible for performing tests and inspections.
 - h. Requirements for obtaining samples.
 - i. On elevated slabs on metal deck, test at deepest portion of deck flute.
 - j. Each test shall be identified by its own unique number directly on concrete and site map.
 - k. Digital pictures of testing methods in place.
 - 2. Submit reports of test results and include following:
 - a. Date of issue.
 - b. Project title and number.

- c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making tests and inspections.
 - f. Description of Work and test and inspection method.
 - g. Record for each test listing interior temperature, interior humidity, concrete internal RH, moisture vapor, and alkalinity results for testing period for both new or existing concrete slabs or both.
 - h. Test and inspection results and an interpretation of test results.
 - i. Provide electronic copy of Architectural Floor Plans identifying each test by number and location where conducted.
 - j. Name and signature of laboratory inspector.
 - k. Recommendations on retesting and re-inspection.
3. Testing equipment and devices used to conduct tests:
- a. Product data for components.
 - b. Date of most recent calibration as required by manufacturer.
- B. Contract Closeout Information:
- 1. Testing Agency shall include closeout document including testing reports, test location maps, submittal information for installed below grade vapor barrier, concrete mix designs, admixtures, curing methods and moisture control products utilized on project.

1.4 SEQUENCING

- A. Owner Responsibilities:
- 1. Owner shall engage qualified Testing Agency to perform testing specified herein and in accordance with Section 01 45 23.
 - 2. Payment for testing services will be made by Owner directly to testing agency.
 - 3. Costs for retesting and reinspection construction that replaces or is necessitated by work that failed to comply with the Contract Documents shall be paid by Owner and charged to Contractor by an adjustment to Contract Sum through a Change Order.
- B. Testing Agency Responsibilities:
- 1. Cooperate with Contractor and Architect in performance of duties.
 - 2. Provide qualified personnel to perform required tests and inspections.
 - a. Provide documented confirmation of previous projects completed of similar size and scope of proposed project.
 - b. Technicians conducting or overseeing performance of moisture testing are required to be International Concrete Repair Institute (ICRI) certified to Grade 1, Moisture Testing Technician level.
 - 3. Notify Contractor and Architect promptly of irregularities or deficiencies observed in Work during performance services.
 - 4. Determine locations from which test samples will be taken.
 - 5. Provide test results marked on finish floor plan drawings showing test results with vapor reduction system recommendations.
 - 6. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 7. Submit a certified written report for each test, inspection, and similar quality assurance service to Owner, Architect, and Contractor.
- C. Schedule of Tests and Inspections:
- 1. Allow adequate time for results of tests, inspections and moisture control system to conclude prior to erection of interior walls, fixtures and equipment.
 - 2. Prepare a schedule of tests, inspections, and similar quality control services required by Contract Documents.
 - 3. Submit schedule within 30 days of date established for Notice to Proceed.
 - 4. Distribute schedule to Owner, Architect, Contractor, testing agencies, and each party involved in performance of portions of Work where tests and inspections are required.
 - 5. Preinstallation Conference:

- a. Testing Agency, Owner, Architect, and Contractor shall meet 90 days prior to flooring installation to discuss testing requirements, specifications, and locations of test sites.
 - b. See Section 01 31 19.
- D. Acclimate building to working environment as required by manufacturer requirements of specified flooring materials and in accordance with ASTM F2170 requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Base:
 - 1. Wagner Electronics.
- B. Optional:
 - 1. American Moisture Test.
 - 2. Delmhorst Instrument Co.
 - 3. Tramex.

2.2 MATERIALS

- A. Testing equipment shall be from single source, meeting specified requirements:
 - 1. Alkalinity (pH): ASTM F710.
 - a. Wide Range 1-14pH.
 - 2. Relative humidity (RH): ASTM F2170.
 - a. Relative humidity range of 0-100 PCT.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify building weatherproof, exterior doors installed and windows secured.
- B. Begin testing process when concrete installation is minimum 90 days of age.

3.2 PREPARATION

- A. Prepare test sites per ASTM F710 and ASTM F2170.
- B. Conditioning: Minimum 48 HRS prior to testing:
 - 1. Concrete floor slabs: Service temperature.
 - 2. Occupied air space above the floor slab: Service temperature.
 - 3. Occupied air space relative humidity above floor slab: Service humidity.
 - 4. Continue conditioning required until and during floor installation and adhesive cure.
- C. Clearly mark each test location on floor plan and directly on concrete surface with non-removable marker.

3.3 TESTING

- A. Test concrete for each area of each non-permeable flooring type.
- B. Perform tests at rate of 3 tests for areas up to 1000 SQFT , and 1 for each 1000 SQFT thereafter.
- C. HVAC system shall be operational during testing period and for a minimum period of 60 days preceding tests.
 - 1. Record temperature and humidity readings at start and end of testing.
 - 2. Continue conditioning after flooring installation as required by applicable manufacturers.
 - 3. If proper conditions cannot be achieved during construction process and testing is performed results shall be used as preliminary information only.
 - a. Re-testing when conditions are achieved or application of Section 07 16 05 scope is required.

- D. Perform in-situ probe tests per probe manufacturer's specifications with regard to temperature and humidity of space being tested.
 - 1. Proof of calibration is required for each sensor or testing apparatus prior to use.
 - 2. Test conditions: Service temperature and humidity.
- E. Perform digital Alkalinity (pH) tests within water vapor emission test dome.
 - 1. Test in accordance with ASTM F710 and manufacturer's recommendations.
 - 2. Apply manufactures recommended liquid to form 1 IN diameter puddle.
 - 3. Allow liquid to absorb for 60 seconds.
 - 4. Expose probe to liquid and allow meter to calculate pH level for 10 seconds.
 - 5. Document results to nearest hundredth.
- F. Perform Relative Humidity (RH) tests.
 - 1. Test in accordance with ASTM F2170 and manufacturer's recommendations.
 - 2. Drill hole to diameter and length required for concrete thickness.
 - 3. Remove concrete debris by compressed air and vacuuming holes.
 - 4. Place RH probe sleeve in opening, secure cap and allow acclimating for minimum 72 HRS.
 - 5. Protect from wet work and trade traffic.
- G. Acceptable readings during HVAC operation shall be in accordance with following:
 - 1. Relative Humidity Level per ASTM F2170: Less than 75 PCT.
 - 2. Alkalinity-pH per ASTM F710: Acceptable Range 7.0 pH to 9.0 pH.
- H. Section 07 16 05 Water Vapor Emission Control System is required where test results are found unacceptable per flooring manufacturer installation recommendations and requirements.

3.4 POST-INSTALLATION TESTING

- A. Coordinate and conduct tests for moisture vapor emissions and alkalinity reductions to comply with specifications prior to placement of self-leveling cementitious surfacing.
- B. Repair and re-test locations where system is found to be deficient prior to commencement of topping installation and scheduled floor covering products.

END OF SECTION

SECTION 07 16 05
WATER VAPOR EMISSION CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Water Vapor Emission Control System, as indicated, in accordance with provisions of Contract Documents.
- B. Coordinate with Section 01 35 32, Interim Infection Control Measures (IICM), and Section 07 16 04, Concrete Floor Moisture Testing, and work of other trades.

1.2 SYSTEM DESCRIPTION

- A. Water Vapor Emission Control System:
 - 1. Two component fluid applied epoxy based coating which restricts excessive levels of relative humidity and extreme alkalinity readings at below-grade, on-grade and suspended concrete floor slabs for compliance with subsequent floor coverings or coating materials.
 - 2. Primer:
 - a. One or two component non-porous moisture tolerant primer as recommended by manufacturer of control system.
 - 3. Cementitious Surfacing:
 - a. Self-leveling, calcium aluminate base formula.
 - b. Compressive strength: 4,100 PSI minimum.
 - c. Nominal thickness of 1/8 IN to 1/4 IN over treated floor surface as required by system manufacturer.
 - d. Provide smooth porous substrate suitable for application of finish flooring and moisture absorption from adhesive.
 - 4. Provide 100 PCT coverage of interior on grade, below grade, and slab on deck floor areas.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Minimum five (5) years in production of water vapor emission control system products.
 - 2. Meet source limitations and assume responsibility for performance of materials supplied by or approved by manufacturer.
 - 3. Product Liability Insurance in amount of not less than five (5) million dollars per occurrence.
 - 4. Warranty program covering cost associated with correction of system component failure, labor and collateral product failure as result, per section warranty requirements.
- B. Installer Qualifications:
 - 1. Firm with not less than five (5) years of successful installations.
 - 2. Equipment required to prepare concrete and apply products per manufacturers requirements for warranted installation.
 - 3. Submit minimum of five (5) project references of similar size and scope.
 - 4. Personnel employed by, trained or certified by, system manufacturer.
- C. Single source responsibility for Water Vapor Emission Control System including but not limited to:
 - 1. Mechanical preparation of concrete surfaces.
 - 2. Application of system components.
 - 3. Placement of cementitious surfacing.
- D. Install specified, or Manufacturer approved, products from one source to provide compatible products of consistent quality in appearance and physical properties.
- E. American Concrete Institute (ACI):

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
- F. ASTM International (ASTM):
1. ASTM D1308 Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 2. ASTM D7234 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
 3. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials
 4. ASTM F710 Preparing Concrete Floors to Receive Resilient Flooring
 5. ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride
 6. ASTM F2170 Standard Test Method for Determining Relative Humidity-RH in Concrete Floor Slabs Using in situ Probes.
 7. ASTM F3010 Standard Practice for Two-Component Resin Based Membrane Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings
- G. Provide products that do not contain, or are classified as:
1. More than 65 g/liter VOC content.
- H. Preconstruction Conference:
1. See Section 01 31 19.

1.4 SUBMITTALS

- A. Product Data:
1. Manufacturers' product data sheets, details and installation instructions including components and accessories, indicating product used in compliance with specifications.
- B. Project Information:
1. Independent ASTM testing reports.
 2. Manufacturer's installer certificate.
 3. Sample certificate of Warranty.
 4. Sample certificate of Product Liability Insurance.
 5. Manufacturer certification products comply with 1.3 Quality Assurance requirements.
 6. Minutes from Preinstallation Conference.
- C. Contract Closeout Information:
1. Warranty:
 - a. Provide upon completion of Water Vapor Emission Control System installation.
 2. Certificate of Product Liability Insurance.
 3. Test result documentation of post cure and post seal control application for alkalinity- pH tests.
 - a. Indicate test locations and results on electronic copy of floor plans.

1.5 SPECIAL WARRANTY

- A. Provide manufacturer materials and labor for repair or replacement of damaged finish flooring system and remedial work to replace Water Vapor Emission Control System in event of treatment system failure for a period of fifteen (15) years, including:
1. Deficiencies in system resulting from installation or manufacturing defects.
 2. Material and labor to replace damaged finish flooring due individually, or a combination of, concrete moisture, relative humidity, or alkalinity from substrate originated sources, joints, or cracks.
 3. Concrete cracks, joints and slab imperfections after application.
 4. Mitigation of biological growth, if present.
 5. ACI-318, dew point, concrete salts, admixtures, resin, and silicate surface treatments.
- B. Provide warranty underwritten by product liability insurance carrier having a minimum Secure "A" rating by A. M. Best, or equivalent rating system, in amount of five million dollars (\$5,000,000) per occurrence.

- C. Submit warranty as confirmation of compliance with warranty requirements prior to commencement of finished flooring materials.
 - 1. Include statement that substrate is prepared and ready to accept commercial floor covering products specific to project requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Water Vapor Emission Control System:
 - 1. Base:
 - a. Allied Construction Technologies, AC Tech 2170.
 - b. Apac, Apac 70.
 - c. Aquafin International, Vaportight Coat SG3.
 - d. Ardex Engineered Cements, MC PLUS Moisture Control.
 - e. Concrete Curative Systems, LLC. CCS - S2 Fast Cure System
 - f. Koster American, VAP I 2000.
 - g. Mapei, Planiseal VS.
- B. Other Manufacturers desiring approval comply with provisions in Section 00 26 00.

2.2 DESIGN CRITERIA

- A. Water Vapor Emission Control System Performance:
 - 1. Spread rate of water vapor emission control system shall maintain tolerances with following performance requirements after application:
 - a. Alkalinity (pH) resistance per ASTM F710: 14pH, 100 PCT resistant.
 - b. Relative Humidity (RH) per ASTM F2170: 100 PCT RH tolerant.
 - c. Moisture Vapor Emissions Rate (MVER) per ASTM F1869:
 - 1) no upper moisture limit:
 - 2. Adhesion strength per ASTM D7234: 100 PCT concrete failure.

2.3 MATERIALS

- A. Moisture Control System:
 - 1. For use over normal and lightweight concrete floor slabs, suspended, on grade and below grade.
 - 2. Two component fluid applied topical mitigation system.
 - 3. High density 100 PCT solids epoxy resin.
- B. Primer:
 - 1. As required and approved by manufacturer.
- C. Cementitious Surfacing:
 - 1. 4,100 PSI minimum.
- D. Testing: See Section 07 16 04.
 - 1. Concrete alkalinity-pH, and relative humidity-RH testing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Review concrete mix designs, admixtures, below slab vapor barrier and curing methods.
- B. Install in accordance with control system manufacturer instructions in compliance with independent testing agency test reports for digital alkalinity-pH per ASTM F710 and relative humidity RH per ASTM F2170.
- C. Installation constitutes acceptance of substrate and responsibility for system performance.

3.2 PREPARATION

- A. Protect work space and labor force from exposure to silica dust during preparation and application process per Section 01 35 32.
- B. Edge grind near wall base, columns, edges and difficult to reach areas prior to shot blasting.
- C. Abrade concrete surfaces using No. 390 - 420 shot to create an International Concrete Repair Institute (ICRI) No. 3 -5 profile or as recommended by water vapor emission control system manufacturer.
- D. Overlap edge grinding.
- E. Clean joints using a crack chasing blade to remove debris.
- F. Broom-sweep and vacuum surfaces slab surfaces to remove dust and debris.
- G. Do not use clean sweeping agents or chemicals to clean surface.

3.3 CONTROL SYSTEM COATING INSTALLATION

- A. Install system components with manufacturer trained, certified or employed personnel.
- B. Saturate cracks and joints with control system material to seal inner walls of crack or joint, then fill with flexible sealant or control system as recommended by manufacturer.
- C. Apply control system coating and surface irregularities with manufacturer approved two-component epoxy resin fill, and allow to cure and set prior to application of control system coating at rate recommended by manufacturer based upon test data.
- D. Allow to cure and set in accordance with manufacturers recommendations.
- E. Verify product thickness using a digital mil gauge at minimum of twenty (20) locations.
 - 1. Report results to manufacture's technical representative for written approval and warranty registration.

3.4 FIELD QUALITY CONTROL

- A. Prior to placement of cementitious surfacing, conduct post-installation testing for moisture vapor emissions and alkalinity at areas receiving Water Vapor Emission Control System.
 - 1. See Section 07 16 04.
- B. Correct deficiencies as recommended by manufacturer of Water Vapor Emission Control System, where tests do not meet specified levels.
- C. Final surfaces shall be compatible with floor coverings and require no special floor adhesives or methods and confirm products meet or exceed requirements of flooring covering sections.

3.5 CEMENTITIOUS SURFACING INSTALLATION

- A. Install cementitious surfacing after mil thickness testing verifies proper application rates of control system and testing reveals success in application
- B. If required by cementitious surfacing installation, apply primer over control system surfaces at rate and cure as recommended by manufacturer.
- C. Place cementitious surfacing a minimum of 1/8 IN to 1/4 IN thickness to produce smooth flooring compatible surface.
- D. Protect finished surfaces from construction damage, contamination of oil, grease, paint, excess water, and sweeping compounds prior to installation of finish flooring materials.

END OF SECTION

SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Building Insulation in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM:
 - a. C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - b. C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - c. C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 - d. C739, Standard Specification for Cellulosic Fiber Loose Fill Thermal Insulation.
 - e. C1289, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - f. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - g. E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - h. E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
 - i. E136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 DEGC.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Typical vapor retarder termination details at openings in walls, penetrations, and head and base of walls at floor and roof levels.
- B. Product Data:
 - 1. Manufacturers' product data sheets, details and installation instructions including components and accessories, indicating product is in compliance with specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Rigid Board Insulation Extruded Polystyrene (XPS):
 - 1. Base:
 - a. Dow Chemical.
 - 2. Optional:
 - a. Owens-Corning.
 - b. Pactiv Building Products.
- B. Rigid Fiber Insulation:
 - 1. Base:
 - a. Thermafiber, Inc., an Owens Corning company.
 - 2. Optional:
 - a. Rockwool.
- C. Mineral Fiber Spandrel Insulation:

1. Base:
 - a. Thermafiber, Inc., an Owens Corning company.
 2. Optional:
 - a. Rockwool.
 - b. Johns Manville.
- D. Fiberglass Batt Insulation:
1. Base:
 - a. Owens-Corning.
 2. Optional:
 - a. CertainTeed
 - b. Johns Manville.
 - c. Knauf Insulation.
- E. Vapor Retarder (VR):
1. Base:
 - a. Griffolyn, Reef Industries.
 2. Optional:
 - a. Lamtec.
- F. Other Materials:
1. Base:
 - a. As indicated.
- G. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Rigid Board Insulation - Extruded Polystyrene Foam (XPS):
1. Minimum Compressive Strength:
 - a. 25 PSI . (type IV).
 2. Minimum Surface Burning Characteristics per ASTM E84 and NFPA 268:
 - a. Flame Spread: 25 or less.
 - b. Smoke Developed: less than 450.
 - c. No ignition from radiant heat source.
 3. Water vapor permeance per ASTM E96:
 - a. 1.50 perm , maximum.
 4. Water absorption per ASTM D2842:
 - a. 0.3 PCT, maximum.
 5. Thermal resistance per ASTM C518:
 - a. R-value of 5.0 per IN at 75 DEGF mean temperature.
 6. Base Product:
 - a. Styrofoam by Dow.
 7. Optional:
 - a. GreenGuard by Pactiv Corporation.
 - b. Foamular by Owens Corning.
 8. Minimum thickness: 2 IN or as otherwise shown or required.
 9. Adhesives for adhering polystyrene insulation: As recommended by insulation manufacturer.
- B. Rigid Fiber Insulation:
1. Unfaced, non-combustible, water repellent, semi-rigid rock wool insulation board.
 2. Temperature Resistance: Per ASTM C612.
 - a. Over 2000 DEGF .
 3. Surface Burning Characteristics per ASTM E84.
 - a. Flame Spread: 0.
 - b. Smoke Developed: 0.
 4. Moisture Resistance: Absorbs less 0.03 PCT by volume, per ASTM C1104.
 5. R-value: 4.2 per IN .

6. Density: 4.5 PCF .
 7. Non-corrosive per ASTM C665.
 8. Thickness: As noted in drawings.
 9. Base: Thermafiber RainBarrier 45 Insulation.
 - a. Optional: Rockwool CavityRock MD.
 10. Mechanical fasteners; impaling clips/pins:
 - a. Pronged hangers and slotted washers or arrow pointed hangers.
 - b. Size pins to fit insulation thickness.
 - c. Base Product: GEMCO as manufactured by Goodloe E. Moore.
 - 1) Gemco pronged hanger with pronged washer.
 11. Mastic for use with mechanical fasteners:
 - a. Base Product: As approved by fastener manufacturer.
- C. Unfaced Fiberglass Batt Insulation:
1. Inorganic fibers and resinous binders formed into flexible blankets or semi-rigid sheets.
 2. Un-faced, Type I in accordance with ASTM C665.
 3. Minimum Surface Burning Characteristics per ASTM E84: Flame Spread: <25; Smoke Developed: <50.
 4. Combustion characteristics: Noncombustible; unfaced per ASTM E136.
 5. Manufactured without urea-formaldehyde binders.
- | | |
|-----------|------|
| 3-5/8 IN | R-13 |
| 6-1/2 IN | R-19 |
| 8-1/4 IN | R-25 |
| 10-1/4 IN | R-30 |
| 13 IN | R-38 |
6. Nominal Thickness / Thermal Resistance Value, measured at 75 DEGF :
 - a. Nominal Thickness: 6-1/2 IN / R-19 .
- D. Vapor Retarder (VR):
1. Three plies of low density polyethylene, bonded with two layers of scrim reinforcing.
 2. Fire retardant type: Flame Spread 5/ Smoke developed 90 per ASTM E84.
 3. Permeance: Not exceeding 0.015 Perm .
 4. Puncture Strength: 54 LBS .
 5. Base Product: Type 90 FR by Griffolyn.
 6. Optional Product: R-3035HD by Lamtec.
 7. Seaming Tape:
 - a. Self-adhering, asphaltic mastic.
 - b. Base Product: Fab Tape by Griffolyn.
 - c. Optional Product: 491 FSK by American Biltrite, Inc.
 8. Repair Tape, for punctures and other damaged areas:
 - a. Base Product: Griff Tape by Griffolyn.
 - b. Optional Products: Same products listed for optional seaming tapes.
- E. Sheet Metal Vapor Retarder:
1. Minimum 24 GA galvanized steel sheet metal.
 - a. Continuous taping flange.
 - b. Size: As required.
 - c. Profile: As required.
 2. Provide at interface of vapor retarder and steel structure adjacent to the exterior wall.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.

B. Installation indicates acceptance of responsibility for performance.

3.2 INSTALLATION

A. General:

1. Insulate full thickness over surfaces to be insulated.
2. Fit tightly around obstructions, fill voids.
3. Cover penetrations with insulation.
4. Comply with manufacturer's instructions for installation unless more stringent requirements are specified.
5. Consult manufacturer's technical representative if installation instructions are not applicable.
6. Apply rigid insulation over 2 IN thickness in double layer with staggered joints to achieve total thickness.
7. Do not use broken or torn pieces of insulation.
8. Provide minimum cover of 5/8 IN type X gypsum wallboard over exposed foam surfaces.

B. Un-Faced Batt Insulation and Vapor Retarder in exterior Stud Wall systems:

1. Installing Batts:
 - a. Friction fit un-faced batts between studs.
 - b. Tightly butt ends.
 - c. Where specified thickness of batts is less than the depth of framing, install retaining devices to prevent sagging.
2. Installing Vapor Retarder:
 - a. Position vapor retarder over inside face of framing.
 - b. Install vapor retarder in 50 IN wide sheets.
 - c. Install vapor retarder vertically.
 - d. Install in continuous sheets, floor to structure above, without horizontal joints.
 - e. Vertical Seams:
 - 1) Tape vertical edge of vapor retarder to stud.
 - 2) Position subsequent adjoining sheet and continuously tape vertical edge to preceding sheet.
 - f. Tape bottom and top edges to structure continuously.
 - g. Tape edges to window, door frames, and penetrations to maintain continuity.
3. Sealing vapor retarder to sheet metal vapor retarder continuous taping flange:
 - a. Include where wall adjoins steel columns, spandrel beams and similar structural steel members, and where indicated.
 - b. Install sheet metal vapor retarder continuous taping flange to flange of structural steel members prior to application of fireproofing.
 - 1) Seal to structure with urethane sealant and mechanical fasteners.
 - 2) Protect flange with masking tape to prevent accumulation of fireproofing over-spray.
 - 3) Remove masking tape after fireproofing application.
 - c. Prior to installation of vapor retarder tape: Clean taping flange to remove oily residue and remaining fireproofing over-spray, if present.
 - d. Continuously tape vapor retarder to previously installed taping flange.
 - 1) Seal vapor retarder to taping flange continuously, using vapor retarder tape specified.
 - 2) Optional: Continuous clips may be used in lieu of tape.
 - a) Product: Finish Trim No. 3910 by Trim-Tex.
4. Sealing vapor retarder at other areas of discontinuity:
 - a. Prior to installation of gypsum wallboard or other covering:
 - 1) Repair tears, flaw in seams and terminations with vapor retarder tape.
 - 2) Seal vapor retarder to conduit, electrical boxes, piping and other penetrating items using vapor retarder tape.

- b. Continuously seal or tape vapor retarder sheets to abutting materials and penetrations such as windows, doors, conduit, boxes, pipes or other items to maintain vapor tightness.
 - c. Continuously seal joints or voids in abutting materials and penetrations with sealant or tape as applicable to provide continuous vapor tightness.
- C. Rigid Board Insulation (XPS) at foundations:
- 1. Extend down for distance indicated in one layer.
 - a. If not indicated, extend down to design frost line.
 - 2. Install in mastic with tight joints on walls.
 - 3. Protect from damage and/or displacement during backfilling.
 - 4. Apply Concrete Faced Insulation Panel to exterior, exposed portions of foundation.
 - a. Install with concealed fasteners. Where exposed fasteners must be used, cover fastener head with sealant.
 - b. Seal exposed insulation with manufacturer's standard trim.
 - c. Seal joints between panels with concrete masonry sealant: See Section 07 92 13.
 - d. Miter outside corners and seal joint.
 - e. Finish exposed surfaces with Cementitious Dampproofing: See Section 07 11 16.

END OF SECTION

SECTION 07 54 25
FULLY ADHERED TPO ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Fully Adhered TPO Roofing in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer authorized roofing installer.
- B. Component products made by single manufacturer or approved for use with warranted system.
- C. ASTM International (ASTM):
 - 1. ASTM C1289, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 2. ASTM C1303 Standard Test Method for Predicting Long-Term Thermal Resistance of Closed-Cell Foam Insulation
 - 3. ASTM D6878 .
- D. American National Standards Institute (ANSI) / Single Ply Roofing Industry (SPRI):
 - 1. ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems
- E. National Roofing Contractors Association (NRCA):
 - 1. Roofing and Waterproofing Manual.
- F. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
 - 1. Architectural Sheet Metal Manual.
- G. Underwriters Laboratories (UL):
 - 1. UL 790, Standard for Tests for Fire Resistance of Roof Covering Materials.
- H. Concrete Moisture Vapor Testing:
 - 1. Coordinate maximum moisture allowed in concrete deck with roofing manufacturer.
 - 2. Test concrete decks for moisture in accordance with Section 07 16 04.
 - 3. If moisture content exceeds manufacturer's recommendation, install moisture control system per Section 07 16 05.
- I. Fire Resistance Rating:
 - 1. UL 790, Class A.
 - 2. Assembly in conformance with fireproofing as specified.
- J. Preinstallation Conference:
 - 1. See Section 01 31 19.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Roof layout showing insulation thicknesses and details.
 - 2. Indicate location of expansion joints, crickets, saddles, curbs, walkways, safety tiebacks, vents, drains and other penetrations.
 - 3. Indicate slope direction, slope amount, and key vertical elevation points.
 - 4. Profiles of flashing assemblies.
 - 5. Installation Drawings.
- B. Product Data:

1. Manufacturer standard literature for vapor barrier, insulation and roofing system components, including adhesives and accessories indicating compliance with specification requirements.
 2. Manufacturer standard literature for roof coping system indicating components and accessories including anchor plate configuration.
- C. Samples:
1. Roofing manufacturer's facsimile of each sheet metal color for pre-selection.
 2. 3 IN x 5 IN samples of roofing manufacturer's sheet metal color for final approval.
- D. Project Information:
1. Minutes from Preinstallation Conference.
- E. Contract Closeout Information:
1. Warranty.
 2. Maintenance Data:
 - a. See Section 01 78 23.

1.4 WARRANTY

- A. Fifteen (15) year warranty of weathertightness signed by roofing materials manufacturer.
1. Warranty to include coverage for peak gusts of wind to:
 - a. 55 MPH at 33 FT above ground.
 2. Warranty to include the entire system: membrane, flashings, adhesives, sealants, counterflashings, insulation, fasteners, fastener plates, fastener strips, hard rubber or metal edging, metal termination bars, sheet metal copings and edge metal, and other material authorized by manufacturer.
- B. Twenty (20) year warranty on 70 PCT PVDF (Kynar 500) coatings on edge metal and copings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fully Adhered TPO Roofing:
1. Base:
 - a. Carlisle SynTec
 2. Optional:
 - a. Firestone Building Products
 - b. GAF
 - c. Johns Manville
- B. Sheathing:
1. Base:
 - a. Georgia-Pacific.
 2. Optional:
 - a. Same as Membrane Manufacturer.
 - b. USG Corporation.
 - c. National Gypsum.
- C. Vapor Retarder (VR):
1. Base:
 - a. Same as Membrane Manufacturer.
- D. Walkways and Pavers:
1. Base:
 - a. Same as Membrane Manufacturer.
- E. Sheet Metal Coping and Edge Metal:
1. Base:
 - a. Provided by manufacturer of roofing system.

- F. Other Materials:
 - 1. Manufacturers as noted.
- G. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN CRITERIA

- A. Determine per Wind Load Design Guide for Low Sloped Flexible Membrane Roofing Systems published by SPRI.
- B. Design roof system and anchorage fastener type and spacing needed to resist uplift pressures including roof covering and metal edge securement to meet design loads and satisfy requirements of applicable building codes, local amendments, and ANSI/SPRI ES-1.
- C. Wind loads: Use the greater of the following:
 - 1. Wind pressures as required per local building code based on wind speed, exposure factor and importance factor noted in Structural Drawings.
 - 2. Wind pressures defined by California Building Code with OSHPD amendments.
- D. Requirements applicable to designated warranty.
- E. Roof height and parapet height: As indicated.
- F. Static pressure of building interior: < 0.5 IN water.

2.3 MATERIALS

- A. Sheathing:
 - 1. Install over steel deck or existing roofing materials.
 - 2. Moisture resistant gypsum core with fiberglass mat and non-asphaltic surfacing.
 - 3. Minimum Thickness: 5/8 IN.
 - 4. DensDeck Prime Roof Board by Georgia-Pacific.
- B. Vapor Retarder:
 - 1. Rubberized asphalt membrane adhered to polyethylene or polyolefin top sheet.
 - 2. 30 MIL thick, minimum.
 - 3. Vapor Permeance: Not exceeding 0.05 Perm .
 - 4. UV protected for 90 day exposure.
 - 5. Primer or adhesive as recommended for substrate by manufacturer.
 - 6. Base: Carlisle 725TR.
- C. Roof Insulation:
 - 1. Furnished by roofing manufacturer.
 - 2. UL listed for assembly indicated.
 - 3. Provide crickets and saddles as required.
 - 4. Polyisocyanurate (PISO) roof insulation:
 - a. Rigid, closed cell foam core bonded to heavy-duty glass fiber mat facers.
 - b. ASTM C1289 Type II, Class 1.
 - c. R-value: 5.6 per inch in accordance with ASTM C1303, CAN/ULC S770.
 - d. Compressive strength: 25 PSI minimum per ASTM D1621, Grade 3.
 - e. Dimensional stability: 2 PCT maximum linear change in seven days per ASTM D2126.
 - f. Minimum insulation thickness:
 - 1) Areas where tapered insulation is indicated:
 - a) Minimum R-30 at roof drains.
 - b) Taper to provide slope of 1/4 IN per FT .
 - 2) Areas with uniform insulation thickness (sloped structures):
 - a) Minimum R-30 at roof drains.
- D. Cover Board:
 - 1. Moisture resistant gypsum core with fiberglass mat and non-asphaltic surfacing.
 - 2. Minimum Thickness: 5/8 IN.
 - 3. DensDeck Prime Roof Board by Georgia-Pacific.

- E. TPO Roofing Membrane:
 - 1. Material: Thermoplastic Polyolefin (TPO) single-ply roofing membrane.
 - a. Fire Retardant.
 - b. Polyester fabric reinforced.
 - 2. Color: White.
 - 3. Thickness: 60 MIL thick.
 - 4. Minimum Physical Properties:
 - a. Thickness over scrim: 15 MIL by ASTM D4637.
 - b. Tearing Strength: 55 LBS MIN by ASTM D751.
 - c. Breaking Strength: 225 LBS MIN by ASTM D751.
 - d. Heat Aging: retain 90 PCT of original Breaking Strength and Elongation values.
 - e. Weather Resistance: 10,080 kJ/m² by ASTM G155.
 - 5. Base Product: SureWeld by Carlisle SynTec.
- F. Membrane flashings, fasteners, adhesives, tapes, cements and sealants:
 - 1. Roofing manufacturer's standard.
- G. Edge Metal and Coping:
 - 1. Roofing Manufacturer's pre-engineered, prefabricated system for termination of roofing membrane.
 - 2. Field fabricated components approved by roofing manufacturer for warranted system.
 - 3. Fasteners concealed from view.
 - 4. Concealed splice plates, with color matching snap-on covers.
 - 5. Anchor cleats:
 - a. Material: G90 galvanized steel.
 - b. Thickness: 20 GA.
 - 6. Snap-on cover:
 - a. Material: G90 galvanized steel.
 - b. Thickness:
 - 1) For dimensions less than 10 IN : 24 GA .
 - 2) For dimensions 10 to 24 IN : 22 GA .
 - c. Finish: 70 PCT PVDF Kynar 500.
 - d. Color:
 - 1) To be selected from manufacturers standard colors by Architect.
 - 7. Wind Rating: Design for pressure indicated for balance of roof system.
 - 8. Coverage of these items to be included in roof system warranty.
 - 9. Comply with applicable standards.
 - 10. Roof Edge/Fascia:
 - a. Match profiles indicated.
 - b. Include accessories such as pre-fabricated inside and outside corners, Overflow and Downspout Scuppers, Edging Extensions, Fascia Sumps, and other items indicated.
 - c. Base: SecurEdge 200 Fascia by Carlisle SynTec.
 - 11. Coping:
 - a. Match profiles indicated.
 - b. Include accessories such as pre-fabricated inside and outside corners (seamed), End Caps, Saddles, Tee's, Crosses, Transition Pieces and Radiused Copings, and other items indicated.
 - c. Base: SecurEdge 200 Coping by Carlisle SynTec.
- H. TPO Walkway Roll:
 - 1. Manufacturer's standard walkway roll stock, designed to protect TPO roof membrane.
 - a. Slip-resistant surface.
 - 2. Nominal Thickness: 160 MIL .
 - 3. Size: 34 IN x 50 FT roll.
 - 4. Secure to roof membrane by heat welding.
 - 5. Discontinue walkway at roof membrane seams.
 - 6. Color:

- a. To be selected from manufacturers standard colors by Architect.
7. Base Product: Sure-Weld Walkway Roll by Carlisle SynTec.

2.4 COLOR COATING

- A. Nailing Strips:
 1. As detailed and required.
- B. Pipe Flashings:
 1. Provide for each pipe penetration; include clamps, adhesive and sealants.
- C. Underlayment for Pavers:
 1. As recommended by roofing manufacturer.
- D. Adhesives, Cleaners, and Primers:
 1. As recommended by roofing manufacturer.
- E. Fire-Retardant Treated (FRT) Wood Blocking:
 1. See Section 06 10 53.
- F. Other Materials as required by manufacturer for complete system warranty.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect entire area to be roofed for acceptability.
- B. Ensure substrate for insulation or roofing membrane is clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges and foreign materials.
- C. Correct unsatisfactory conditions.
- D. Commencement of roofing activities constitutes acceptance of all conditions affecting installation and roofing system performance.

3.2 INSTALLATION

- A. Sheathing:
 1. Install per UL requirements.
 2. Lay sheathing tightly butted and cut to fit around penetrations.
 3. Attach sheathing to deck in accordance with roofing manufacturer's recommendations.
- B. Vapor Retarder:
 1. Install in largest practical widths.
 2. Bond vapor retarder to substrate using approved adhesive.
 3. Install continuously.
 - a. Ensure surfaces to be taped are clean and dry.
 - b. Ensure that no discontinuities occur, including at seams, penetrations, and edge terminations.
 - c. Join sections of vapor retarder and lap seams in direction of water flow.
 - d. Continuously seal roof vapor retarder to wall air and moisture retarder.
 4. Seal around pipes, conduits, curbs, safety tie-backs, and other penetrations with pipe boots in accordance with manufacturer's instructions.
 5. Maintain continuity of vapor retarder over expansion joints.
 6. Repair holes in vapor retarder with method and material recommended by manufacturer.
 7. Protect vapor retarder from damage until covered with insulation.
- C. Wood Nailers:
 1. Design to resist a minimum of 200 LBS/LF in any direction per SPRI Test Method RE-1.
 2. Provide where indicated or required for proper securement of roofing system.
 3. Install top of blocking flush with top of insulation.

- D. Insulation:
 - 1. Where required thickness of insulation is greater than 2 IN : Install insulation in at least 2 layers.
 - 2. Stagger board joints in successive layers laterally and longitudinally.
 - 3. Butt joints tightly.
 - 4. Cut insulation neatly to fit around roof penetrations and projections.
 - 5. Secure insulation with approved adhesive.
- E. Membrane:
 - 1. Unroll and position membrane without stretching.
 - a. Allow membrane to relax prior to bonding.
 - 2. Position sheets to accommodate contours of roof deck.
 - 3. Apply bonding adhesive in accordance with the manufacturer's instructions, to exposed underside of the membrane and the corresponding substrate area.
 - 4. Protect membrane from stains/discoloring caused by adhesives.
 - 5. Membrane Splices:
 - a. Hot air weld TPO membrane sheets using Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's hot air welding procedures.
 - b. Locate field splices away from low areas and drain sumps.
 - c. Shingle field splices to avoid bucking water.
 - d. Probe seams once the hot air welds have thoroughly cooled.
 - e. Repair seam deficiencies same day they are discovered.
 - f. Apply sealant of type recommended by membrane manufacturer on cut edges of reinforced membrane where scrim reinforcement is exposed after seam probing is complete.
 - 6. Secure membrane along the perimeter of each roof level, roof section, curb, skylight, penthouse, and other penetrations as recommended by membrane manufacturer.
 - 7. Flashing:
 - a. Follow manufacturer's typical flashing procedures for wall, curb, and penetration flashing including metal edging/coping and roof drain applications.
 - b. Flashing of parapets, curbs, expansion joints and other parts of roof must be performed using reinforced TPO membrane.
 - c. Manufacturer's standard, non-reinforced TPO membrane can be used for flashing pipe penetrations, sealant pockets, scuppers, as well as inside and outside corners when use of pre-fabricated accessories is not feasible.
 - d. Terminate base-of-wall flashings in accordance with manufacturer's approved details.
 - e. Pre-flashing at sheet metal parapet copings:
 - 1) Extend TPO membrane, flashing or both over top of parapet prior to capping with sheet metal.
 - f. Expansion Joints:
 - 1) Extend TPO membrane across roofing expansion joints.
 - 2) Include adequate slack in membrane to accommodate anticipated movement.
 - 8. Hot or Cold Weather Procedures:
 - a. Comply with manufacturer's instructions.

3.3 INSTALLATION - EDGE METAL AND COPING

- A. Sub-flash details with a layer of TPO membrane prior to installation of edge metal or coping system.
- B. Secure anchor cleat to blocking as recommended, using corrosion-resistant fasteners.
- C. Install splice plates and snap-on covers.

3.4 INSTALLATION – WALKWAYS

- A. Install walkways at traffic concentration points, such as roof hatches, access doors, rooftop ladders, or locations as indicated.
- B. Do not locate within 10 FT of roof edge.

- C. Clean surfaces to be bonded.
- D. Secure by heat welding as recommended by membrane manufacturer.

3.5 PROTECTION

- A. When completion of flashings and terminations is not achieved by end of work day, seal system to temporarily prevent water infiltration.
- B. Remove temporary water cutoffs prior to proceeding with Work.
- C. Remove and replace wet insulation.

3.6 SCHEDULE OF ROOF SYSTEMS

- A. Roof System 1 – Fully Adhered TPO over Steel Deck:
 - 1. Gypsum Sheathing.
 - 2. Insulation.
 - 3. Cover Board.
 - 4. TPO Membrane.
- B. Roof System 2 – Fully Adhered TPO over Concrete Deck:
 - 1. Insulation.
 - 2. Cover Board.
 - 3. TPO Membrane.
- C. Roof System 3 – Fully Adhered TPO over Concrete Deck at Precast Concrete Pavers:
 - 1. XPS Insulation.
 - 2. Cover Board.
 - 3. TPO Membrane.

END OF SECTION

SECTION 07 62 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Flashing and Sheet Metal, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 2. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM B209 Standard Specification for Aluminum-Alloy Sheet and Plate
 - 4. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes
 - 5. ASTM B308/B308M Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
 - 6. ASTM F2329/F2329M Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
- B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1. Architectural Sheet Metal Manual

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Dimensioned drawings of profiles and shapes.
 - 2. Plans and elevations to show locations of each shape.
- B. Samples:
 - 1. For finish, color and color range selection.
- C. Contract Closeout Information:
 - 1. Warranty

1.4 WARRANTY

- A. Furnish twenty (20) year finish warranty on PVDF coated sheet metal, covering color, fade, chalking and film integrity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Formed Sheet Metal items:
 - 1. Base:
 - a. Ryerson Metals, ColorKlad.
 - 2. Optional:
 - a. Berridge Manufacturing Company.
 - b. Petersen Aluminum, PAC-CLAD.
- B. Sheet metal systems:

- 1. Optional:
- C. Reglets:
 - 1. Base:
 - a. Fry Reglet.
- D. Roofing expansion joint cover:
 - 1. Base:
 - a. Johns Manville.
- E. Other materials:
 - 1. Base:
 - a. Manufacturers as noted.
 - 2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Sheet Metal – Galvanized Steel with PVDF coating.
 - 1. ASTM A653/A653M galvanized steel, Z275 G90.
 - 2. Minimum thickness: 0.024 IN or as noted for individual fabrications.
 - 3. Smooth
 - 4. PVDF coating: Minimum 1 MIL fluorocarbon coating, 70 PCT PVDF.
 - a. Color:
 - 1) Custom color to match existing

2.3 SHEET METAL FABRICATIONS

- A. Formed Roof Edge Flashing, Gravel Stop and Fascia Coping:
 - 1. Fabricate to size and profile indicated.
 - 2. Supply sections with minimum length of 96 IN , but not exceeding 10 FT .
 - 3. Joint Style:
 - a. 1/4 IN Butt Joint with 6 IN wide, exposed cover plate
 - 4. Integral Scuppers:
 - a. Locate integral scuppers along length of roof edge.
 - 1) Space 10 FT apart where continuous gutter is indicated.
 - b. Fabricate to dimensions indicated. Include a minimum 4 IN wide flanges on 3 sides for embedment into roofing system.
 - c. Fasten gravel guard angles to base of scupper where applicable.
- B. Formed Sheet Metal Copings:
 - 1. Fabricate to size and profile indicated.
 - 2. Supply sections with minimum length of 96 IN , but not exceeding 10 FT .
 - 3. Fabricate joint plates of same sheet thickness as copings.
 - 4. Securement:
 - a. External Leg: Continuous cleats, no exposed fasteners.
 - b. Internal Leg: Color-matched fasteners in slotted holes.
 - 5. Miter corners, seal, and solder or weld watertight.
 - 6. Joint Style:
 - a. 1/4 IN Butt Joint with 6 IN wide, exposed cover plate
- C. Hanging Gutters:
 - 1. Fabricate to size and profile indicated, complete with end pieces, outlet tubes, and other accessories as required.
 - a. Gutters shall be complete with mitered corners, end caps, and outlets sized to fit downspouts.
 - 2. Material:

Hanging Gutters - Minimum Sheet Thickness / Weight	
Material	Gutter Girth

	up to 20 IN up to 520 MM	21 to 25 IN 521 to 650 MM	26 to 30 IN 651 to 770 MM	31 to 35 IN 771 to 890 MM
PVDF coated Galvanized Steel	0.024 IN 0.61 MM	0.034 IN 0.864 MM	0.040 IN 1.016 MM	0.052 IN 1.132 MM
PVDF coated Galvanized Steel	0.040 IN 1.016 MM	0.050 IN 1.27 MM	0.063 IN 1.6 MM	-
PVDF coated Galvanized Steel	0.019 IN 0.483 MM	0.025 IN 0.635 MM	0.031 IN 0.787 MM	0.038 IN 0.965 MM

3. Fabricate sections in maximum lengths practical; not less than 96 IN long.
4. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice gutter thickness.
5. Fabricate expansion joints, expansion joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
6. Gutter supports shall be adjustable minimum 1 IN wide by minimum 0.080 IN thick hanger, provided in sufficient number to be located at maximum 30 IN on center, or minimum 0.032 IN thick continuous cleats.
7. Expansion Joints: Lap or Butt types.

D. Through Wall Parapet Scuppers:

1. Fabricate to dimensions indicated with closure flange trim to exterior, 4 IN wide wall flanges to interior, and base extending 4 IN beyond cant or tapered strip into field of roof.

E. Conductor Heads:

1. Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shapes indicated.
2. Include outlet tube and exterior flange trim.
3. Include built-in overflows where indicated.

2.4 ACCESSORIES

A. Fasteners:

1. Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by flashing manufacturer.
2. Blind fasteners or self drilling screws, gasketed, with hex-washer head.
3. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
4. Blind Fasteners: High strength aluminum or stainless steel rivets suitable for metal being fastened.
5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
6. Fastener Materials:
 - a. Fasteners for Galvanized Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329/F2320M.

B. Cleats:

1. 16 GA galvanized or stainless steel.

C. Dissimilar metal and cementitious materials protection:

1. Alkali resistant bituminous paint.
2. Tnemec Tneme Tar 46-413.

D. Base Flashing:

1. Fabricate to size and profile indicated.

E. Counterflashing and Flashing Reglets:

1. Fabricate to size and profile indicated.
2. Provide interior and exterior preformed corners as required.
3. Fabricate as required to fit special conditions.

- F. Roof Expansion Joint Cover:
 - 1. Flexible, insulated bellows.
 - 2. 36 MIL thick chlorinated polyethylene sheet permanently anchored between and sealed to stainless steel flanges
 - 3. Insulate with 3/8 IN thick closed cell foam
 - 4. Provide in maximum available lengths
 - 5. Corners and intersections: Manufacturer's standard prefabricated units.
 - 6. Splicing strips and adhesives: Manufacturer's standard neoprene splicing strips and adhesives.
- G. Sealants: Specified in Section 07 92 13.

2.5 FABRICATION

- A. General:
 - 1. Fabricate true and sharp to profiles and sizes indicated.
 - 2. Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA Architectural Sheet Metal Manual, that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated.
 - 3. Shop fabricate items to greatest extent possible.
 - 4. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 5. Form sheet metal flashing and trim without oil canning, buckling, and tool marks, true to line and level indicated, with exposed edges folded back to form hems.
 - 6. Conceal fasteners and expansion provisions where possible. Exposed fasteners not allowed on faces exposed to view.
- B. Fabrication Tolerances:
 - 1. Fabricate sheet metal flashing and trim to tolerance of 1/4 IN per 20 FT on slope and location lines as indicated and within 1/8 IN offset of adjoining faces and alignment of matching profiles.
- C. Sealed Joints: Form movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 IN deep. Fill with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA Architectural Sheet Metal Manual for application, but not less than thickness of metal being secured.
- G. Seams in metals with painted, coated or lacquered finishes:
 - 1. Fabricate nonmoving seams with flat-lock seams.
 - 2. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
- H. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

- A. Verify suitability of substrates to accept work.
 - 1. Verify continuous wood blocking sloped 1:12, and covered with one layer of building paper or roofing membrane.
- B. Installation constitutes acceptance of conditions and responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. Install in accordance with details and recommendations of SMACNA, current edition.
- B. Set shop fabricated interior and exterior preformed corners and intersections.
- C. Set top edges of flashings into reglets as indicated.
- D. Fasten materials at recommended intervals.
- E. Provide slip joints to allow for thermal movement.
 - 1. Use SMACNA Table 3-1, Design J9 - J12, with caulked lap.
 - 2. Maximum spacing: 10 FT on center.
 - 3. Provide slip joint in conjunction with splices and corners.
- F. Caulk joints with 2 beads of sealant on each overlap: See Section 07 92 13.
- G. Turn down cap flashing over base flashings 4 IN and caulk.
- H. Form flashings to provide spring action with exposed edges hemmed or folded.
- I. Provide dissimilar metals and materials protection where dissimilar metals come in contact, or where sheet metal contacts mortar or concrete.
- J. Provide miscellaneous sheet metal items not specifically covered elsewhere, as indicated or required to provide a weathertight installation.

3.3 INSTALLATION – GUTTERS AND DOWNSPOUTS

- A. Install gutters below slope line of roof, supported on adjustable hangers spaced maximum 30 IN on center or by continuous cleats.
- B. Join gutter sections with flat locked, riveted and sealed joints with hard setting sealant fill.
- C. Adjust gutters to slope uniformly to downspout outlets, with high point midway between outlets.
- D. Install downspouts supported by leader straps or concealed rack and pin type fasteners at top, bottom and intermediate points not exceeding 5 FT on center.
- E. Install downspout 1 IN clear of building wall.

3.4 INSTALLATION – FORMED COPINGS AND FORMED ROOF EDGES

- A. Prefabricated corner sections with no joint within 30 IN of corners.
- B. Space gutter bars and anchor bolts as recommended by coping manufacturer for installation indicated.
- C. Conceal joints with cover plates and top of adjacent wall counter flashing under coping leg.

3.5 INSTALLATION - ROOFING EXPANSION JOINT COVERS

- A. Comply with manufacturer's instructions for handling and installation of elastic expansion joint materials.
- B. Coordinate installation and associated work to provide a complete system.
- C. Extend over curbs, parapets, gutters, valleys, fascias and other elements in construction, to provide continuous, uninterrupted, watertight expansion joint.
- D. Provide uniform hump throughout length of installation.
- E. Do not stretch elastic sheet.
- F. Anchor edges of units and seal in compliance with manufacturer's instructions.

3.6 CLEAN-UP

- A. Upon completion of work, repair damaged areas.

- B. Repair finish of PVDF coated flashing which fades or is damaged.
- C. Clean stains and debris.
- D. Remove protective coverings.

END OF SECTION

SECTION 07 72 13
PREFABRICATED ROOF CURBING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for roof curbs, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- B. National Roofing Council of America (NRCA):
 - 1. Roofing Manual.
- C. American Welding Society (AWS):
 - 1. Welding codes, specifications, manuals and handbooks..
 - 2. Qualify welding processes and operations in accordance with AWS Standard Qualification Procedure.
- D. Provide Prefabricated Roof Curbing engineered to support dead, live, and lateral (wind or seismic) loads indicated.
 - 1. Comply with Section 01 71 21, Specialty Engineering Requirements.
 - 2. Include headers and reinforcing members around openings.
 - 3. Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Layout including size, location and type of each curb.
 - 2. Indicate framing, blocking and anchorage details.
- B. Product Data:
 - 1. Materials and general construction features of each curb type.
- C. Project Information:
 - 1. Manufacturer's load tables.
 - 2. Seismic certification where required by AHJ. Coordinate with Division 01 and Section 20 05 48 specifications.
 - 3. Structural calculations for Prefabricated Roof Curbing indicating design conforms to specified design criteria, sealed by the Specialty Structural Engineer.
 - a. Submit concurrent with Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Prefabricated Roof Curbing:
 - 1. Base:
 - a. Thybar Corporation/ThyCurb.
 - 2. Optional:
 - a. Curbs Plus Inc.
 - b. Roof Products, Inc.

- c. Roof Products Systems Corporation (RPS).
- 3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIAL

- A. Shell, Liner, and Base:
 - 1. Galvanized steel ASTM A653, G60.
 - 2. Thicknesses as indicated for each curb type.
 - 3. Paint exposed portions in field.
 - 4. Integral Base Plate.
- B. Insulation:
 - 1. Factory installed 1-1/2 IN thick, 3 PCF density fiberglass.
- C. Wood Nailers:
 - 1. Factory-installed, pressure-treated wood.
 - 2. Sizes as indicated.
- D. Provide splice plates, connector clips and integral crickets as required.
- E. Provide sloped transition units as required.
- F. Construct curbs in maximum practical lengths, with fully mitered and welded corners at intersections and closed end sections.
- G. Roof Curbing:
 - 1. Prefabricate roof curbs to elevate fans, condensers and other rooftop equipment.
 - 2. Sizes: As indicated on roof plan.
 - 3. Material thickness (outer shell & base flange):
 - a. Min 0.053 IN (16 GA).
 - 4. Material thickness (liner):
 - a. Min 0.042 IN (18 GA).
 - 5. Wood nailer: Nominal 2x2.
 - 6. Internal Reinforcing:
 - a. Provide lateral stiffeners at not more than 36 IN OC
 - b. Same gauge as outer shell.
 - 7. Curb Height: Minimum 8 IN from the surface of the roof membrane to top of curb.
 - 8. Base product: TC-3 by Thybar Corporation.
- H. Roof Curbs Surrounding HVAC Ducts:
 - 1. Description: Prefabricated roof curbs, as described above, with additional Damper Tray.
 - 2. See Mechanical Drawings for Fire Dampers & Ducts.
- I. Pipe Curb and Cap Assemblies:
 - 1. Description: Prefabricated roof curb and cap assembly designed to seal around piping, conduit and similar items which pass through roofing.
 - 2. Base Curb:
 - a. Material Thickness (outer shell, base flange, and liner): 18 GA minimum.
 - b. Size: 15 IN x 15 IN.
 - 3. Curb Height: Minimum 8 IN from the surface of the roof membrane to top of curb.
 - 4. Base Product: TC-3 by Thybar Corporation.
 - 5. Curb Cap (top-outlet pipes):
 - a. ABS thermoplastic korad acrylic cover, graduated boots molded of weather-resistant Plastisol and 2 stainless steel pipe clamps per boot.
 - b. Base Product: TCC-1, TCC-3 or TCC-5 by Thybar Corporation. Contractor to select appropriate cap model for pipe quantity and sizes.
 - 6. Curb Cap (side-outlet pipes):
 - a. Sheet metal or ABS cover with horizontally projecting hood flanges.
 - b. 2x8 preservative treated wood nailer (vertical) on side where pipes exit.
 - c. Base Product: TP-2 by Thybar Corporation.

- J. Curb and Solid Cap Assemblies:
 - 1. Description: Prefabricated roof curb and solid cap assembly designed to seal-off a curbed opening for future use.
 - 2. Base Curb:
 - a. Material Thickness (outer shell, base flange, and liner): Min 0.042 IN (18 GA).
 - b. Size: As indicated.
 - 3. Curb Height: Minimum 8 IN from the surface of the roof membrane to top of curb.
 - 4. Wood Nailer: Nominal 2x2.
 - 5. Base Product: TC-3 by Thybar Corporation.
- K. Solid Cap (no penetrations):
 - 1. Definition: Custom sheet metal cap used to cap Curb for future use.
 - 2. Sub-Frame:
 - a. Cold-formed steel members designed for roof loads anticipated.
 - 3. Plywood Sheathing: Type:
 - a. Preservative-treated, structural grade, CDX or better.
 - b. Min Thickness: 3/4 IN.
 - 4. Sheet Metal Cap:
 - a. Min 0.042 IN (18 GA) steel.
 - b. Uniformly slope to drain.
 - 5. Base Product: custom item by Thybar Corporation.
- L. Straight Curbs:
 - 1. Prefabricated roof curbs designed to support and elevate fans, condensers and other roof-top equipment.
 - 2. Curb Lengths and Spacing: As indicated on Roof Plan.
 - 3. Curb Width: Matching width of Nailer.
 - 4. Material Thickness (shell, base flange & counterflashing):
 - a. Min 0.067 IN (14 GA).
 - 5. Wood Nailer:
 - a. Nominal Size: 2x6.
 - 6. Internal Reinforcing/Gussets:
 - a. Provide lateral stiffeners at not more than 36 IN OC
 - b. Same gauge as shell.
 - 7. Curb Height: Minimum 8 IN from the surface of the roof membrane to top of curb.
 - 8. Base Product: TEMS-3 by Thybar Corporation.

2.3 RELATED ITEMS – SPECIFIED ELSEWHERE

- A. Vibration Isolation Devices: Specified in Section 20 05 50.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which curbs are to be installed for conditions detrimental to proper and timely completion of work.
- B. Start of installation constitutes acceptance of responsibility for correct installation and performance.

3.2 INSTALLATION - GENERAL

- A. Install units and accessories as indicated.
- B. Coordinate installation with decking, roofing, and equipment to be supported.
- C. Do not start placement until deck work is complete.
- D. Do not overload supporting members.

- E. Install metal closure and flashing strips required.
- F. Caulk units as required for weather tightness.
- G. Provide pedestals and curbs with load carrying capacities adequate for items being supported.
- H. Provide roof pedestals for roof-mounted pipe and ductwork.
- I. Provide roof pedestals or curbs for roof-mounted equipment.
 - 1. Use curb only when interior of curb is completely protected from weather by item being supported.
- J. Verify attachments have been installed, to both roof construction and supported equipment/components, in accordance with seismic and wind load requirements.

3.3 CLEAN AND TOUCH-UP

- A. Wire brush, clean and touch up scarred areas, welds and rust spots.
- B. Touch-up damaged galvanized surfaces with galvanizing repair paint.

END OF SECTION

SECTION 07 81 23
INTERIOR INTUMESCENT FIREPROOFING (IFP)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Interior Intumescent Fireproofing (IFP), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications:
 - 1. Approved by manufacturer of intumescent fireproofing for application.
 - 2. Personnel trained and qualified in techniques and procedures for proper application.
- B. Minimum of five (5) years successful experience in application Interior Intumescent Fireproofing.
- C. Primers, Undercoat Materials, Intumescent Fireproofing and Protective Finish Topcoat:
 - 1. Products of or approved by, single intumescent fireproofing manufacturer.
- D. ASTM International (ASTM):
 - 1. ASTM D2240 Standard Test Method for Rubber Property Durometer Hardness.
 - 2. ASTM D2794 Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - 3. ASTM D4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Tabor Abraser.
 - 4. ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - 5. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
- E. Warnock Hersey Certification Listings.
- F. Underwriters Laboratories (UL):
 - 1. ANSI/UL263 Fire Tests of Building Construction and Materials .
- G. Underwriters Laboratories Canada (ULC) CAN/ULC-S101.
- H. National Fire Protection Association (NFPA):
 - 1. NFPA 251 Standard Test Methods of Fire Endurance of Building Construction and Materials.
- I. Association of the Wall and Ceiling Industries International (AWCI):
 - 1. AWCI Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide.
- J. Steel Structures Painting Council (SSPC) PA-2.
- K. Regulatory Requirements:
 - 1. Conform to applicable codes for following ratings:
 - a. Flame spread.
 - b. Fuel contributed.
 - c. Smoke developed.
 - d. Volatile organic compound (VOC).
 - e. Fire resistance.

1.3 SUBMITTALS

- A. Product Data:

1. Data indicating physical properties of proposed products.
- B. Samples:
1. Topcoat colors for selection by Architect.
- C. Project Information:
1. Test reports.
 2. Schedule of intumescent fireproofing for specific structural elements, selected and prepared under direction of fireproofing manufacturer, indicating location of proposed products including:
 - a. Complete Warnock Hersey or UL design data for each system selected.
 - b. Dry film thickness of intumescent fireproofing for specific structural elements.
- D. Contract Closeout Information:
1. Letter of Certification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Interior Intumescent Fireproofing (IFP):
1. Base:
 - a. Carboline
 2. Optional:
 - a. Albi Manufacturing
 - b. Hilti, Inc.
 - c. Isolatek International
 - d. Promat Firetemp
 - e. Sherwin-Williams
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN CRITERIA

- A. Select UL approved fireproofing assemblies which meet or exceed hourly fire resistive requirements.
- B. Restraint classification of structural members: Restrained or unrestrained as defined by ASTM E119.
- C. Utilize fireproofing systems which have been tested for use in proposed manner.
- D. Comply with Section 01 41 00 as it applies to building occupancy and construction type.
- E. See Drawings for minimum fire resistance of building structural elements.
- F. Minimum hourly fire resistance of building structural elements:

Minimum Fire Resistance Requirement – 2012 IBC Construction Type I-A	
Building Element ¹	Minimum Fire Resistance Requirement
Primary Structural Frame ²	3-Hour
Primary Structural Frame ² supporting Roof only	2-Hour
Floor Decking and Secondary Structural Members	2-Hour
Roof Decking and Secondary Structural Members	1-1/2 Hour

Footnotes

1. As defined by Building Code.

Minimum Fire Resistance Requirement – 2012 IBC Construction Type I-A	
Building Element ¹	Minimum Fire Resistance Requirement

2. Columns and Girders/Beams/Trusses having direct connections to columns. Members not directly connected to columns are considered secondary members.

1. Determine where fireproofing is required to provide fire resistance protection of structural elements indicated in the drawings.
- G. Determine where fireproofing is required to provide fire resistance protection of structural elements indicated by tabular values above.
- H. Provide services of manufacturer's field service representative prior to, and during application for purposes of:
 1. Checking surfaces which fireproofing is to be applied for proper preparation.
 2. Provide instructions and technical assistance.
- I. Do not install fireproofing until structure is sufficiently enclosed and roofing is installed to prevent damage to material.
- J. Sequence and coordinate application of intumescent fireproofing with other construction operations to comply with following requirements.
 1. Prevent deterioration of fireproofing material due to exposure to weather or unfavorable ambient conditions of humidity, temperature or ventilation.
- K. Avoid exposure of fireproofing material to moisture, abrasion and other damage caused by construction operations after application.

2.3 MATERIALS

- A. Products formulated for use on interior, non-wet, areas.
- B. Refer to Section 07 81 24 for intumescent products to be used for exterior conditions and wet areas.
- C. Product/Systems Testing. Any of the following:
 1. Listed by ULI and bearing the UL label.
 2. Listed by ITS/WH and bearing ITS/WH label.
 3. Listed by FM and bearing the FM mark.
- D. Fire resistance:
 1. 2-hour unless otherwise noted.
 2. 1-hour unless otherwise noted.
- E. Final finish:
 1. Smooth to slight orange peel.
- F. Primer:
 1. Select from manufacturer's list of approved primers, and according to substrate type, quality and conditions.
- G. Fireproofing:
 1. Water-based, thin film, intumescent fireproofing.
 2. Base Product: AD Firefilm III by Carboline.
 3. Physical Properties:
 - a. Durometer Hardness : 65 Shore D by ASTM D2240.
 - b. Impact Resistance: 152 IN-LB by ASTM D2794.
 - c. Abrasion Resistance: less than 0.26 grams per 1000 cycles by ASTM D4060.
 - d. Bond Strength: 125 PSI by ASTM D4541.
- H. Topcoat:
 1. Single-component, low VOC, silicone alkyd or latex acrylic coating.

2. Gloss rating:
 - a. Semi-gloss.
3. Color:
 - a. Selected by Architect
 - b. Color: _____.
4. Base Product: AD Colorcoat by Carboline.

2.4 MIXING

- A. Obtain pre-blended material from factory.
- B. Mix gently in order to minimize introduction of air to product.
- C. Do not add water or solvent at site.

2.5 SPRAY APPLICATION EQUIPMENT

- A. Spray equipment:
 1. Capacity, pressure, tip sizes: Comply with manufacturer's requirements.
- B. Dry film thickness gage to provide measurements complying with SSPC PA-2.
- C. Air movement and dehumidification equipment approved by manufacturer of intumescent fireproofing.
- D. Roller or brush applications will not be accepted unless approved by Architect.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrates to accept application.
 1. Correct defects, including but not limited to solvent based identification markings on steel and weld flashes.
 2. Verify ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is complete.
- B. Verify that substrate surfaces are ready to receive work.
 1. Clean steel surfaces in accordance with Commercial Blast Cleaning SSPC-SP6/NACE No.3.
 2. Grind welds smooth.
 3. Remove existing coatings including non-compatible primers, paints, coatings and mill scale.
- C. Verify clips, hangers, sleeves and similar devices have been attached.
- D. Prime steel surfaces with primer approved by intumescent product manufacturer.
- E. Start of application constitutes acceptance of conditions and responsibility for performance.

3.2 APPLICATION

- A. General:
 1. Comply with manufacturer's product data, including technical bulletins, product catalogue, application instructions and product markings for installation.
 2. Apply spray method, utilizing brush or roller application only when spray application is not practical.
 - a. Comply with manufacturer's requirements for application equipment, capacities, application pressures, tip sizes, etc. in order to achieve a smooth finish with minimum of orange peel texture.
 3. Allow materials and substrate steel to reach same temperature before application, by storing unopened containers in area of application.
 4. Apply in accordance with manufacturer's and Warnock Hersey or UL requirements.

B. Primer:

1. Prime steel surfaces with compatible primer approved by manufacturer of intumescent fireproofing to ensure adhesion.
- C. Fireproofing:
1. Thoroughly mix products and apply in sufficient thickness to achieve fire resistance rating indicated.
 2. Keep container covered to the maximum extent during application.
 3. Limit each coat of application to not more than 30 mils wet thickness, or approximately 23 mils DFT.
- D. Topcoat:
1. Do not apply topcoat until required dry film thickness (DFT) of the intumescent and basecoat layers has been met.
 2. Allow intumescent and basecoats to dry at least 24 HRS before applying topcoat.
 3. Thickness for uniform opaque coverage ranging from 2 to 4 MIL final dry film thickness.
 4. Do not apply successive coats until previous coat is dry.

3.3 FIELD QUALITY CONTROL

- A. General:
1. Independent testing laboratory shall take samples and conduct required tests.
 - a. Arrange work schedule in coordination with testing agency to allow for testing of each incremental area of work followed by any corrections required prior to proceeding with next area of work.
 - b. Testing laboratory will perform tests at random for each area or work.
 - c. Provide agreed advance notice to testing agency for each incremental test.
 2. Test in accordance with ASTM E84 and ASTM E119.
 - a. Comply with applicable UL requirements for thickness, density and adhesion.
 3. Should any test fail, test until extent of defective area has been determined.
 4. Repair or replace defective material and retest until requirements are met.
 5. Measure final dry film thickness of intumescent fireproofing with dry film thickness gage.
 - a. Comply with specified field quality control requirements.
 - b. Thickness measurement method: Comply with AWCI Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide.
- B. Manufacturer's representative to certify fireproofing system is properly installed in accordance with design requirements and manufacturer's instructions.
- C. Test Frequency:
1. Comply with more stringent criteria from following:
 - a. Building Code as locally adopted.
 - b. AWCI requirements, ASTM requirements, or both.
- D. Testing Paid by Owner:
1. Contractor to arrange with independent testing laboratory to take samples and conduct required tests.
 - a. Contact laboratory, solicit quotes, and provide additional information about laboratory Owner requires.
 - b. Provide information to Owner for review.
 - c. Obtain written Owner approval of selected laboratory.
 - d. If laboratory is unacceptable, investigate others until Owner accepts one.
 2. Test in field, per ASTM standards indicated to ensure conformance with applicable building Code and UL requirements for thickness, density and bond strength.
 3. Should test fail, test until extent of defective area has been determined.
 4. Repair or replace defective material and retest until requirements are met.
 5. Cost of initial tests paid by Owner.
 6. Retesting due to test failure paid by Contractor.

3.4 CLEANING AND PROTECTION

- A. Remove excess fireproofing material, overspray, droppings and debris from surfaces not required to be fireproofed.
- B. Protect fireproofed surfaces from moisture, dust, and damaging cold temperatures.
- C. Where areas of fireproofing become damaged, after work under other sections has progressed sufficiently, patch, repair and restore fireproofing to complete required condition.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Firestopping, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Certified, licensed or approved by firestopping manufacturer, trained to install firestop products per specified requirements.
 - 2. Licensed by State or local authority, where applicable.
 - 3. Shown to have successfully completed not less than 5 comparable scale projects.
- B. Provide firestop systems in compliance with following requirements:
 - 1. Obtain firestop system for each type of penetration and construction condition from a single firestop systems manufacturer.
 - 2. Firestop products and systems shall bear classification marking of qualified testing and inspection agency.
 - 3. Firestopping tests, performed by qualified, testing and inspection agency.
 - a. UL or other agency, performing testing and follow up inspection services for firestop systems, acceptable to local authorities having jurisdiction.
 - 4. Existing applications for which no tested and listed classified system is available through a manufacturer:
 - a. Provide Engineering Judgment or Equivalent Fire Resistance Rated Assembly (EFRRRA) for submittal derived from similar UL system designs or other tests approved by local authorities having jurisdiction, prior to installation.
 - b. Engineering judgment drawings must follow requirements set forth by International Firestop Council.
 - 5. Mold Resistance:
 - a. Less than 1 per ASTM G21.
 - 6. Inspect applied firestopping systems in accordance with International Building Code (IBC) Chapter 17.
 - a. See Section 01 45 23.
- C. UL:
 - 1. UL 263, Fire Tests of Building Construction and Materials
 - 2. UL 723, Surface Burning Characteristics of Building Materials
 - 3. UL 1479, Fire Tests of Through Penetration Firestops
 - 4. UL 2079, Tests for Fire Resistance of Building Joint Systems
- D. Underwriters Laboratories (UL) Fire Resistance Directory:
 - 1. Through Penetration Firestop Systems (XHEZ).
 - 2. Joint Systems (XHBN).
 - 3. Fill, Void or Cavity Materials (XHHW).
 - 4. Firestop Devices (XHJI).
 - 5. Forming Materials (XHKU).
 - 6. Wall Opening Protective Materials (CLIV).
 - 7. Fire Resistance Ratings (BXRH)
- E. ASTM International (ASTM):
 - 1. ASTM E84 Surface Burning Characteristics of Building Materials

2. ASTM E119 Fire Tests of Building Construction and Materials
 3. ASTM E136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750F
 4. ASTM E814 Fire Tests of Through Penetration Fire Stops
 5. ASTM E1399 Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
 6. ASTM E1966 Test Method for Fire Resistive Joint Systems
 7. ASTM E2174 Standard Practice for On-site Inspection of Installed Fire Stops
 8. ASTM E2307 Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA)
 9. ASTM E2393 Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
 10. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- F. National Fire Protection Association (NFPA):
1. NFPA 70: National Electrical Code
 2. NFPA 101: Life Safety Code
 3. NFPA 221: Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls
 4. NFPA 251: Fire Tests of Building Construction and Materials
- G. Firestop Contractors International Association (FCIA):
1. MOP – FCIA Firestop Manual of Practice
- H. International Firestop Council (IFC):
1. Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments, latest revision.
 2. Inspectors Field Pocket Guide, latest edition.
- I. Identification Labels for Firestop Assemblies:
1. Follow guidelines set in Chapter 7 of International Building Code.
 2. Coordinate with Section 04 22 00 and Section 09 29 00.
- J. Pipe insulation shall not be removed, cut away or otherwise interrupted at wall penetrations or floor openings.
1. Provide products appropriately tested for the thickness and type of insulation utilized.
- K. Cabling where frequent cable moves, additions, and changes are likely to occur in future:
1. Where cable trays are used:
 - a. Utilize re-enterable products (e.g. removable intumescent blocks) specifically designed for retrofit.
 2. Where cable trays are not used:
 - a. Utilize fire rated cable pathway devices.
 - b. Where not practical, re-enterable products designed for retrofit may be used.
- L. Protect penetrations passing through fire resistance rated floor-to-ceiling assemblies contained within chase wall assemblies with products tested by being fully exposed to fire outside of chase wall.
1. Identify systems within UL Fire Resistance Directory with the words: Chase Wall Optional.
- M. Fire-resistive Joint Sealant:
1. Provide flexible fire resistive joint sealants to accommodate normal and thermal building movement without seal damage.
 2. Provide fire resistive joint sealants designed to accommodate a specific range of movement.
 - a. Test in accordance with cyclic movement test criteria as outlined in: ASTM E1399, ASTM E1966 or UL 2079.
 3. Provide fire resistive joint systems subjected to an air leakage test.
 - a. Conduct in accordance with UL 2079, with published L-Ratings for ambient and elevated temperatures.
 4. Coordinate firestopping with acoustical sealant requirements in Section 07 92 16.

- N. Subject smoke barrier containment systems to air leakage test.
 - 1. Conduct in accordance with UL 1479, with published L-Ratings for ambient and elevated temperatures.
- O. System Description:
 - 1. Through Penetration Firestop Systems for protection of penetrations through following fire resistance rated assemblies, including both blank openings and openings containing penetrating items:
 - a. Roof assemblies.
 - b. Floor assemblies.
 - c. Wall and partition assemblies.
 - d. Fire rated smoke barrier assemblies.
 - e. Existing, fire and smoke rated assemblies.
 - f. Construction enclosing compartmentalized areas.
 - 2. Fire Resistive Joint Assemblies for linear voids where fire rated floor, roof, or wall assemblies abut one another, including following types of joints:
 - a. Top and bottom of wall interface with overhead roof or floor structure:
 - 1) Coordinate with acoustical sealant specified in Section 07 92 16.
 - 2) Select products to maintain acoustical, smoke and fire ratings indicated.
 - b. Fire Rated Expansion Joints: Specified in Section 07 95 13.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's standard information indicating certification of products proposed for use on project.
- B. Project Information:
 - 1. UL reports with illustration of systems, system numbers, temperature ratings, and products proposed for use on project.
- C. Contract Closeout Information:
 - 1. Warranty.

1.4 WARRANTY

- A. Written five (5) year warranty guaranteeing quality of installation and meeting requirements of manufacturer's written instructions and tested systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Firestopping:
 - 1. Base:
 - a. Hilti Inc.
 - 2. Optional:
 - a. 3M
 - b. Rectorseal.
 - c. Specified Technologies, Inc.
 - d. Tremco, Inc.
 - e. United States Gypsum Company.
- B. Forming Materials:
 - 1. Base:
 - a. Hilti Inc.
 - 2. Optional:
 - a. Rockwool.
 - b. Thermafiber.

- C. Fire Rated Enclosures:
 - 1. Base:
 - a. Tenmat, Inc.
 - 2. Optional:
 - a. EZ Barrier, Inc.
- D. Other manufacturers desiring approval comply with Section 00 26 00.
 - 1. See systems Volume 2 of UL Building Materials Directory.

2.2 MATERIALS

- A. Through Penetration Firestop Systems:
 - 1. VOC content not to exceed 250 g/L.
 - 2. Base Products:
 - a. FS-ONE MAX Intumescent Firestop Sealant.
 - b. CFS-S SIL GG Elastomeric Firestop Sealant.
 - c. CFS-S SIL SL Elastomeric Firestop Sealant.
 - d. CP 620 Fire Foam.
 - e. CP 606 Flexible Firestop Sealant.
- B. Fire resistive Joints:
 - 1. VOC content not to exceed 250 g/L
 - 2. Base Products:
 - a. CFS-SP WB Firestop Joint Spray.
 - b. CFS-S SIL GG Elastomeric Firestop Sealant.
 - c. CFS-S SIL SL Elastomeric Firestop Sealant.
 - d. CP 606 Flexible Firestop Sealant.
- C. Firestop Devices:
 - 1. Factory assembled collars lined with intumescent material sized to fit specific outside diameter of penetrating item.
 - 2. Base Products:
 - a. CP 680-P Cast-in-Place Firestop Device.
 - b. CP 680-M Cast-in-Place Firestop Device.
 - c. CP 681 Tub Box Kit.
 - d. CFS-DID Firestop Device.
- D. Intumescent Pads, Wall Opening Protective Materials:
 - 1. Intumescent, non-curing pads or inserts for protection of electrical panels, switch and receptacle boxes, medical gas outlets and valve boxes and other items recessed in face of fire rated walls.
 - 2. Base Product:
 - a. CFS-P PA Firestop Putty Pad.
 - b. CP 617 Firestop Putty Pad.
 - c. Hilti Biox Insert.
- E. Fire Rated Cable Pathways:
 - 1. Steel raceway and intumescent pads with adjustable smoke seal sleeve.
 - 2. Fire rating equal to rating of barrier device penetrates.
 - 3. Pathway devices:
 - a. Allow 0 to 100 PCT fill of cables.
 - b. Adjust automatically to cable additions or subtractions.
 - 4. Size to accommodate quantity and size of electrical wires and data cables indicated plus 100 PCT expansion.
 - 5. Provide cable management devices with gang plates for single or multiple devices.
 - 6. Base products:
 - a. CP 653 BA Speed Sleeve.
 - b. CFS-SL GP Gangplate.
 - c. CFS-SL GP CAP Gangplate Cap.

- d. CFS-CC Firestop Cable Collar.
 - e. CFS-SL SK Firestop Sleeve.
 - f. CFS-SL RK Retrofit Sleeve.
 - g. CFS-COS Composite Sheet.
- F. Smoke and Acoustic Cable Pathways:
- 1. Non-rated steel raceway with adjustable smoke seal polyurethane sleeve for single cables and cable bundles.
 - 2. Re-penetrable and self-closing.
 - 3. Base product:
 - a. CS-SL SA Smoke and Acoustic Sleeve.
- G. Single Cable and Cable Bundles to 1 IN Diameter:
- 1. CFS-D Firestop Cable Disc.
- H. Firestop Putty:
- 1. Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
 - 2. Provide firestop putty at, but not limited to, the gap between wire, cabling, or both, exiting an open end of conduit, where conduit penetrates one or both sides of a smoke or fire rated wall assembly.
 - 3. Base products:
 - a. CP 618 Firestop Putty Stick.
 - b. CFS-PL Firestop Plug.
- I. Wrap Strips:
- 1. Single component intumescent elastomeric strips faced on both sides with a plastic film:
 - 2. Base Products:
 - a. CP 643N Firestop Collar.
 - b. CP 644 Firestop Collar.
 - c. CP 648E/648S Wrap Strips.
- J. Firestop Blocks and Plugs:
- 1. Non-curing, flexible intumescent device.
 - 2. Re-enterable.
 - 3. Base products:
 - a. CFS-BL Fire Block.
 - b. CFS-PL Firestop Plug.
- K. Mortar:
- 1. Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.
 - 2. Base product:
 - a. CP 637 Firestop Mortar.
- L. Silicone Sealants:
- 1. Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces pourable or nonsag or vertical surface nonsag.
 - 2. Base product:
 - a. CFS-S SIL GG Elastomeric Firestop Sealant.
 - b. CFS-S SIL SL Elastomeric Firestop Sealant.
- M. Preformed Mineral Wool:
- 1. CP 767 Speed Strips
 - 2. CP 777 Speed Plugs
- N. Fire Sealant:
- 1. Single component latex or acrylic formulations that upon cure do not re-emulsify during exposure to moisture.
 - a. CFS-S SIL GG Elastomeric Firestop Sealant.

- b. CFS-S SIL SL Elastomeric Firestop Sealant.
 - c. CFS-SP WB Firestop Joint Spray.
- O. Composite Sheet:
 - 1. Non-curing, re-penetrable material.
 - 2. Base Products:
 - a. CP 675T Firestop Board.
 - b. CFS-BL FireBlock.
- P. Forming Materials:
 - 1. Materials listed as components in laboratory approved designs.
 - 2. Mineral Wool:
 - a. Base Product:SAF by Thermafiber, or
 - b. Similar product specifically named as components in laboratory approved designs.
- Q. Perimeter Fire Containment:
 - 1. Specified in Section 07 84 53.
- R. Acoustical Sealant:
 - 1. Specified in Section 07 92 16.
- S. Through Penetration Firestop Systems:
 - 1. Comply with building code and fire code as locally adopted and amended.
 - 2. Requirements for single membrane penetrations and through penetration firestops are identical.
 - a. Unless otherwise noted, treat penetrants which pass through a single membrane same as though passed through entire fire resistive assembly.
 - 3. Select each firestop system based on actual field conditions, including penetration type, shape, size, quantities and physical position within opening.
 - 4. See Drawings for indication of the required ratings of fire resistive wall, floor, and roof assemblies.
 - a. Indicated ratings are minimum and may be exceeded.
 - 5. Firestop assemblies at fire rated walls:
 - a. Minimum fire (F) rating for firestop assemblies in walls shall equal that of wall, but not less than 1 HR.
 - b. Minimum temperature (T) rating of firestop assemblies in walls may equal zero.
 - c. Smoke barrier:
 - 1) In addition to (F) rating, (L) rating of maximum 5 CUFTM/ SF .
 - d. Non-rated walls and smoke partitions with no fire resistive requirement:
 - 1) Assembly with (L) rating.
 - 6. Firestop assemblies at fire rated floors and roofs:
 - a. Minimum fire (F) and temperature (T) ratings of firestop assemblies used in floors or roof shall equal hourly rating of floor or roof being penetrated, but not less than 1 HR.
 - 1) Exception 1: T-rating may equal zero when portion of penetration, above or below floor, is contained within a wall.
 - 2) Exception 2: Firestops are not required for floor penetrations within a 2-hour rated shaft enclosure.
- T. Voids in Wall with No Penetrations:
 - 1. Fill with approved through penetration firestopping system.
 - 2. Contractor's option: Patch void in wall with like construction.
- U. Penetrating Ducts with Dampers:
 - 1. Utilize only firestop materials which are included in damper's classification.
 - 2. Do not install firestop systems that hamper performance of fire dampers.
- V. Cable Trays and Similar Devices:
 - 1. Provide re-enterable products specifically designed for removal and re-installation at openings within walls and floors designed to accommodate voice, data and video cabling.

W. Electrical panels and devices, medical gas outlets and valve boxes, film illuminators, and other items recessed in to face of rated walls:

1. Where electrical devices are placed on opposite sides of wall, and are less than 24 IN apart measured horizontally, install intumescent pads over back of devices in approved manner or maintain continuity of rated barrier within wall cavity surrounding recessed item.

32 to122 DEGF 122 DEGF

32 DEGF122 DEGF

32 DEGF122 DEGF

6 IN 144 SQIN

16 SQIN 100 SQIN100 SQFT24 IN

100 SQIN100 SQFT

X. Fire Resistive Joint Assemblies:

1. Where joint will be exposed to elements, fire resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM C920.
2. Head of Wall Assemblies:
 - a. Use at top of fire rated and smoke barrier walls and partitions where they abut floor and roof structures above.
 - b. Select systems with D designation, rated for dynamic movement capability.
 - c. Select systems that can accommodate deflection of structure above.
 - d. Maximum Leakage for Fire resistive Joints in Smoke Barriers: 5 CUFTM or less per linear foot as tested in accordance with UL 2079.
 - e. Seal non-fire rated sound control walls and smoke partitions with acoustical sealant as specified in Section 07 92 16.
3. Minimum F and T ratings:
 - a. The minimum fire rating for firestop assemblies in walls shall equal that of wall, but not less than 1 HR.
 - b. The minimum temperature rating of firestop assemblies in walls may equal zero.
4. Acceptable Systems:
 - a. Metal stud and drywall partitions: Select system from UL HW-D-0000 Series.
 - 1) For metal stud partitions installed on flat concrete slab use one piece, pre-formed polyurethane foam firestop seal designed for use with standard head joint top tracks and bottom joint tracks or slip-type head joints to maintain continuity of the fire resistance rated assembly indicated.
 - 2) Provide in width and configuration required to accommodate depth and installation of studs and designed to saddle over the top track or under the bottom track.
 - b. Concrete and Masonry Walls: Select system from UL HW-D-1000 Series.

Y. Fire Rated Enclosures:

1. Provide where required as part of a UL Fire Resistance Directory design for fixtures mounted in rated walls or ceilings.
 - a. Field constructed enclosures meeting Fire Resistance Directory designs will be accepted.
2. Include accessories and install according to enclosure manufacturer's written instructions.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- B. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
- C. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
- D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install firestop systems in accordance with manufacturer's instructions and conditions of testing and classification as specified in UL or other acceptable third party testing agency listing.
- B. Penetrations through fire resistive floor assemblies shall be sealed with firestop system providing minimum Class 1 W-rating as tested in accordance with UL 1479 and ensure air and water resistant seal.
- C. Protect materials from damage on surfaces subjected to traffic.
- D. Identification Labels:
 - 1. Identify each firestop assembly as defined in Quality Assurance.
 - 2. Do not locate identification labels, tags, or both, on finished surfaces or where exposed to view by public.

3.3 FIELD QUALITY CONTROL

- A. Maintain areas of work accessible until inspection by authorities having jurisdiction.
- B. Where deficiencies are found, repair or replace assemblies to comply with requirements.

3.4 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean surfaces adjacent to sealed openings free of excess materials and soiling as work progresses.
- C. Perform patching and repair of firestopping systems damaged by other trades.

END OF SECTION

SECTION 07 92 13
EXTERIOR JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Exterior Joint Sealants, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Caulk and Caulking are synonymous with sealant work.
- B. Paving Joints include joints in floor slabs, sidewalks, steps, ramps and curbs.
- C. Seal joints which would otherwise permit penetration of moisture or air, unless sealant work is specifically required under other section.
- D. Provide sealant at following locations:
 - 1. Flashing reglets and retainers.
 - 2. Exterior wall joints.
 - 3. Masonry control joints, and between masonry and other materials.
 - 4. Isolation joints.
 - 5. Joints between paving or sidewalks and building.
 - 6. Joints at penetrations of walls, floors and decks by piping and other services and equipment not requiring firestopping.
 - 7. Perimeters door and window frames, louvers, grilles, etc.
 - 8. Joints between dissimilar materials, to provide visually acceptable closures.
 - 9. Solidly bed thresholds at exterior doors.
 - 10. Other joints where caulking, or sealant is indicated.
 - 11. Joints where Pre-molded Compressible Sealants is indicated.
- E. Related materials specified elsewhere:
 - 1. Interior Joint Sealants: See Section 07 92 16.
 - 2. Firestopping: Specified in Section 07 84 00.
- F. ASTM International (ASTM):
 - 1. ASTM C510 Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
 - 2. ASTM C920 Standard Specification for Elastomeric Joint Sealants
 - 3. ASTM C1193 Standard Guide for Use of Joint Sealants

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Sealant Schedule with the following information:
 - a. Generally describe locations requiring sealants (i.e. Brick to Aluminum Window).
 - b. List type of sealant and name of product proposed for each location.
 - c. Include a blank Color Column on schedule for selection.
 - d. Architect to complete Color Column upon selection from submitted samples.
- B. Product Data:
 - 1. Performance characteristics and limitations.
 - 2. Recommended installation.
- C. Samples:
 - 1. Cured sample of each color. Submit with Sealant Schedule.

D. Contract Closeout Information:

1. Warranty.

1.4 WARRANTY

A. Provide written warranty that sealant work will remain free of defects for a period of three (3) years from Date of Substantial Completion:

1. Failure of water or air tightness constitutes defect.
2. Loss of adhesion, cohesion or failure to cure constitutes defect.
3. Remove defective work and materials and replace with new work and materials.
4. Non- prorated warranty to include labor and material.
5. Warranty signed by Installer, Contractor, or both.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Silicone Sealant:

1. Base:
 - a. Tremco.
 - b. Dow Performance Silicones.
2. Optional:
 - a. Pecora.
 - b. GE Silicone by Momentive Performance Materials.
 - c. BASF Master Builders Solutions.
 - d. Bondaflex Technologies.

B. Polyurethane Sealants:

1. Base:
 - a. Tremco.
2. Optional:
 - a. Pecora.
 - b. BASF Master Builders Solutions.
 - c. Sika.
 - d. Bondaflex Technologies.

C. Silyl Terminated Polyether (STPE) Sealant:

1. Base:
 - a. BASF Master Builders Solutions.
2. Optional:
 - a. Pecora.
 - b. GE Sealants by Momentive Performance Materials.

D. Other Sealants:

1. Base: As indicated.

E. Pre-molded Compressible Sealant:

1. Base:
 - a. Emseal.
2. Optional:
 - a. Sealtite.
 - b. Tremco
 - c. Construction Specialties, (C/S).
 - d. MM Systems.

F. Epoxy Sealants:

1. Base:
 - a. Sika.
2. Optional:

- a. L&M Construction Chemicals.
- b. Pecora

G. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Elastomeric Sealants:

- 1. ASTM C920 Type S or M, Grade-NS, minimum Class 25.
- 2. Non-staining sealant complying with ASTM C510.
- 3. Where sealant is not exposed to view, use manufacturer’s standard color which has best performance.
- 4. Use non-sag sealant in vertical joints.
- 5. Use self-leveling or non-sag sealant in horizontal joints.
- 6. Before use of sealant, investigate its compatibility with surfaces, fillers and other materials in joint system.
- 7. Refer to Sealant Selection Guide for Base Products.
- 8. Comply with VOC limits as required by local laws.
- 9. VOC content no greater than 250 g/L.

1/2 IN	1-1/4 IN
3/4 IN	
1 IN	1-1/2 IN
1-1/4 IN	
1-1/2 IN	2 IN
1-3/4 IN	
2 IN	2-1/2 IN
2-1/4 IN	
2-1/2 IN	2-3/4 IN
2-3/4 IN	
3 IN	3-1/8 IN
3-1/2 IN	
4 IN	5 IN
5 IN	4-3/8 IN
6 IN	5 IN
	6 IN

B. Pre-molded Compressible Sealant:

- 1. Pre-finished.
- 2. Foam backing: Multiple layers of acrylic-impregnated, expanding foam sealant.
- 3. Weather Facing: Low-modulus silicone with bellows profile.
- 4. Movement capability: +/-25 PCT movement, 50 PCT total.
- 5. Material to be sized appropriately for joint widths indicated.
- 6. Base Product: ColorSeal by Emseal.

C. Compressible Backer:

- 1. Foam backing with multiple layers of acrylic-impregnated, expanding foam sealant.
- 2. Provide behind conventional backer-rod and sealant where indicated.
- 3. Movement capability: +/- 25 PCT movement, 50 PCT total.
- 4. Material to be sized appropriately for joint widths indicated.
- 5. Base Product: Backerseal by Emseal.

D. Installation Adhesive:

- 1. As recommended by manufacturer of compressible sealants and backers.
- 2. Comply with VOC limits as required by local laws.

- E. Joint Cleaner, Primer, Bond Breaker:
 - 1. As recommended by sealant manufacturer.
- F. Backer Rod:
 - 1. Polyethylene, polyethylene jacketed polyurethane foam, flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not proceed with installation of joint sealants under following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 DEGF .
 - 2. When joint substrates are wet.
- B. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Apply only to joints free of material which may inhibit bond.
- D. Apply to cementitious materials only when thoroughly cured and dry.

3.2 PREPARATION

- A. Clean joints and prime as required by sealant manufacturer.
- B. Install sealant after finish coating or covering is scheduled to be applied.
- C. Limit application to surfaces to receive sealants and mask edges of joints to protect adjacent surfaces.

3.3 INSTALLATION

- A. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Control joint depth.
 - 2. Break bond of sealant at bottom of joint.
 - 3. Provide proper shape of sealant.
 - 4. Do not leave gaps between ends of sealant backings.
 - 5. Do not stretch, twist, puncture, or tear sealant backings.
 - 6. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- B. Make depth of sealant not more than one-half width of joint, but not less than 1/4 IN .
- C. Sub-caulk joints without suitable backstop, to proper depth.
- D. Install correctly sized backer rods.
- E. Apply bond breaker as required or recommended by sealant manufacturer.
- F. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- G. Make joints water and air tight.
- H. Install sealants using proven techniques that comply with the following and at same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- I. Tooling of Non-sag Sealants:
1. Tool immediately after sealant application and before skinning or curing begins, to form smooth, uniform beads, eliminate air pockets, and ensure contact and adhesion of sealant with sides of joint.
 2. Remove excess sealant adjacent to joints as the Work progresses with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.
 3. Use tooling agents that are approved by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 4. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.
- J. At traffic joints, slightly recess sealant to avoid direct contact with wheeled traffic.

3.4 SEALANT USAGE GUIDELINES

Guide to Sealant Types - Exterior				
Location	Materials	Sealant Type	Base Product	Remarks / Exceptions
General Exterior	Cast in Place Concrete	Multi-part Polyurethane, chemically curing, epoxidized	Tremco Dymeric 240FC	Exception: Use Dymonic where used as bedding sealant for frames, sills, thresholds etc.
	Brick and Concrete Masonry			
	Portland Cement Plaster			
	Hollow Metal Door and Window Perimeters			
	Aluminum Composite Panels (ACM) and Metal Column Covers	Silyl Terminated Polyether (STPE)	MasterSeal NP150	--
	Joints in materials with high coefficients of linear expansion			
	Weatherseals of Aluminum Window Frames (including perimeter joints)			
	Precast Concrete Panels	Silicone Silicone or Silyl Terminated Polyether (STPE)	Tremco Spectrem 1 or Spectrem 3 or MasterSeal NP150	--
	EIFS Systems			
	Stone Work	Silicone or Silyl Terminated Polyether (STPE)	Tremco Spectrem 3 or MasterSeal NP150	Exception: Pre-test for staining potential per ASTM C1248, with stain-sensitive stone Note: MasterSeal will not stain.
	General Exterior Glazing	Silicone; Neutral-cure	Tremco Spectrem 2 or Proglaze	Exception: Select alternate silicone sealant types as appropriate for specific glazing application.
	Butt Glazing and Structural Silicone Joints	Silicone; 1-part, Neutral-cure	Dowsil 795	--
	Fabrication of Insulating Glass Units (IGU)	Primary Seal: Polyisobutylene	Select high quality sealants, of basic type listed, as appropriate for specific application.	
		Secondary Seal: Silicone	Dowsil 982	--
Zone dams, shear blocks and other internal component of Aluminum Window Systems	Silicone	Use product which offers optimal adhesion and performance for application.		
Sheet Metal Gutters, Downspouts, Scuppers, etc	Synthetic Rubber-Resin, elastomeric	Tremco Gutter Sealant	--	
Existing joints where Silicone was previously used	Silicone	Use product which offers optimal adhesion and performance for condition, and which offers suitable color choices for matching.		
Exterior Flatwork	Concrete Paving and Parking Structures	Multi-part Polyurethane	Tremco THC 900 / 901	Exception: Where subject to continual water emersion; use Vulkem 45 or 245
	Concrete Walks			
	Brick Paving and Walks			
	Stone and Precast Plazas			
Detention Facilities				

Guide to Sealant Types - Exterior				
Location	Materials	Sealant Type	Base Product	Remarks / Exceptions
Building Exterior	Door and Window Frame Perimeters	Epoxy	Sikadur 51	Flexible Epoxy above 10 FT AFF
	Electrical Fixtures			
Group Yards and Management Yards	Plumbing and Electrical Fixtures	Epoxy	Sikadur 51	Flexible Epoxy above 10 FT AFF
	Furnishings and Fixed Equipment			

Notes

1. The above is intended to be an overall guide. Additional conditions and materials may be required. Notify Architect if additional Guidance is required to select unlisted items.
2. Optional sealant products shall offer same number of color choices as the Base Product listed.
3. All of the conditions and materials listed may not apply to subject project.

END OF SECTION

SECTION 07 92 16
INTERIOR JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Interior Joint Sealants, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Definitions:
 - 1. Caulk and Caulking are synonymous with sealant work.
 - 2. Interior Wet Areas includes toilets, showers, kitchens and similar areas where sealant is subject to moisture.
- B. Seal joints which permit penetration of moisture or air, unless sealant work is specifically required under other sections.
- C. Provide sealants at the following:
 - 1. Masonry control joints, and between masonry and other materials.
 - 2. Flooring joints.
 - 3. Isolation joints.
 - 4. Joints at penetrations of walls, floors and decks by piping and other services and equipment not requiring firestopping.
 - 5. Perimeters of door and window frames, louvers, grilles, etc.
 - 6. Between cabinets, casework, countertops and back splashes where adjacent to walls.
 - 7. Joints between dissimilar materials, to provide visually acceptable closures.
 - 8. Other joints where caulking, or sealant is indicated.
- D. ASTM International (ASTM)::
 - 1. ASTM C510 Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
 - 2. ASTM C711 Standard Test Method for Low-Temperature Flexibility and Tenacity of One-Part, Elastomeric, Solvent-Release Type Sealants
 - 3. ASTM C719 Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement
 - 4. ASTM C792 Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
 - 5. ASTM C793 Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
 - 6. ASTM C910 Standard Test Method for Bond and Cohesion of One-Part Elastomeric Solvent Release-Type Sealants
 - 7. ASTM C920 Standard Specification for Elastomeric Joint Sealants
 - 8. ASTM C1193 Standard Guide for Use of Joint Sealants
- E. South Coast Air Quality Management District (SCAQMD), Rule #1168.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Sealant Schedule with the following information:
 - a. Generally describe locations requiring sealants (i.e. GWB to Aluminum Window).
 - b. List type of sealant and name of product proposed for each location.
 - c. Include a blank Color Column on schedule for selection.
 - d. Architect to complete Color Column upon selection from submitted samples.

- B. Product Data:
 1. Performance characteristics and limitations.
 2. Recommended installation.
- C. Samples:
 1. Submit cured sample of each color with Sealant Schedule.
- D. Contract Closeout Information:
 1. Warranty.

1.4 WARRANTY

- A. Provide written warranty that sealant work will remain free of defects for a period of three (3) years from Date of Substantial Completion:
 1. Failure of water or air tightness constitutes defect.
 2. Loss of adhesion, cohesion or failure to cure constitutes defect.
 3. Remove defective work and materials and replace with new work and materials.
 4. Repair other work damaged as a result of defective sealant work at no additional expense to Owner.
 5. Non- prorated warranty to include labor and material.
 6. Warranty signed by Installer, Contractor, or both.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Polyurethane Sealants:
 1. Base:
 - a. Tremco
 2. Optional:
 - a. Pecora
 - b. BASF
 - c. Sika
 - d. Bondaflex Technologies
- B. Silicone Sealants:
 1. Base:
 - a. As noted for individual items.
 2. Optional:
 - a. Bondaflex Technologies
 - b. Color Rite
 - c. Dow Performance Silicones
 - d. GE Silicones
 - e. Pecora
 - f. BASF
 - g. Tremco
- C. Epoxy Sealants:
 1. Base:
 - a. Sika
 2. Optional:
 - a. L&M Construction Chemicals
 - b. Pecora
- D. Acoustical Sealant:
 1. Base:
 - a. Hilti
 2. Optional:
 - a. Grabber

- b. Pecora
 - c. STI
 - d. 3M
- E. Compressible Security Seal
- 1. Base:
 - a. Emseal
 - 1) SecuritySeal SSW2 for vertical applications.
 - 2) SecuritySeal SSF2 for horizontal applications.
- F. Other Sealants:
- 1. Base: As indicated.
- G. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
- 1. All elastomeric joint sealants: ASTM C920 Type S or M, Grade-NS, minimum Class 25.
 - 2. All latex sealants: ASTM C834, Type OP, Grade -18 degrees Celsius.
 - 3. Non-staining sealant complying with ASTM C510.
 - 4. Where sealant is not exposed to view, use manufacturer's standard color which has best performance.
 - 5. Use non-sag sealant in vertical joints.
 - 6. Use self-leveling or non-sag sealant in horizontal joints.
 - 7. Before use of sealant, investigate its compatibility with surfaces, fillers and other materials in joint system.
- B. Volatile Organic Compounds (VOC):
- 1. Comply with South Coast Air Quality Management District (SCAQMD), Rule 1168.
 - a. Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L
- C. Elastomeric Sealant:
- 1. Refer to Sealant Selection Guide for types required.
 - 2. Comply with VOC limits as required by local laws or specified otherwise.
- D. Casework Sealant:
- 1. Solid Colors.
 - 2. 100 PCT silicone.
 - 3. Color-Sil by Color Rite
- E. Acoustical Sealant:
- 1. Flexible, non-hardening.
 - 2. UL listed.
 - 3. Seal perimeter of sound rated partitions.
 - 4. Seal perimeter and cover outside faces of electrical boxes and similar utilities in sound rated partitions.
 - 5. Base Products:
 - a. Gun - CP 506 by Hilti
 - b. Spray – CP 572 by Hilti
- F. Flexible Epoxy Sealant:
- 1. High solids, two-part epoxy.
 - 2. Tensile Strength: 650 PSI
 - 3. Seal spaces and cracks between similar and dissimilar materials.
 - 4. Provide elsewhere as indicated.
 - 5. Do not install until final building, wall and roof loads have been imposed for 7 days.
 - 6. Base Product: Sikadur 51

- G. Joint Cleaner, Primer, Bond Breaker:
 - 1. As recommended by sealant manufacturer.
- H. Backer Rod:
 - 1. Polyethylene, polyethylene jacketed polyurethane foam, flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not proceed with installation of joint sealants under following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 DEGF .
 - 2. When joint substrates are wet.
- B. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Apply only to joints free of material which may inhibit bond.
- D. Apply to cementitious materials only when thoroughly cured and dry.

3.2 PREPARATION

- A. Clean joints and prime as required by sealant manufacturer.
- B. Install sealant after finish coating or covering is scheduled to be applied.
- C. Limit application to surfaces to receive sealants and mask edges of joints to protect adjacent surfaces.

3.3 INSTALLATION

- A. Install sealant backings to support sealants during application.
 - 1. Control joint depth.
 - 2. Break bond of sealant at bottom of joint.
 - 3. Provide proper shape of sealant.
 - 4. Do not leave gaps between ends of sealant backings.
 - 5. Do not stretch, twist, puncture, or tear sealant backings.
 - 6. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- B. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- C. Install sealants using proven techniques that comply with the following and at same time backings are installed:
 - 1. Place sealants to directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths allowing optimum sealant movement capability.
- D. Prime joint surfaces as recommended by sealant manufacturer for conditions:
 - 1. Limit application to surfaces to receive sealants.
 - 2. Mask off adjacent surfaces.
- E. Sub-caulk joints without suitable backstop, to proper depth.
- F. Tool sealants using sufficient pressure to fill voids.
- G. Remove excess sealant adjacent to joints.
- H. Hollow Metal Frames:

1. Seal frames to wall.
2. Seal frames to floor substrates and hard floor finishes.
3. Do not seal frames to previously installed carpet and similar finishes.
4. Seal hairline gaps where stops and rabbets of frame members intersect.

I. Acoustical Sealant:

1. General:
 - a. Apply acoustical sealant at joints, voids, and penetrations through wallboard to maximize sound control.
 - 1) Seal wallboard edges to adjacent construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant.
 - 2) Install acoustical sealant at both faces of partitions at perimeters and through penetrations.
 - 3) Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
 - b. Refer to Section 07 84 00 for firestopping of through-wall penetrations.
 - 1) Provide firestop sealant where required in fire-rated assemblies.
2. Base of walls:
 - a. Apply acoustical sealant to bottom edge of gypsum wallboard at floor.
3. Head of walls:
 - a. Apply acoustical sealant to top edge of gypsum wallboard at building structure.

3.4 SEALANT USAGE GUIDELINES

Guide to Sealant Types - Interior				
Location	Materials	Sealant Type	Base Product	Remarks / Exceptions
Interior (General)	Window Sills / Stools	100 PCT silicone	Color-Sil Poly-Sil	--
	Cabinets and Casework to wall			
	Countertops and Backsplashes			
	Sinks in Countertops			
	Interior Alum Doors and Window Frame Perimeters	Multi-part, chemically curing Polyurethane	Tremco Dymeric 240FC	--
	Non-rated wall, floor and deck penetrations.			
	Hollow Metal Door and Window Frames	Siliconized Acrylic Latex (paintable)	Tremco Tremflex 834	Exception: Where sealant will not be subsequently painted and white color will not be visually compatible with adjacent finishes: Use Dymeric 240FC of matching color.
Acoustical Sealant Joints at top and bottom terminations of Interior Walls		Acrylic	Hilti CFS-SP WB	--
		Silicone	Hilti CP 601S	
Interior Flatwork	Control Joints in Concrete Floors in Mechanical Rooms and other unfinished spaces	Multi-part Polyurethane	Tremco THC 900 / 901	Exception: Where subject to continual water emersion; use Vulkem 45 or 245
	Stone and Precast Flooring			
Interior Wet Areas	Porcelain, Ceramic Tile, Metals, and surfaces with Epoxy Paints	Silicone; Air cure	Tremco Tremsil 200	--
Detention Facility Secure Areas	Door and Window Frame Perimeters, Sills and Stools	Epoxy	Sikadur 51	Construction joints and items fastened to wall,

(Cells, Housing Units, Day Rooms, Inmate side of Visiting and Interview Rooms and where indicated)	Cabinets and Casework to wall			ceiling and floor less than 10 FT AFF
	Sinks, Countertops and Backsplashes			
	Plumbing Fixtures, Electrical Fixtures and Fixed Equipment			
	Porcelain, Ceramic Tile, Metals, and surfaces with Epoxy Paints			
	Control Joints in Concrete Floors and other hard surface Flooring	Epoxy	Sikadur 51	Do not use at expansion joints or joints covered by another floor material
	Materials in Secure Areas listed above	Flexible Epoxy	Sikadur 51	Use 10 FT AFF and above for all locations where Epoxy is listed
Laboratories	Sanitary seal at joints between ceramic and prefinished surfaces	Sanitary Silicone	Tremco Tremsil 200	White only
	Sanitary seal at joints between epoxy painted and prefinished surfaces	Sanitary Silicone	Pecora 898	White only
	Airtight seal at openings in walls and ceilings	Structural Silicone	GE SilPruf SCS2000	Includes electrical conduits
		Heat Shrink Polyolefin Tubing	NP-700md	
Clean Zone / Cleanrooms	Cleanroom Sealant	Polyurethane	Sikaflex-1A Or Dowsil 6-1125 CV	White only

Notes

1. The above is intended to be an overall guide. Additional conditions and materials may be required. Notify Architect if additional Guidance is required to select unlisted items.
2. Optional sealant products shall offer same number of color choices as the Base Product listed.
3. All of the conditions and materials listed may not necessarily apply to subject project.
4. Not all project conditions may be addressed on above table; Refer also to other specification sections and install sealants where called for by other sections.
5. Materials and Conditions conventionally occurring on Exterior but used on Interior (e.g. Brick Masonry on interior) may not be listed on this Table. Refer to Exterior Guide (Section 07 92 13) for appropriate sealant type.

END OF SECTION



DIVISION 08

OPENINGS



SECTION 08 11 13
HOLLOW METAL (HM) DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Hollow Metal Doors and Frames in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM A568 Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled
- B. Hollow Door and Frame Standards:
 - 1. ANSI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors
 - 2. ANSI A250.8 / SDI 100 Recommended Specifications for Standard Steel Doors and Frames
 - 3. ANSI A250.11 Recommended Erection Instructions for Steel Frames
- C. Fire Rated Doors and Frames:
 - 1. Label and list for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
 - 2. Affix physical label or approved marking to fire door or fire door frame at an authorized facility as evidence of compliance with procedures of labeling agency.
 - 3. Where pairs of doors require fire rating (90 minute maximum), doors shall have passed appropriate test without the use of astragals.
 - 4. Positive Pressure:
 - a. Comply with Positive Pressure Requirements UL 10C, Category A or NFPA 252.
- D. Smoke and Draft Control Assemblies:
 - 1. Maximum Leakage: 3 CUFTM per SF of door face area when tested at pressure of 0.10 IN water per UL 1784.
 - 2. Applicability:
 - a. Doors in Smoke Barriers and fire-rated Corridor walls.
 - b. Doors forming part of an Elevator Lobby enclosure.
 - 3. Provide S-Labels on smoke and draft control openings.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Use same reference numbers for openings as those in Section 08 06 00 – Door and Frame Schedule or Door and Frame Schedule in Drawings
 - 2. Indicate door elevations, gauges; frame configuration; anchor types and spacing; location of reinforcement and preparations for hardware, including items recessed within door edges; details of moldings, removable stops, glazing and louvers; details of conduit and preparations for power, signal, and control systems.
- B. Product Data:
 - 1. Include construction details, material descriptions, core descriptions, fire resistance rating and finishes.
 - 2. Shop primer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Base:
 - a. Curries
 - 2. Optional:
 - a. Ceco Door Products
 - b. Philipp Manufacturing Company
 - c. Republic Doors and Frames
 - d. Steelcraft Manufacturing
 - 3. Other manufacturers desiring approval comply with Section 00 26 00.
- B. Galvanizing Repair Coating:
 - 1. Base:
 - a. Tnemec
 - 2. Optional:
 - a. ZRC Worldwide
 - b. SherwinWilliams
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Steel Sheet and Strip:
 - 1. Comply with ASTM A568.
- B. Corrosion Resistant Coating:
 - 1. Standard:
 - a. Hot dip galvanized: A60 per ASTM A653.
 - b. Minimum zinc-iron alloy coating: 0.6 OZ/FT² .
 - 2. Provide above corrosion resistant coating at door and frame components where used at wet and humid locations as defined by following:
 - a. Openings located in an exterior wall.
 - b. Interior openings:
 - 1) Rooms with showers, tubs or pools.
 - 2) Kitchens
 - 3) Soiled utility and soiled holding rooms.
 - 4) Loading docks, trash collection and compacting areas.
 - 5) Ambulance and vehicular garages.
 - 6) Rooms with washer equipment.
- C. Primer:
 - 1. Shop prime.
 - 2. Clean and phosphatize doors and frames.
 - 3. One coat of baked-on rust inhibiting primer paint in accordance with ANSI A250.10.
 - 4. Suitable and compatible as base for specified finish paints.
- D. Galvanizing Repair Coating:
 - 1. Galvanized coating repair.
 - 2. VOC 250 g/L maximum.
- E. Hollow Metal Doors:
 - 1. Comply with ANSI/SDI A250.8.
 - 2. Determination of performance level for each door:
 - a. Use level of HM door indicated for its location, size and other listed criteria.

Schedule of HM Door Levels

Location	Additional Criteria	HMMA Level	Miscellaneous
Exterior Doors ¹ (flush)	Openings where each leaf is less than 47 IN	Level 3 (Extra Heavy duty)	Galvanized / galvanized, Thermally Insulated
	Openings where one or more of the leaves exceeds 47 IN	Level 4 (Maximum-duty)	
Exterior Doors ¹ (stile and rail)	All	Level 3 (Extra Heavy duty)	Galvanized / galvanized, Thermally Insulated
	2		
Interior Doors	Non-fire rated	Level 3 (Extra Heavy duty)	--
	Fire rated	Level 3 (Extra Heavy duty)	Labeled as indicated (w/out astragal wherever possible)
	Wet / Humid Areas ²	Level 3 (Extra Heavy duty)	Galvanized / galvanized; Moisture-resistant core - Fire resistant were required

Notes

Refer to Door Schedule for indication of the Door Type (I.e. Width, Fire Rating, Flush vs. Stile & Rail, etc.)

Refer to Plans for door location (Exterior vs. Interior).

Where Hurricane or Tornado resistant openings are specified: Refer to ADDITIONAL REQUIREMENTS for appropriate door/frame construction.

Not all items included in table may apply to subject project.

Footnotes

1. Refer to Part 2.2 MATERIALS for definition of Exterior locations.

2. Refer to Part 2.2 MATERIALS for definition of Wet/Humid locations.

3. Door Thickness: 1-3/4 IN .
4. ANSI A250.8 Level 4, Maximum duty, physical performance Level A.
 - a. Face Sheet Thickness: 0.067 IN (14 GA) .
5. ANSI A250.8 Level 3, Extra Heavy duty, physical performance Level A.
 - a. Face Sheet Thickness: 0.053 IN (16 GA) .
6. ANSI A250.8 Model 2, Seamless.
7. End closures at top and bottom of door:
 - a. Top: Flush closure top cap. Minimum Sheet thickness: 0.032 IN (20 GA)
 - b. Bottom: Flush closure. Minimum Sheet thickness: 0.032 IN (20 GA) .
 - c. Bottom: Inverted channel. Minimum Sheet thickness: 0.053 IN (16 GA) 1.3 MM.
8. Vertical door edges:
 - a. Lock Stile Edges: Beveled 1/8 IN per 2 IN .
 - 1) Exception for inactive leaves: Fabricate inactive leaves with a square edge at the lock stile edge. Active leaves to be beveled per above.
 - 2) Hinge Stiles Edge: Beveled 1/8 IN per 2 IN .
 - 3) Exceptions for Double Acting Doors: Provide convex, radiused edges at lock stiles and hinge stiles.
9. Hardware Reinforcement (doors):
 - a. Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as door face sheets.
 - b. Minimum thickness: As prescribed in ANSI/SDI A250.6; Upgrade as necessary for conditions such as door weight, size, frequency, etc. and as follows:
 - c. Butt Hinges: 0.167 IN (7 GA) .
 - d. Continuous hinges: Reinforce with 0.067 IN (14 GA) thick x 1-1/4 IN wide strapping extending full height and welded to hinge edge of door.
 - e. Closers and Overhead Stops: 0.067 IN (14 GA) .
10. Cores:
 - a. Steel stiffeners where structurally required.
 - b. Exterior Doors:
 - 1) Thermally insulated core.
 - a) 1.0 LBS/CFPolystyrene.
 - b) Minimum R-value: 2.0 when tested according to ASTM C1363.

- c. Interior doors:
 - 1) Non-rated doors: Kraft honeycomb laminated to face sheets.
 - 2) Rated doors: Fire resistant core as required by label.
 - 3) Wet/humid Areas: Moisture resistant materials, fire resistant where applicable.
 - d. Specific materials used for above listed core types: Manufacturer's option.
 - e. Reinforce for Hardware.
- F. Lites:
- 1. Fire rated doors:
 - a. Provide lite kits and fire rated glass tested as part of door assembly and labeled for intended opening.
 - b. See Section 08 81 26 Interior Glass and Glazing for materials.
 - c. Locate bottom of glazed panel 43 IN maximum above finish floor.
 - d. Locate fixed stop at exterior face integral to door.
 - e. Locate removable stop on interior face.
 - f. Snap-in stops or stops secured with countersunk phillips head machine screws.
 - g. Provide label as required for opening.
 - 2. Non-fire rated doors:
 - a. Same material and finish as door.
 - b. See Section 08 81 26 Interior Glass and Glazing for materials.
 - c. Locate bottom of glazed panel 43 IN maximum above finish floor.
 - d. Locate fixed stop at exterior face integral to door.
 - e. Locate removable stop on interior face.
 - f. Snap-in stops or stops secured with countersunk phillips head machine screws.
- G. Hollow Metal (HM) Frames:
- 1. Comply with ANSI/SDI A250.8 and with details indicated for type and profile in accordance with SDI 111.
 - 2. Fabricate frames with mitered or coped corners and 1/2 IN nominal backbend.
 - a. Provide extended backbend at wall tile applications as detailed in drawings.
 - b. Touch-up galvanized/galvannealed frames with zinc-rich primer.
 - 3. Fabricate frames as Face Welded (modified ANSI definition):
 - a. Face Joints: Continuously back weld face joints (weld on concealed side).
 - 1) Fill and finish exposed sides to be free of visible seams.
 - b. Intersections of Rabbets, Stops and Soffit Joints: Fabricate to hairline joints. Stitch weld on concealed side.
 - c. Split type frames and knock down type frames are not acceptable.
 - d. Fasteners which are exposed to view are not acceptable.

Schedule of HM Frames			
Location	Criteria	Minimum Thickness	Miscellaneous
Exterior Frames ¹	Standard and Thermally Enhanced	0.067 IN (14 GA)	Galvanized / galvannealed
Interior Frames ¹	Non-fire rated	0.053 IN (16 GA)	--
	Fire rated	0.053 IN (16 GA)	--
	Frames for doors with automatic openers	0.067 IN (14 GA)	--
	Wet / Humid Areas ²	0.053 IN (16 GA)	Galvanized / galvannealed

Notes

Gauge of frame listed is the minimum. Use heavier gauge as required due to size, physical configuration or if required to meet fire label requirements.

Refer to Door Schedule for indication of the Frame Type (I.e. Width, Single vs. Pair; Fire Rating, etc)

Refer to Plans for door location (Exterior vs. Interior).

Where Hurricane or Tornado resistant openings are specified: Refer to ADDITIONAL REQUIREMENTS for appropriate door/frame construction.

Some items listed may not apply to subject project.

Footnotes

1. Refer to Part 2.2 for definition of Exterior locations.
 2. Refer to Part 2.2 for definition of Wet/Humid locations.
4. Hospital stops:
 - a. Provide where indicated.
 - b. Cut and fully weld.
 - c. Height from floor: 4-1/2 IN .
 - d. 45 degree bevel termination at bottom of stop.
- H. Light Kits:
1. Label for intended opening.
 2. Fixed Stop:
 - a. Locate at exterior face.
 - b. Integral to door/frame.
 3. Removable Stop:
 - a. Locate on interior face.
 - b. Snap-in stops or stops secured with countersunk Phillips head machine screws.
- I. Silencers:
1. Specified in Section 08 71 00.
 2. Quantity:
 - a. Three on strike jamb of single frames.
 - b. Two per door for pair doors. Locate at head.
 3. Space per manufacturer's recommendations.
 4. Use plastic plugs to keep holes clear during construction.
- J. Hardware Reinforcement:
1. Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
 2. Minimum thickness: As prescribed in ANSI/SDI A250.6; upgrade as necessary for conditions such as door weight, size, frequency, etc. and as follows:
 - a. Butt Hinges: 7 GA.
 - b. Continuous hinges: Reinforce with 0.067 IN (14 GA) thick x 1-1/4 IN wide strapping extending full height and welded to hinge jamb door rabbet of frame.
 - c. Closers and Overhead Stops: 0.093 IN (12 GA) thick x 12 IN long strapping welded to vertical flange of frame.
- K. Head Stiffeners:
1. Provide at double egress frames:
 2. Position stiffeners at mid span of frame opening.
- L. Junction Boxes:
1. Sheet metal enclosure:
 - a. Provide to facilitate pulling of wires and making electrical connections.
 - b. Weld to back side of frames.
 2. Material: 0.032 IN (20 GA) sheet steel.
 3. Size and shape: As required by hardware device.
 4. Include knockout to receive 1/2 IN conduit.
 5. Locate Junction Boxes in frames scheduled to receive electrified security, door hardware devices, or both.
- M. Jamb Anchors:
1. ASTM A879 Commercial Steel, 4 OZ/SF coating; mill phosphatized.
 - a. Frames in exterior walls:
 - 1) Steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A153, Class B.
 2. Provide anchors in accordance with manufacturer's recommendations on fire rated doors.
 3. Provide minimum number as indicated in following table:

Minimum Quantity of Jamb Anchors	
Nominal Frame Height	Minimum Quantity per Jamb
Less than 60 IN 1.5 m	2
60 IN to 90 IN 1.5 M to 2.3 m	3
90 IN to 120 IN 2.3 M to 3 m	4
120 IN to 150 IN 3 M to 3.8 m	5
Greater than 150 IN 3.8 m	Add 1 additional for each 30 IN increase in height thereafter

- a. Jamb anchors for stud framed walls:
 - 1) Z-shaped clips, welded to inside of frames; not less than 0.042 IN (18 GA) thick, or compression anchors to suit frame size.
 - 2) Attach anchors to studs with screws.
 - b. Jamb anchors for masonry walls:
 - 1) Adjustable strap-and-stirrup or T-shaped anchors to suit frame size.
 - 2) Minimum 0.042 IN (18 GA) .
 - 3) Corrugated or perforated straps:
 - a) Minimum 2 IN wide by 10 IN long.
 - 4) Wire anchors:
 - a) Minimum 0.184 IN (6 GA) thick.
 - 5) Embed long leg into masonry wall as units are placed.
 - 6) Post installed expansion type for in place concrete or masonry:
 - a) Minimum 3/8 IN countersunk, flat head expansion bolts with expansion shields or inserts.
 - b) Include pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
 - c) Minimum embedment length: 1-3/4 IN .
 - c. Floor Anchors:
 - 1) Same for Jamb Anchors but not less than 0.053 IN (12 GA) thick.
 - a) Anchors built into exterior walls:
 - (1) Steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A153, Class B.
 - b) Monolithic concrete slabs:
 - (1) Clip type anchors, with two holes to receive fasteners.
 - c) Topped slabs:
 - (1) Adjustable anchors with extension clips allowing not less than 2 IN height adjustment. Terminate bottom of frames at finish floor surface.
 - 2) Include concealed fasteners.
 - 3) Provide anchors in accordance with manufacturer's recommendations at fire rated openings.
 - d. Head Anchors for Double Egress Frames:
 - 1) Provide two head frame anchors for Double Egress frames.
 - 2) Locate at third points of span.
4. Spreaders:
 - a. Provide removable spreaders at bottom of door frames.
 5. Inserts, bolts and fasteners:
 - a. Manufacturer's standard units
 - b. Galvanize items built into exterior walls ASTM A153, Class C or D as applicable.

2.3 FABRICATION

- A. Factory fit doors to frame openings with uniform clearances in accordance with:
 1. NFPA 80 for fire rated doors.
 2. NFPA 105 for smoke control doors.

3. ANSI A250.8.
4. Locally adopted Building Code.
5. SDI 117.

Door To Frame Clearances Table		
Location		Clearance
Door to Frame at top and sides		1/8 IN 3 MM
Meeting Stiles at Pair Doors		1/8 IN 3 MM
Face of door to face of Stop		3/32 IN 2.4 MM
Door Bottom to Floor / Flooring	Top of floor covering	Less than 1/2 IN 13 MM
	Non-combustible sills	3/8 IN
	Bare floors; No flooring or sills	Greater than 3/4 IN

- B. Hardware Preparation:
1. Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to Door Hardware Schedule and templates furnished as specified in Section 08 71 00.
 2. Locate hardware indicated, or if not indicated, according to ANSI/SDI A250.8.
 3. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 4. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 5. Coordinate locations of conduit and wiring boxes for electrical connections.
 6. Remove mill scale and foreign materials, touch up damaged galvanized or galvanized surfaces.
- C. Hollow Metal Doors:
1. Exterior:
 2. Provide weep openings in bottom of exterior doors.
 3. Seal joints in top edges of doors against water penetration.
 4. Glazed lites:
 - a. Factory cut openings in doors.
 - b. Locate bottom of glazed panel 43 IN maximum above finish floor.
 5. Astragals:
 - a. Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire performance rating or where indicated.
- D. Fire Labels:
1. Affix permanent labels to fire rated units in accordance with testing agency requirements.
 2. Where labels are stamped or embossed directly into frame, ensure label will remain legible upon application of finishes.
 3. At openings where continuous hinges or other items conceal fire label, locate labels on alternative locations as allowed by listing agency and local authorities.
- E. Door Position Switches (DPS):
1. Coordinate locations with Security System provider.
 2. Locate DPS frame head approximately 4 IN from latching door edge.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine structure, substrates, and conditions under which work is to be installed for conditions detrimental to correct and timely completion.

- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Frames:

1. Place frames before construction of adjacent walls.
 - a. Where adjacent walls are cast in place concrete, set frames after wall is constructed.
2. Adjust hollow metal door frames for square, alignment, twist, and plumb to following tolerances:
 - a. Plumb: Plus or minus 1/16 IN , measured at jambs at floor.
 - b. Level: Plus or minus 1/16 IN per leaf, measured across width of header.
 - c. Square: Plus or minus 1/16 IN , measured at door rabbet on a line 90 DEG from jamb perpendicular to frame head.
 - d. Alignment: Plus or minus 1/16 IN , measured at jambs on horizontal line parallel to plane of wall.
 - e. Twist: Plus or minus 1/16 IN , measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
3. Do not remove spreaders until surrounding wall construction is complete.
4. After surrounding walls have been constructed, verify frames remain in alignment.
 - a. Re-check for level, plumb, square, twist and issues that will prevent proper fitting of doors.
 - b. Correct deficiencies before allowing surrounding construction to proceed.
 - c. Coordinate with other trades to correct alignment problems.
5. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
6. Verify frame alignment, and correct deficiencies prior to hanging doors.
7. Install frames with removable glazing stops located on secure side of opening.
8. Provide anchor type specified for wall condition.
9. Align anchors at hinge centers on hinge jamb and at corresponding heights on strike jamb.
10. Secure frame to wall per manufacturer's instructions.

B. Prime Coat Touchup:

1. Immediately after erection, sand smooth rusted or damaged areas of primer coat.
2. Touch up primer coat with compatible air drying primer.
3. Leave surfaces smooth for finish painting.

C. Field Painting of HM Frames and Doors:

1. Painting of Exterior openings: Specified in Section 09 91 13.
2. Painting of Interior openings: Specified in Section 09 91 23.

D. Install Sealants:

1. Seal frames to walls.
2. Seal frames to floor slabs and hard floor finishes.
3. Hairline gap at intersections of head and jamb frames intersections of rabbets and stops:
 - a. Fill exposed seam with painter's caulk.
4. Sealants:
 - a. Exterior: See Section 07 92 13.
 - b. Interior: See Section 07 92 16.

E. Install silencers.

3.3 ADJUSTING AND CLEANING

- A. Verify frames remain in proper alignment.
- B. Correct deficiencies before proceeding with surrounding construction.
- C. Remove protective wrappings from doors and frames.
- D. Verify fire labels are intact, and readily visible.

END OF SECTION

SECTION 08 30 00
FIRE AND SMOKE RATED CURTAINS WITH EGRESS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide all materials, labor, equipment and services necessary to furnish, deliver and install all work under this section as shown on the contract documents, specified herein, and as specified by the job conditions.

1.2 DESCRIPTION

- A. Related Work specified elsewhere:
 - 1. Miscellaneous Metal Fabrication - Section 05 50 10
 - 2. Carpentry - Section 06 10 53
 - 3. Overhead Door Schedule – Section 08 06 13
 - 4. Access Panels & Doors - Section 08 31 16
 - 5. Interior Painting - Section 09 91 23
 - 6. Electrical – Division 26

1.3 SUBMITTALS

- A. Procedures: Furnish submittals in accordance with the general requirements specified.
- B. Shop Drawing: Furnish shop drawings for architect's approval. Include elevations, sections, and details indicating dimensions, materials, finishes, conditions for anchorage and support of each fire and smoke rated curtain.
- C. Product Literature: Submit manufacturer's technical literature describing the product to be used under this section.
- D. Maintenance and Operating Manuals: Furnish complete manuals describing the materials, devices and procedures to be followed in operating and maintaining all of the fire and smoke rated curtains under this section. Include manufacturer's brochures and parts lists describing the actual materials used in the product.
- E. Product Approval Reports: Submit copy of manufacturer's Listing Report and Authorization To Mark clearly detailing the description of product, fire endurance test method, test results and test conclusions of the test criteria as conducted and witnessed by a United States accredited testing laboratory such as Underwriters Laboratories (UL) or Intertek-Warnock Hersey (Intertek). Testing agency's Listing Report shall clearly state that the fire and smoke rated curtains have been tested and approved to the standards and criteria of UL 10B (20 minutes), UL 10D (90 minutes) and UL 1784 Smoke & Draft rating.

1.4 QUALITY ASSURANCE

- A. Fire & Smoke Rated Assemblies: Provide all curtains with fire and smoke resistance rating required to comply with governing regulations which are inspected, tested, listed and labeled by UL or Intertek and complying with NFPA 80 for class of opening. Provide units tested, approved and labeled under the UL 10B, UL 10D and UL 1784 standards. Provide testing agency label permanently fastened to each fire curtain assembly as evidence of product compliance.
- B. Oversize Assemblies: Where units exceed the testing laboratory's label size, an Oversize Certificate label issued by either UL or Intertek shall be provided and permanently fastened to each fire curtain assembly as evidence of product compliance. Oversize assemblies requiring the joining of curtain sections together on site by the installer must require documented field certification by UL or Intertek.

- C. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of federal, state and municipal authorities having jurisdiction.

1.5 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver and store materials in manufacturer's original packaging, labeled to show name, brand and type. Store materials in a protected dry location off the ground in accordance with manufacturer's instructions.

1.6 WARRANTY

- A. Fire & Smoke Rated Curtain Warranty: Furnish two (2) year written warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the owner.

PART 2 - PRODUCTS

2.1 FIRE & SMOKE RATED CURTAINS WITH EGRESS

- A. Manufacturer: Fire and smoke rated curtains with egress shall be the FireFighter™ Series model D200E as manufactured by McKeon Door Company, Bellport, NY.

2.2 MATERIALS

- A. Curtain: Shall be of EFP4/1000 type reinforced fabric curtain, consisting of a satin fiberglass fabric with integral stainless steel wire weave and 90 minute fire retardant polyurethane coating. Curtain shall be at minimum no less than .054 cm thick.
- B. Egress Door: Shall be an integral fire and smoke rated, 90 minute rated, manually operable soft surface swinging type egress door. The swinging egress door shall be readily operable from the egress side without the use of a key or special knowledge or effort and shall comply with opening force requirements as outlined under the International Building Code (IBC).
- C. Bottom Bar: Shall consist of a tubular member formed to fit curtain, provide stiffness, limit deflection and allow for a tight fitting closure. Bottom bar shall be designed of adequate size and weight to keep the curtain fully extended, taut and level when the unit is activated to the self-closing position while preventing any deflection caused by the building's air pressure currents.
- D. Guide Assemblies: Each guide assembly shall be fabricated of a steel mounting adjustment angle or channel with an integral pressure retaining side guide with a minimum 3-1/2" depth. Each pressure retaining guide shall be fitted with UL approved and classified smoke seals.
- E. Mounting Brackets: Fabricated of minimum 14 gauge steel plates, brackets shall be provided to house and support ends of the barrel assembly.
- F. Hood: Shall be provided to entirely enclose curtain and barrel assembly. Hood shall be fabricated of minimum 18 gauge galvanized steel formed to match brackets. Top and bottom shall be bent and reinforced for stiffness. Hood shall be fitted with UL approved and classified smoke seals.
- G. Barrel Assembly: Fabricated of structural quality carbon steel seamless pipe of sufficient size and diameter to house operating motor drive, support curtain assembly and limit horizontal deflection of the fire and smoke curtain assembly.
- H. Motor Drive Unit (M): Fire and smoke curtain shall be powered by an inboard 24 volt DC motor including gearbox assembly, electromechanical distance travel limit switches all linked to an internal 24 volt DC electromagnetic brake which allows the fire and smoke curtain to remain operational even during the loss of power to the motor drive unit.

- I. Fail-Safe Release Device: A fail-safe release device shall be built into the motor drive unit as an integral part of the release mechanism. When power is interrupted to the release mechanism by an alarm condition, the fire and smoke curtain shall automatically self-close. In the event of power failure the time delay shall prevent the fire and smoke curtain from closing for a predetermined programmable period of 30 minutes, unless there is an alarm condition at which point the fire and smoke curtain shall immediately self-close. Once the predetermined programmable period of 30 minutes has lapsed, the fire and smoke curtain shall self-close. Once power has been restored and the alarm condition has been cleared, the release mechanism shall automatically reset and the fire and smoke curtain shall immediately become operable.
- J. Easy Trip Test Feature: The fire and smoke curtain shall be designed so that it may be trip tested simply by activating the True-Test switch. By turning the True-Test switch to the "off" position, the draft curtain shall automatically self-close. Once the draft curtain assembly has satisfactorily closed, it shall be reset simply by turning the True-Test switch back to the "on" position. No ladders, tools or special equipment shall be required to test or reset the fire and smoke curtain.
- K. Finish: After completion of fabrication, clean all metal surfaces to remove dirt and chemically treat to provide for paint adhesion. Hood, bottom bar and guide assemblies shall be of a powder coat finish, white in color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and field conditions to which this work is to be performed and notify architect if conditions of surfaces exist which are detrimental to proper installation and timely completion of work.
- B. Verify all dimensions taken at job site affecting the work. Notify the architect in any instance where dimensions vary.
- C. Coordinate and schedule work under this section with work of other sections so as not to delay job progress.

3.2 INSTALLATION

- A. Perform installation using only factory approved and certified representatives of the fire and smoke curtain manufacturer.
- B. Install fire and smoke curtain assemblies at locations shown in perfect alignment and elevation, plumb, level, straight and true.
- C. Adjust fire and smoke curtain installation to provide uniform clearances and smooth non-binding operation.
- D. Install wiring in accordance with applicable local codes and the National Electrical Code Standard. Materials shall be UL listed.
- E. Test fire and smoke curtain closing sequence when activated by the building's fire alarm system. Reset fire and smoke curtain after successful test.

3.3 PROTECTION AND CLEANING

- A. Protect installed work using adequate and suitable means during and after installation until accepted by owner.
- B. Remove, repair or replace materials which have been damaged in any way.
- C. Clean surfaces of grime and dirt using acceptable and recommended means and methods.

END OF SECTION

SECTION 08 31 16
ACCESS PANELS AND DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Access Panels and Doors, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Fire Rated Construction:
 - 1. Provide in fire rated walls, floors and ceilings.
 - 2. UL listed.
- B. Provide panels for project by single manufacturer.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Technical data on each type of access panel and/or door.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Access Panels and Doors:
 - 1. Base:
 - a. Milcor.
 - 2. Optional:
 - a. JL Industries.
 - b. Nystrom.
 - c. Karp Associates.
 - d. Williams Brothers.
 - e. Acudor Products, Inc.
 - f. Ventfabrics.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN CRITERIA

- A. Sandwich type door filled with insulation.
- B. Size:
 - 1. As required to allow access, inspection, service, and removal of items served.
 - 2. Minimum 18 x 18 IN 457 x 457 MM.
 - 3. Minimum 16 x 16 IN 406 x 406 MM at CMU or brick masonry walls.
- C. Non-Fire Rated:
 - 1. Door panels: Minimum 0.053 IN (16 GA) 1.3 MM steel.
 - 2. Frame: Minimum 0.053 IN (16 GA) 1.3 MM steel.
- D. Fire Rated Construction:
 - 1. Provide in fire rated walls, floors and ceilings.
 - 2. UL listed, 1-1/2 HR B fire rating.
- E. Material:
 - 1. Carbon Steel, minimum 0.053 IN (16 GA) 1.3 MM.

2. Finish: Factory primed.
3. Paint in field:
 - a. Specified in Section 09 91 23 for interior units.
 - b. Specified in Section 09 91 13 for exterior units.
- F. Latching Mechanism:
 1. Automatic door closing system.
 2. Cylinder operated steel cam lock with 2 keys; all units keyed alike.
 - a. Exception: Standard screwdriver slotted cam locks may be used at units that are installed 90 IN 2.3 M or higher above floor or walking surface when measured to the centerline of latching mechanism.
- G. Access Doors, Panels, and Frames in Ductwork:
 1. See Section 23 31 13.

2.3 MATERIALS

- A. Provide style and type as required for wall or ceiling materials in which installed.
- B. Flush Access Doors - For use in gypsum wallboard walls and ceilings:
 1. Provide units with galvanized wallboard taping flange to be embedded in wallboard construction.
 - a. Units to have a trimless final appearance when installation is complete.
- C. Recessed Face Access Doors - For use in gypsum wallboard walls and ceilings:
 1. Description: Form face of steel door panel to with a recess to accommodate inset section of wallboard.
 2. Inset to finish flush with adjacent wall surface and receive similar finish.
 3. Reinforce panel as required to prevent buckling.
 4. Provide access sleeves for each locking device.
 5. Furnish plastic grommets and install in holes cut through finish.
 6. Base Product: _____ by _____.
- D. Flush Access Doors - For use in concrete, masonry and tile walls and ceilings:
 1. Provide units with exposed trim flange having a nominal face width of 1 IN 25 MM or less.
 2. Paint trim to match door.
 3. Install with adjustable metal masonry anchors.

2.4 FABRICATION

- A. Metal Surfaces:
 1. For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes.
 2. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Doors and Frames:
 1. Grind exposed welds smooth and flush with adjacent surfaces.
 2. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
- C. Latching Mechanisms:
 1. Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 33 24
OVERHEAD COILING DOOR - SECURITY (CD-S)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Overhead Coiling Door - Security, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. UL Fire Rating.
 - 2. UL 325 Standard for Door, Drapery, Gate Louver and Window Operators and Systems.

1.3 SUBMITTALS

- A. Shop Drawings:
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - 2. Warranty.

1.4 WARRANTY

- A. Manufacturer's standard two (2) year warranty covering repair or replacement resulting from defects in material or workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Overhead Coiling Door - Security
 - 1. Base:
 - a. Cornell.
 - 2. Optional:
 - a. Cookson.
 - b. McKeon.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Overhead Coiling Door - Security (CD-S):
 - 1. Coiling steel with galvanized steel slats, sizes indicated.
 - 2. UL label: Minimum 1-1/2 HR B automatic closing by solenoid linked to fire alarm.
 - 3. Curtain slats: Steel slats with G60 galvanized coating; flat faced, interlocking slats with end locks.
 - 4. Insulated curtain slats: Double wall steel slats with G60 galvanized coating; flat faced, interlocking slats with end locks.
 - 5. Minimum steel thickness: 0.042 IN (18 GA)
 - 6. Grille section:
 - a. 5/16 IN diameter horizontal steel rods at 1-1/2 IN on center maximum, 3/4 IN flat bar connector links at 3 IN on center, non-corrosive grommets, end locks.
 - 7. Bottom reinforcement, minimum 2 x 3 x 1/8 IN tube.
 - 8. Barrel spring wire to have fiber stress not exceeding 140,000 PSI .
 - 9. Provide precision bearings in both barrel and brackets.

10. Wind load resistance: 20 PSF .
11. Weatherstripping at hood: Neoprene air baffle.
12. Weatherstripping at jambs: Neoprene guide sealing strip.
13. Air infiltration: 1 CUFTM/FT of perimeter, maximum.
14. Finish:
 - a. Factory galvanize and prime coat.
 - b. Field paint per Section 09 91 13.
15. Mounting: Between jambs.
16. Guides: Manufacturer's standard.

2.3 OPERATION – MOTORIZED UNITS

- A. Furnish complete with motor starter, overcurrent protection, disconnect switches, junction boxes, interconnecting wiring and conduit.
- B. Automatic switch over to emergency manual operation.
- C. Motor operator:
 1. Rated for continuous duty.
 2. Minimum 7.5 HP, 480 Y, 3-Phase.
 3. Motor and other electrical components NEMA 12.
 4. Gear motor reduction drive: Vertical.
 - a. Mounted at end of curtain housing on bracket.
- D. Controls:
 1. Rotary limit switch to adjust up and down door travel.
 2. Provide limit switch to prevent over-travel.
 3. Automatic door bottom to stop and reverse door if bottom edge touches obstacle in down travel.
 4. Emergency disengagement of motor operator and switch over to manual operation.
 5. 3-button control, requiring a key to operate.
 - a. Located where directed.
- E. Back-up operation:
 1. Hand chain (HC) operator in case of power failure.
 - a. Continuous chain drive through reduction gears.
 - b. Removable chain.
- F. Design door for high cycle operation.
- G. Locking:
 1. Motor brake (MB):
 - a. Lock through deactivated motor operator brake and gear.
 2. Jamb deadlocking (JDL):
 - a. Electric deadbolt locks furnished under Section 11 19 00, each door guide at floor.
 - b. Locks engage foot piece or applied steel receivers mounted on door bottom.
 - c. Provide mounting brackets and fasteners for locks and keepers, interconnect wiring to motor control.
 - d. Locks disengage automatically in case of power failure.
 - e. Provide motor interlock to prevent motor operation when locks are in locked position.
 - f. Locks automatically project when door reaches fully closed position.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate and opening to accept installation.
- B. Installation constitutes responsibility for performance.

3.2 INSTALLATION

- A. By manufacturer or authorized representative.
- B. Prior to occupancy, adjust door for smooth operation.

END OF SECTION

SECTION 08 33 30
COILING FIRE AND EGRESS ASSEMBLY

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Coiling Fire and Egress Assembly, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Comply with governing regulations inspected, tested, listed and labeled by UL or WH and NFPA 80.
- B. Supply units tested and approved in accordance with UL 10B, UL 1784 and NFPA 252.
- C. Permanently fasten testing agency label to each fire door assembly.
- D. Comply with applicable requirements of the laws, codes, ordinances and regulations of federal, state and municipal authorities having jurisdiction.
- E. Provide certified documentation that fire door operator and self-closing mechanism has been tested for a minimum of 50,000 cycles and 500 drop tests.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Include elevations, sections, and details indicating dimensions, materials, finishes, conditions for anchorage and support of each door.
- B. Product Information:
 - 1. Manufacturer's technical literature describing specified products.
 - 2. Manufacturer's burn test report.
- C. Contract Closeout Information:
 - 1. Maintenance and Operating Manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Coiling Fire and Egress Assembly:
 - 1. Base:
 - a. McKeon Door Company.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Base Product: Safescape model T2000/T2500 by McKeon Door Company.
- B. Curtain:
 - 1. Galvanized steel slats, cold rolled.
 - 2. 0.032 IN (20 GA) minimum.
 - 3. Provide slat endlocks.
- C. Bottom Bar:
 - 1. Material: Galvanized steel.
 - 2. Double-angle assembly with safety edge.

- D. Swinging Egress Door:
 - 1. Door frame:
 - a. Hollow metal.
 - b. ASTM A366 hot rolled galvanized steel.
 - c. 0.067 IN (14 GA) .
 - d. Fire label: As specified for door.
 - 2. Door assembly:
 - a. Door, butts, and locking channel mechanism.
 - b. Stretcher leveled, electro-galvanized and bonderized carbon steel faces.
 - c. 0.032 IN (20 GA) .
 - 3. Hardware:
 - a. Panic Devices: 202P type fire exit device on push side; lever trim on pull side.
 - b. Closers: 4004T 90-degree for pocketed applications, surface mounting.
 - c. Electro Magnetic Door Holders: 1304AQ Series, surface mounted, with projection to hold swinging door in fully open position.
- E. Grooves:
 - 1. Mount each fire door on 4 x 4 IN minimum structural tube frame.
 - a. Tube material: Steel.
 - 2. Provide slip joint for thermal expansion.
 - 3. 1/8 IN thick steel shapes with a minimum 3-1/2 IN depth.
 - 4. Provide internal UL classified smoke seals.
- F. Floating Guide:
 - 1. Steel channel assembly to ensure proper feeding of the curtain into the door frames.
 - 2. Allow engagement of coiling curtain in egress door frame.
- G. Hood:
 - 1. Material: Galvanized steel.
 - 2. Minimum Thickness: 0.026 IN (22 GA) .
 - 3. Fabricate to fully enclose coiled curtain and counterbalance assemblies.
 - 4. Hem top and bottom edges for stiffness.
 - 5. Provide UL classified lintel smoke seals.
- H. Counterbalance Assembly:
 - 1. Counterbalance curtain assembly by means of adjustable steel helical torsion springs attached to shaft and enclosed in pipe with required mounting blocks or rings for attachment of curtain.
 - 2. Attach grease sealed bearings or self-lubricating graphite bearings to the spring barrel.
 - a. Fabricated of hot formed structural quality carbon steel seamless pipe.
- I. Electric Motor Operator:
 - 1. General:
 - a. Adjustable screw type limit switch.
 - b. Planetary gearing with centrifugal governor, spring set solenoid operated brake and fail-safe magnetic release device.
 - c. Operator Enclosure: NEMA type 1 enclosure.
 - 2. Motor:
 - a. Enclosed, intermediate duty, thermally protected, ball bearing type with a class A insulation.
 - b. Minimum Horsepower: 1/2 HP or as otherwise recommended by manufacturer.
 - c. Overload motor protection device.
 - 3. Starter:
 - a. Size 0 magnetic reversing starter with 24V control circuit.
 - 4. Reducer: Planetary gear type.
 - 5. Brake: Double shoe type, continuous duty, solenoid activated.
 - 6. Flush mount key switch control station marked open, close and stop.
- J. Self-Closing Mechanism:

1. Automatic release mechanism activated by a fusible link, smoke detector or fire alarm.
2. Control speed of door with centrifugal governor, designed for normal operating speed at a rate no greater than 9 IN/Second or less than 6 IN/Second .

K. Magnetic Release Mechanism:

1. Design fail-safe magnetic release mechanism into the operator.

2.3 FINISHES

A. Galvanized Steel Units:

1. Powder coat finish :
2. Color as selected by Architect from manufacturers standard palate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and field conditions to which this work is to be performed.
- B. Verify dimensions taken at job site affecting the work.

3.2 INSTALLATION

- A. Perform installation using only factory approved representatives of door manufacturer.
- B. Install door assemblies at locations shown in alignment and elevation, plumb, level, straight and true.
- C. Adjust door installation to provide uniform clearances and smooth non-binding operation.
- D. Install wiring in accordance with applicable local codes and National Electrical Code.
- E. Test door closing sequence when activated by building's fire alarm system.

3.3 PROTECTION AND CLEANING

- A. Protect work during and after installation until accepted by owner.
- B. Remove, repair or replace materials which have been damaged.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Door Hardware, as indicated, in accordance with provisions of Contract Documents.
- B. Notify Architect of items which will not operate properly, attain the required fire label, or where components are physically or functionally incompatible.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Hardware Supplier Qualifications:
 - 1. Architectural door hardware supplier with warehousing facilities.
 - 2. Operating in the project's vicinity for a period of not less than 2 years.
 - 3. Certified Architectural Hardware Consultant (AHC) available throughout construction.
- B. Fire Rated Door Assemblies:
 - 1. Provide door hardware rated for use in assemblies complying with NFPA 80.
 - 2. Include listed and labeled hardware from a qualified testing agency, for fire protection ratings indicated,
 - 3. Comply with Positive Pressure Requirements UL-10C, Category A or NFPA 252.
- C. Smoke and Draft Control Assemblies:
 - 1. Maximum Leakage: 3 CUFTM per SF of door face area when tested at pressure of 0.10 IN water per UL 1784.
 - 2. Applicability:
 - a. Doors in Smoke Partitions, Smoke Barriers and Corridor walls.
 - b. Doors forming part of an Elevator Lobby enclosure.
 - 3. Provide S-Labels where required.
- D. Finish designations and standards: Builders Hardware Manufacturers Association (ANSI/BHMA) Standard 1301.
- E. Regulatory Requirements:
 - 1. Barrier free design requirements of the local jurisdiction and Americans with Disabilities Act (ADA).
 - 2. Listing requirements of the local jurisdiction and UL listing where applicable by type.
- F. Preinstallation Conference:
 - 1. Prior to installation of hardware, Construction Manager/Contractor conduct an on-site meeting to instruct hardware installer personnel in the proper installation of hardware and related electronics.
 - a. Manufacturer's Reps for Locksets, Closers, Exit Devices and other major hardware devices shall be present and direct instruction of installers.
 - b. Require attendance of affected parties, not limited to: Construction Manager/Contractor, hardware installer, electrical installer, door and frame installers and security installer, where applicable, and installer working with low voltage wiring of electromechanical hardware.
 - c. Discuss installation sequence of components, point-to-point wiring diagrams, and address questions raised by installers.

1.3 SUBMITTALS

- A. Shop Drawings:

1. Complete Hardware Schedule by door.
 - a. Complete list of products including model numbers and cut sheets.
 - b. Use Heading Numbers logically derived from Architect's Hardware Set numbers.
 - c. Hardware Sets shall follow the guidelines established in Door and Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule.
 - d. Notify Architect of items which will not operate properly, attain the required fire label, and where components are physically or functionally incompatible.
 2. Diagrammatic Elevations and Point-to-Point Wiring Diagrams of openings scheduled to receive electrified hardware and electronic access control devices.
 - a. Provide detailed wiring diagrams showing connections for signaling, control and locking functions and notes pertinent to programming, operation, etc.
 - b. When door hardware sets include automatic operators and locking or latching hardware on the same doors, provide detailed wiring diagrams.
 - c. Submit with Hardware Schedule.
- B. Project Information:
1. Certification that items bear UL label where required.
 2. Meeting minutes from Pre-Installation Meeting.
- C. Contract Closeout Information:
1. Schedule of components installed as hardware sets for each opening.
 2. Operating and maintenance data.
 - a. Parts catalog for each product furnished.
 - b. Keying records.
 3. Owner instruction report.
 4. Letter stating extra material has been delivered.

1.4 SPECIAL WARRANTY

- A. Written warranty in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within 3 years from date of Substantial Completion, or 25 years from date of Substantial Completion in the case of manual surface closers.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking or breakage.
 - b. Faulty operation of door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

1.5 MAINTENANCE

- A. Extra Materials:
1. Provide special tools as supplied by hardware manufacturer, for each different or special hardware component.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- A. Hinges:
1. Base:
 - a. Hager Hinge
 2. Optional:
 - a. Stanley Hardware
 - b. McKinney
 - c. Ives
- B. Continuous Geared Hinges:
1. Base:

- a. Ives
 - 2. Optional:
 - a. Hager
 - b. Pemko
 - c. Zero
 - d. McKinney
 - e. Stanley
- C. Pivots:
- 1. Base:
 - a. Rixson Specialty Door Controls
 - 2. Optional:
 - a. Ives
 - b. ABH Manufacturing
- D. Power Transfer Devices:
- 1. Base:
 - a. Von Duprin
 - 2. Optional:
 - a. Securitron.
 - b. Security Door Controls.
 - c. ABH Manufacturing
- E. Flushbolts and Coordinators:
- 1. Base:
 - a. Ives
 - 2. Optional:
 - a. Door Controls
 - b. Rockwood
 - c. Hager Hinge
 - d. ABH Manufacturing
- F. Cylinders:
- 1. Base:
 - a. Same manufacturer as listed for Locks, Latches and Deadbolts.
- G. Locks, Latches, and Deadbolts:
- 1. Base:
 - a. Schlage Lock
 - 2. Optional:
 - a. Sargent Manufacturing
 - b. Stanley Security Solutions/Best Access Systems
- H. Exit Devices:
- 1. Base:
 - a. Von Duprin
 - 2. Optional:
 - a. Sargent Manufacturing
 - b. Precision Hardware
- I. Electric Strikes:
- 1. Base:
 - a. Von Duprin
 - 2. Optional:
 - a. HES
 - b. Securitron
- J. Magnetic Locks:
- 1. Base:
 - a. Schlage

- 2. Optional:
 - a. Securitron
- K. Door Pulls, Pushplates, and Pushbars:
 - 1. Base:
 - a. Trimco
 - 2. Optional:
 - a. Hager Hinge
 - b. Burns Manufacturing
 - c. Ives
 - d. Rockwood Manufacturing
- L. Overhead Stops and Door Holders:
 - 1. Base:
 - a. Glynn-Johnson
 - 2. Optional:
 - a. Sargent Manufacturing
 - b. Rixson
 - c. Rockwood
 - d. Dorma
 - e. ABH Manufacturing
- M. Door Closers:
 - 1. Base:
 - a. LCN
 - 2. Optional:
 - a. Sargent Manufacturing
 - b. Stanley
- N. Kickplates, Armorplates, and Door Edging:
 - 1. Base:
 - a. Trimco
 - 2. Optional:
 - a. Hager Hinge
 - b. Burns Manufacturing
 - c. Ives
 - d. Rockwood Manufacturing
 - e. ABH Manufacturing
- O. Door Stops:
 - 1. Base:
 - a. Ives
 - 2. Optional:
 - a. Sargent Manufacturing
 - b. Corbin Russwin Architectural Hardware
 - c. Hager Hinge
 - d. Trimco
- P. Thresholds, Head Drips, Weatherstripping, and Smoke Gaskets:
 - 1. Base:
 - a. Reese Enterprises
 - 2. Optional:
 - a. National Guard Products
 - b. Pemko Manufacturing
 - c. Zero International
- Q. Access Control Devices:
 - 1. Base:
 - a. Schlage Electronic Security

- 2. Optional:
 - a. Assa-Abloy (Sargent, Securitron, HES, Folger Adam)
- R. Door Position Switches (DPS) by Security System:
 - 1. Provided by Security System Installer.
- S. Key Cabinet:
 - 1. Base:
 - a. Lund Equipment
 - 2. Optional:
 - a. Telkee
- T. Weldable Gate Boxes:
- U. Other materials:
 - 1. Base: As indicated.
- V. Other manufacturers desiring approval comply with Section 00 26 00 and submit samples of both specified item and proposed item for comparison.

2.2 MATERIALS

- A. Finishes and Fasteners:
 - 1. Finishes:

Hardware Finishes				
Hardware Component	Satin Chrome Series			
	Base Metal	ANSI / BHMA	Finish Description	US Equiv
Locksets and Latchsets	Brass/Bronze	626	Satin Chromium plated over nickel	US26D
Door Pulls, Pushbars, and Pushplates	Stainless Steel	630	Satin Stainless Steel	US32D
Kickplates and Armorplates	Stainless Steel	630	Satin Stainless Steel	US32D
Exit Devices	Brass/Bronze	626	Satin Chromium plated over nickel	US26D
Hinges	Stainless Steel	630	Satin Stainless Steel	US32D
	Steel	652	Satin Chromium plated over nickel	US26D
Thresholds, Weatherstripping, Head Drips	Aluminum	719	Mill finish aluminum	US27
Door stops, holders, pivots, door edging and other unlisted items	Brass/Bronze	626	Satin Chromium plated over nickel	US26D
Patient Latches	Stainless Steel	630	Satin Stainless Steel	US32D
Exposed arms and covers of closers:	Any	689	Powder Coated Aluminum Color	US20A

- a. Tactile Warning:
 - 1) Etched, milled or knurled surface treatment.
 - 2) Provide on corridor-side levers of doors to loading platforms, boiler and mechanical rooms, stages, utility stairs, roof access, communications and electrical closets.
- 2. Fasteners:
 - a. Manufacture hardware to conform to templates.
 - b. Prepare for Phillips oval head machine screw installation unless directed otherwise.
 - c. Exposed screws to match hardware finish or, if exposed in surfaces of other work, to match finish of other work as closely as possible.
 - d. Fasteners in mineral core doors:
 - 1) Attachment of hinges:
 - a) Use screws, which are fully threaded (from tip to head).
 - 2) Attachment of Closers:
 - a) Use through-bolts at mineral core doors.
 - b) Use fully threaded screws at doors with solid wood blocking.
 - e. Provide concealed fasteners (unless thru bolted).

- f. Provide non-corrosive fasteners.
- 3. Templates:
 - a. Provide templates to door and frame suppliers.
 - b. List template numbers on Hardware Schedule submittal for use by fabricators.
 - c. Provide copies of approved Hardware Schedule to related suppliers, fabricators, and installers.

B. Hinges:

- 1. Butt Hinges:
 - a. Butts and Hinges: ANSI/BHMA A156.1
 - b. Template Hinge Dimensions: ANSI/BHMA A156.7
 - c. Full mortise, unless noted otherwise.
 - 1) Non-rising, flat button tips.
 - 2) Non-removable pins (NRP): Provide at out-swinging exterior doors and where specifically indicated.
 - d. Following table refers to manufacturer's numbers that are considered equal:

Definition of Hinge Types						
Type	Manufacturer				Description	
	Hager	Stanley	Ives	McKinney	ANSI	Remarks
1	BB1199	FBB199	5BB1HW	T4B3386 or T4A3386	A5111	Stainless Steel, Heavy Weight, 5-knuckle, 4 Ball Bearing, Non-ferrous for wet/exterior usage.
2	BB1168	FBB168	5BB1HW	T4B3786 or T4A3786	A8111	Heavy Weight, 5-knuckle, 4 Ball Bearing, Steel with Steel Pin.
3	BB1279	FBB179	5BB1	TB2714 or TA2714	A8112	Standard Weight, 5-knuckle, 2 Ball Bearing, Steel with Steel Pin
4	BB1263	FBB268/78	5BB1SCHW	T4B3795 or T4A3795	A8121	Swing Clear Hinge, Heavy Weight, 5-knuckle, 4 Ball Bearing, Steel with Steel Pin
5	1250	2060R	3SP1	1552	K81071F	Spring Hinge, (single-acting), Steel, Use two Type 5 (Spring Hinges) in combination with Type 2 (Heavy Weight Ball Bearing) hinges

NOTES:

Use Type where indicated. It is possible that not all Types will be needed on subject project.

On openings with unequally sized pairs: Utilize same hinge model on both leaves; Hinge type listed for the larger/heavier leaf shall govern.

Use the appropriate variations of the above listed Model Numbers for actual door edge style specified (i.e. Bevel or Square Edge Doors).

Where Type 4 (Swing Clear) or Type 5 (Spring) hinges are called for at Exterior or wet areas: Use the Stainless Steel variations of the above listed Model Numbers.

- e. Hinges Types according to door location and width:
 - 1) Type 1 - Stainless Steel, Heavy Weight, Ball Bearing Hinge:
 - a) Exterior out-swinging doors with non-removable pins (NRP) option.
 - b) Exterior in-swinging doors.
 - c) Interior in-swinging doors to wet areas (showers, kitchens, etc.).
 - 2) Type-2 - Steel, Heavy Weight, Ball Bearing Hinge:
 - a) Interior greater than 36 IN wide.
 - 3) Type-3 - Steel, Normal Weight, Ball Bearing Hinge:
 - a) Interior less than or equal to 36 IN.
 - 4) Type-4 - Swing Clear, Steel, Heavy Weight, Ball Bearing:
 - a) Use on openings where specifically indicated or scheduled.
 - b) Upgrade to Stainless Steel for exterior and interior wet areas.
 - 5) Type 5 - Spring Hinges, Steel, Heavy Weight.
 - a) Where specifically indicated or scheduled.
 - b) Use on steel gates in stairs.

- c) Upgrade to Stainless Steel for exterior and interior wet areas.
- f. Hinge quantities per door leaf:
 - 1) Leaves up to 60 IN: 2 hinges
 - 2) Leaves between 61 IN and 90 IN: 3 hinges
 - 3) Leaves between 91 IN and 120 IN: 4 hinges
 - 4) Leaves between 121 IN and 150 IN: 5 hinges
 - 5) Leaves taller than 151 IN: add 1 hinge for each 30 IN increase in leaf height thereafter.
- g. Hinge sizes:

Guide to Minimum Sizes of Hinges			
Door Thickness	Door Width	Minimum Hinge Height	Minimum Hinge Width
1-3/8 IN	Up to 32 IN	3-1/2 IN	3-1/2 IN
	From 32 IN to 36 IN	4 IN	
	Greater than 37 IN	4-1/2 IN	
1-3/4 IN	Up to 36 IN	4-1/2 IN	4-1/2 IN
	From 37 IN to 48 IN	5 IN	
	Over 48 IN	6 IN	
2 to 2-1/2 IN	Up to 42 IN	5 IN Heavy Weight	5 IN
	Over 43 IN	6 IN Heavy Weight	

NOTES:

1. The above is a guide to minimum sizes. Consider the actual weight of door leaf being supported and its anticipated frequency of use when determining the actual hinge height.
 2. Do not exceed parameters recommended by Hinge manufacturer.
 3. Unequal Pairs: Utilize same hinge size for both leaves; Hinge height stipulated for the wider leaf shall govern.
 4. Increase the hinge width as required to clear door trim where used. Ensure that door, when opened 180 Degrees will not contact the applied trim.
-
2. Continuous Geared Hinges:
 - a. Provide where specifically scheduled by Hardware Sets.
 - b. ANSI/BHMA A156.26.
 - c. Heavy duty hinge (HD) assembly of three interlocking extrusions applied to full height of the door and frame without mortising.
 - d. Door leaf and jamb leaf shall be geared together for the entire length of the hinge and joined by a channel.
 - e. Mounting: Concealed (non-surface mounted) with door edge protector lip.
 - f. Hinge knuckle: Monolithic appearance. Piano hinges visible knuckle separations are not considered equivalent.
 - g. Designed to carry vertical door loads on minimum 3/4 IN acetal bearings through a full 180 DEG.
 - 1) Minimum of 32 bearings for a 7 FT length.
 - h. Template screw hole locations at door leaf and jamb leaf to simplify replacement.
 - i. Base Products: 224HD by Ives.
 - j. Optional Products:
 - 1) FMHD by Pemko
 - 2) MCK-25HD by McKinney
 - 3) 780-224HD by Hager.
 - 4) 662HD by Stanley.

C. Cylinders:

1. ANSI/BHMA A156.5 Grade 1.
 2. Material: Brass or bronze, stainless steel, or nickel silver.
 3. Finish: Match lock mechanism to which cylinders are installed.
 4. Cylinder Type: Interchangeable cores at Exit Devices; Conventional cores (non-interchangeable) at other locksets.
 5. IC Format: Full-sized Interchangeable Cores (IC).
 6. Cylinder Mechanism:
 - a. Conventional, 6-pin tumbler.
 7. Key Control:
 - a. Open.
 8. Determine key type required to suit locking mechanism. Include appropriate trim rings, cams, tail pieces, and adaptors.
 9. Patented cylinders and keys to protect against unauthorized manufacture.
 10. Provide cylinders for all locking mechanisms scheduled.
 11. Base Product:
 - a. Everest Open Conventional by Schlage.
 - b. Optional Products: Comparable products by approved manufacturers.
- D. Keys:
1. Material: Nickel silver
 2. Stamping: Permanently inscribe each key with a control number and the following: DO NOT DUPLICATE.
 3. Quantity: In addition to one extra blank key for each lock, provide the following:
 - a. Cylinder Change Keys: 3
 - b. Master Keys: 6
 - c. Grand Master Keys: 6
 - d. Great-Grand Master Keys: 6
- E. Mortise Locks and Latches:
1. ANSI/BHMA-A156.13, Series 1000, Operational and Security Grade-1.
 2. Mortise with antifriction latch bolt with 3/4 IN throw and deadbolt with 1 IN throw.
 3. Sectional trim.
 4. Backset: 2-3/4 IN
 5. Base Product: L Series by Schlage.
 6. Optional Products:
 - a. 8200 Lever Lock by Sargent Manufacturing
 - b. 40H by Best
 7. Lever Style: 06 design
 8. Functions as indicated in Hardware Sets and in accordance with ANSI/BHMA-A156.13.
- F. Cylindrical Locks and Latches:
1. ANSI/BHMA-A156.2, Series 4000, Grade 1.
 2. Heavy duty cylindrical with latch bolt throw as follows:
 - a. Single doors: 1/2 IN minimum, or as otherwise required by fire label.
 - b. Pair doors: 3/4 IN minimum, or as otherwise required by fire label.
 - c. Backset: 2-3/4 IN.
 3. Base Product: ND Series by Schlage.
 4. Optional Products:
 - a. 10-Line by Sargent Manufacturing
 - b. 9K by Best
 5. Lever Design: Rhodes lever.
 6. Functions as indicated in Hardware Sets and accordance with ANSI/BHMA-A156.2.
- G. Electrified Locksets:
1. Furnish from the same manufacturer as mechanical locks and latch sets.
 2. Match trim style and finish of mechanical locks and latch sets.
 3. Furnish electrical lock function and associated electrical components to perform as indicated in the operational description for each electrified hardware set.

- a. Electrified Mortise Locksets:
 - 1) Base Product: L9080 by Schlage.
 - 2) Optional Products: 8200 Series by Sargent Manufacturing; 47HW Series by Best.
- H. Patient Latches (a.k.a. Hospital Latches):
- 1. Cylindrical, non-Locking Type:
 - a. Base Product: HL-6 by Glynn-Johnson.
 - b. Optional Products:
 - 1) 1500 Series by Trimco.
 - 2) 114/115 by Sargent Manufacturing.
 - 3) 6000 Series by ABH.
 - c. Backset: 5 IN.
 - d. Paddle configuration: Push up/ Pull down.
 - e. Engraving: Paddles engraved with PUSH and PULL.
 - 2. Locking Type, (Push/Pull paddles mated to Classroom Function Mortise Lockbody):
 - a. Base Product: Glynn-Johnson HL6-9070 (Classroom Function).
 - b. Optional Products:
 - 1) 1562M (Classroom Function) by Trimco.
 - 2) 7837 PT (Classroom Function) by Sargent Manufacturing.
 - 3) 6600 Trim by ABH on lockbody by manufactures listed for Mortise Locksets.
 - c. Backset: 2-3/4 IN.
 - d. Paddle configuration: Locked side down; Unlocked side up.
 - e. Engraving: Paddles engraved with PUSH and PULL.
- I. Pushbutton Locksets:
- 1. Fully mechanical
 - 2. 5-pushbutton type with changeable combination.
 - 3. Removable core cylinder in lever.
 - 4. Passage set function to allow temporary unlocking of device.
 - 5. Base Product: Simplex L1000 by Kaba Ilco.
 - 6. Finish: As specified for standard locksets.
- J. Pushbutton Locksets:
- 1. Battery-operated, stand-alone, electronic
 - 2. 12-button lockset
 - 3. Keypad programmable with multiple combinations.
 - 4. Lockbody type:
 - a. Mortise.
 - 5. Mechanical key for override.
 - 6. Passage set function to allow temporary unlocking of device.
 - 7. Base Product: Simplex 4000 by Kaba Ilco.
 - 8. Finish: As specified for standard locksets.
- K. Rescue Assistance Hardware:
- 1. Double-Acting Pivot Set (flush):
 - a. Center hung, double-acting, top and bottom pivots.
 - b. Capacity: 500 LBS.
 - c. Surface mount.
 - d. Base Products: 510 by Hager, DAP-3 by Stanley; 370 by Rixson.
 - 2. Double Lipped Strike:
 - a. Description: Stainless steel plate extending across entire face of frame and having curved lips on both faces.
 - b. Base Products: 451 by Hager; DLS-2 by Stanley.
 - c. Contractor's Option: Products which combine above-described Double-lipped Strike with Emergency Release mechanism below, will be acceptable.
 - 3. Emergency Door Stop:
 - a. Normally functions as a frame stop to limit door to in-swing operation.

- b. In emergency, releasing stop from exterior side allows door to swing out for rescue assistance.
 - c. Base Product: ES-1 by Stanley; DS-6 by McKinney; 610 by Hager.
 - 4. Privacy Gaskets:
 - a. Brush type gaskets installed in vertical gaps between door and frame.
 - b. Kerf into door stiles to depth required for zero sight line.
 - c. Base Product: 369 AP by Pemko with 3/16 IN +/- pile height.
- L. Exit Devices:
 - 1. ANSI/BHMA-A156.3, Grade 1
 - 2. Include cylinders at lockable exit devices.
 - 3. Lever Trim: Match lever style specified for Locks and Latches.
 - 4. Offset Pull Style: 1 IN diameter; 8190-0 by Ives/Von Duprin.
 - 5. Fire Rated Openings:
 - a. Use fire rated exit devices.
 - 6. Non-rated Openings:
 - a. Use doggable devices UL-listed for accident hazard.
 - 1) Exception 1: Omit dogging or use fire rated devices at Smoke Partitions.
 - 2) Exception 2: Omit dogging or use fire rated devices where openings include Card Readers and dogging could compromise ability to secure the opening.
 - 7. CVR (concealed vertical rod) and SVR (surface vertical rod) exit devices:
 - a. Exterior Openings: include bottom rods.
 - b. Interior Openings: Provide LBR (Less Bottom Rod) where permitted by label. Include thermal pins, if required.
 - c. Where exposed bottom rods are required: Protect rods with rod and latch guards.
 - 1) Base product: RG-27 by Von Duprin.
 - 8. Electrified devices:
 - a. Include concealed Power Transfer devices where electrified Exit devices are scheduled.
 - 1) Select Power Transfer models having required number of conductors and conductors of the wire gauge recommended for the device served.
 - b. Include Power Supply as required.
 - 9. Base Products - Push Pad type (smooth-case): 98 Series by Von Duprin; Except 35 Series for narrow stile doors.
 - a. Optional Products: 88-Series by Sargent Manufacturing; Apex 2000 Series by Precision.
- M. Strikes:
 - 1. Provide manufacturer's standard strike for each latching/locking mechanism.
 - a. Finish: Match latch/lock device.
 - 2. Standards:
 - a. Strikes for Bored Locks and Latches: ANSI/BHMA A156.2.
 - b. Strikes for Mortise Locks and Latches: ANSI/BHMA A156.13.
 - c. Strikes for Auxiliary Deadlocks: ANSI/BHMA A156.5.
 - 3. Strike Lip:
 - a. Curved lip extended to protect frame.
 - b. Locks with 3-piece antifriction latch bolts: Flat-Lip Strikes.
 - c. Locks used on frames with applied wood casing trim: Extra-Long-Lip Strikes.
 - 4. Provide manufacturer's standard Wrought Strike Box for each latching/locking mechanism.
 - 5. Provide specially fabricated Strike Boxes where set in aluminum framing.
- N. Door Pulls, Pushplates and Pushbars:
 - 1. ANSI/BHMA A156.6.
 - 2. Door Pull (offset):
 - a. Tubular metal; 1 IN Diameter.
 - b. Size: 10 IN (CTC).
 - c. Base Product: Trimco series 1191.
 - d. Optional Product: Ives 8190-0.

3. Door Pull (straight):
 - a. Tubular metal; 1 IN diameter
 - b. Size: 10 IN (CTC)
 - c. Base Product: Trimco series 1195
 - d. Optional Product: Ives series 8103
 4. Ladder Pull:
 - a. Tubular metal; 1 IN diameter
 - b. Flat ends
 - c. Size: 10 IN
 - d. Base Product: Trimco series 1160
 - e. Optional Product: Rockwood series RM 3100
 5. Pushplate:
 - a. Flat metal plate; 1/16 IN thick.
 - b. Size: 3-1/2 X 15 IN.
 - c. Base Product: Trimco 1001-2.
 - d. Optional Product: Ives 8200.
 - e. Provide cutouts as required for cylinders, deadbolts, etc.
 6. Pushbar:
 - a. Tubular metal; 1 IN Diameter.
 - b. Size: Length as required by door width.
 - c. Base Product: Trimco 1741.
 - d. Optional Product: Ives 9100.
- O. Door Closers (surface applied):
1. General:
 - a. ANSI/BHMA A156.4, Grade 1.
 - b. UL listed for use on fire doors.
 - c. Body Material: Cast iron.
 - d. Size door closers to comply with manufacturer's recommendations for door sizes, locations, and accessibility requirements for opening force.
 - e. Closers adjustable to 3 second closing speed from 70 DEG opening to within 3 IN from latch.
 - f. Supply arms, brackets, and plates, as required.
 - g. Mount closers on room side of corridor doors, unless conditions prohibit such mounting.
 - h. Integral back checks.
 - i. Include limiting cushion stop at exterior, out-swinging doors.
 2. Base Products:
 - a. Models 4011 and 4111 by LCN.
 - b. Models 4041 and 4041XP by LCN.
 3. Optional Products:
 - a. 281 Series by Sargent Manufacturing.
 - b. QDC100 Series by Stanley.
- P. Automatic Doors:
1. Swinging Doors:
 - a. Automatic Operators, Motion Sensors, Wall Switches, Presence Sensors for Automatic Swinging Doors: Specified in Section 08 71 13.
 - b. Balance of Hardware specified in this Section.
 2. Sliding Doors:
 - a. Aluminum Frames, Door Panels, Tracks, Operators, Motion Sensors, Wall Switches, Presence Sensors, Electric Locking Mechanisms, Exit Devices and other elements of automatic sliding door package units: Specified in Section 08 42 29.
 - b. Balance of Hardware specified in this Section.
- Q. Door Trim and Protectives:
1. Kickplates and Armorplates:

- a. ANSI/BHMA A156.6, Type J100.
 - b. Material: Stainless Steel; 0.050 IN thick.
 - c. Height:
 - 1) Kickplates: 8 IN high.
 - 2) Armorplates: 34IN high.
 - d. Width:
 - 1) Single Doors: 2 IN less door width (LDW).
 - 2) Pair Doors: 1 IN less door width (LDW).
 - e. Bevel edge on top and sides of plates.
 - f. Coordinate installation of plates with locks and other hardware items
 - 1) Cutouts where required.
2. Door Edging:
- a. Material: Stainless Steel.
 - b. Minimum Thickness: 0.032 IN thick.
 - c. Provide where indicated in HW sets.
 - d. Quantities:
 - 1) Where Door Edging is indicated in HW sets: Provide 1 at hinge edge and 1 at latch edge of door.
 - 2) Exception: Omit from hinge edge where continuous geared hinges are scheduled.
 - e. Base Product: KE31-1 by Trimco.
3. Height: 34 IN
4. Provide cut-outs for hinges and similar items.
5. Install with supplied screws.
- R. Door Holders and Stops:
- 1. General:
 - a. Provide Door Stop at each door leaf.
 - b. Use type as indicated in Hardware Set.
 - c. If no type is indicated, use criteria listed below.
 - 2. Wall-mounted Door Stops:
 - a. Provide where door encounters a wall when opened 110 DEG or less.
 - 1) Wall stop is not required for times when door is used in rescue mode.
 - b. Except provide overhead type:
 - 1) Where door has pushbutton lockset
 - 2) Where door encounters a tile wall
 - c. See Sections 06 or 09 22 16 for blocking.
 - d. Base Products:
 - 1) Wood Screw, plastic anchor: WS406CCV by Ives
 - 2) Screw, drywall anchor: WS407CCV by Ives
 - 3. Overhead Door Stops:
 - a. Provide where door could swing more than 110 DEG without encountering a wall.
 - b. Base Products:
 - 1) Doors up to 45 IN wide: 450 series by Glynn Johnson
 - 2) Doors over 45 IN wide: 90 series by Glynn Johnson
 - 3) Exterior doors without a closer: 90 series by Glynn Johnson
 - 4) Exterior doors with a closer: 100 series by Glynn Johnson
 - 5) Lead lined doors: 90 series by Glynn Johnson
 - 6) Double-acting door has no wall adjacent: 100 series by Glynn Johnson
 - 4. Magnetic Door Hold Open devices (MHO):
 - a. Specified with Fire Alarm System in Section 28 31 00.
 - b. MHOs are indicated in HW sets for coordination purposes.
- S. Perimeter Seals
- a. Where doors/frame is extruded aluminum, refer to Aluminum Door/Frame specifications for Perimeter Gasket products.
2. Thresholds:

- a. ANSI/BHMA A156.6.
 - b. Material: Aluminum.
 - c. UL and ADA compliant.
 - d. Size for frame depth.
 - e. Provide required bolt cutouts.
 - f. Base Products are meant to describe design intent. Contractor to verify that models indicated are appropriate for sill conditions and finishes.
 - 1) Choose from Base Product models wherever possible.
 - 2) Include elevators and other adaptors where required.
 - g. Base Products:
 - 1) Saddle Thresholds with Thermal-break: S282, S471 or S473 by Reese.
 - 2) Panic Threshold: S248 w/Pile Insert by Reese.
 - 3) Bumper Seal Thresholds with Thermal-break: 273x292 FGPK by Pemko.
3. Weatherstripping:
- a. ANSI/BHMA A156.22; air leakage not to exceed 0.50 CUFTM/FT of crack when tested to ASTM E 283.
 - b. Head and Jamb Stops:
 - 1) Surface mounted, adjustable, screwed to frame stops.
 - 2) Base Product: 775 by Reese.
 - c. Sweeps:
 - 1) Base Product: 810 by Reese.
 - d. Meeting stiles of door pairs:
 - 1) Base Product: M35 by Reese.
4. Head Drip:
- a. Provide on exterior doors other than main entrance doors.
 - b. Bed flange in sealant and screw to head of frame using non-corrosive fasteners.
 - c. Base Product: R201 by Reese.
5. Fire and Smoke Seals:
- a. Provide approved seals to achieve the fire/smoke labels indicated for the opening.
 - b. Provide at other locations indicated to control sound, air and light infiltration.
 - c. Performance:
 - 1) Fire Door Assemblies (other than openings also requiring smoke control):
 - a) ANSI/BHMA A156.22; air leakage not to exceed 0.50 CUFTM/FT of crack when tested to ASTM E 283.
 - 2) Smoke- and Draft-Control Door Assemblies:
 - a) Where smoke- and draft-control door assemblies are required, provide seals that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - b) Air Leakage Rate: Maximum air leakage of 3 CUFTM/FT² at the tested pressure differential of 0.1 IN of water.
 - d. Perimeter Gaskets:
 - 1) Base Product – Frame perimeter seals at jambs and heads:
 - a) 797 by Reese; S88 by Pemko.
 - 2) Base Product - Meeting Stiles:
 - a) 93 by Reese; 355_S by Pemko.
 - e. Astragal:
 - 1) Provide where indicated.
 - 2) Where not indicated:
 - a) Provide as required to obtain fire label.
 - b) Provide on pair doors located on exterior wall.
 - c) Provide on pairs of radiation resistant doors.
 - 3) Fire Rated Openings:
 - a) Flat steel:
 - b) UL listed for labeled doors.
 - 4) Exterior Openings:
 - a) Aluminum with weatherstripping gaskets.

6. Isolation Seals:
 - a. Normal Duty:
 - 1) Jambs and Heads: Reese 99 or 399.
 - 2) Door Bottom: Reese 330, automatic door bottom.
 - 3) Meeting Stiles: Reese 87.
 - b. High Acoustical Performance:
 - 1) Jambs and Heads: Reese 599.
 - 2) Door Bottom: Reese 521, automatic door bottom.
 - 3) Meeting Stiles: Reese 87.
- T. Silencers
1. Silencers are not listed in Hardware sets but are required as described in this Article.
 2. Provide Silencers at openings except those receiving perimeter gasketing such as weather, fire, fire/smoke, and sound gaskets.
 3. ANSI/BHMA 156.16
 - a. Diameter: 1/2 IN.
 - b. Projection: 1/8 IN.
 - c. Tamper-proof.
 - d. Base Product – Steel Frames: SR64 by Ives.
- U. Controlled Access Accessory Items
1. Keyswitch (KS):
 - a. Wall mounted, single gang box activation device.
 - b. Maintained contacts unless otherwise noted; field-selectable to momentary action.
 - c. Red/green LED.
 - d. Include Cylinder.
 - e. Base Product: 653-L2 by Schlage.
 2. Exit Button (EB):
 - a. Wall mounted, single gang box lock release button for emergency egress.
 - b. Momentary contacts.
 - c. Locate EB where indicated in Drawings.
 - d. Base Product: 623-RD-EX by Schlage.
 3. Remote Lock Release (RLR) Button:
 - a. Wall mounted, single gang box activation device.
 - b. Convenience releasing device, located remotely from opening, to release an electrified locking mechanism.
 - 1) Where used with Automatic Doors: RLR shall also activate operator to open.
 - c. Momentary contacts.
 - d. Base Product: 623-GR by Schlage.
 4. Remote Lock Activation (RLA) Button:
 - a. Wall mounted, single gang box activation device.
 - b. Crisis lock Actuation Device located remotely from opening, to activate and hold an electrified locking mechanism in the event of threat to facility or occupants.
 - 1) Where used with Automatic Doors: RLA shall also disable other Actuation Devices on the unsecured side.
 - c. Alternate action/Maintained contacts.
 - d. Base Product: 623-GR-AA-DP by Schlage.
 5. Remote Lock Release (RLR) Button:
 - a. Surface mounted under countertop or under cabinets.
 - b. Convenience lock release device for staff use.
 - c. Where used with Automatic Doors: RLR shall also activate operator to open.
 - d. Momentary contacts.
 - e. Base Product: 660-PB by Schlage.
 6. Remote Lock Activation (RLA) Button:
 - a. Surface mounted under countertop or under cabinets.
 - b. Crisis lock Actuation Device to activate and hold an electrified locking mechanism in the event of threat to facility or occupants.

- c. Where used with Automatic Doors: RLA shall disable other Actuation Devices on the unsecured side.
 - d. Maintained contacts.
 - e. Base Product: 660-T4 by Schlage.
 - 7. Card Readers (OF/CI):
 - a. Furnished by Owner/Installed by Contractor.
 - 8. Door Position Switches (DPS):
 - a. Provided by Security System.
 - 9. Request-to-Exit (REX) motion sensors:
 - a. Provide where necessary to shunt alarm.
 - b. Provided and installed by Security System Installer.
 - 10. Fire Alarm Relays:
 - a. Specified with Fire Alarm System in Section 28 31 00.
 - 11. Low Voltage Power (centrally supplied by Security System):
 - a. Unless otherwise noted, Owner's Security System will provide low voltage power required to power items with current draw less than 2 AMP (24 VDC) including the following:
 - 1) Magnetic Locks.
 - 2) Electric Strikes.
 - 3) Electro-Mechanical Mortise Locksets.
 - 4) Electro-Mechanical Cylindrical Locksets.
 - 12. Power Supplies (PS) – Division 08 devices installed local to opening:
 - a. Provide filtered, regulated power.
 - b. Include relay modules that interface with Fire Alarm System.
 - c. Select power supply units that are:
 - 1) Same brand as primary devices being powered.
 - 2) Capable of receiving Fire Alarm Inputs.
 - 3) Capable of interfacing scheduled hardware with automatic operators.
 - 4) Include time delay modules where required for described function.
 - d. Electrified Exit Devices:
 - 1) Base Product: PS914 by Von Duprin.
 - 2) UL listed.
 - 3) Include options that interface with Fire Alarm and Automatic Operators.
- V. Key cabinet:
- 1. Size to permit minimum 100 PCT expansion of system.
- W. Extra Material
- 1. Deliver to Owner extra materials from same production run as products installed.
 - a. Package products with protective covering and identify with descriptive labels.
 - 2. Interchangeable cores:
 - a. Provide 10 extra for each Master keyed group.
 - 3. Extra Keys:
 - a. As specified in Article entitled: Operation – Keying
- X. Operation - Keying
- 1. Establish keying system with Owner:
 - 2.
 - 3. Provide and set up complete visible card indexed system with key tags and control slips.
 - 4. Tag and identify keys and install in key cabinet.
 - 5. Provide 3 keys for each lock mechanism.
 - 6. Master key and key in groups as directed.
 - a. Provide 6 master keys for each group.
 - 7. Grand Master key and key in as directed.
 - a. Provide 6 copies of grand master keys.
 - 8. Great Grand Master key and key in as directed.
 - a. Provide 6 copies of grand master keys.

9. Key to existing master key system.
10. Construction Keying:
 - a. Provide cylinders with feature that permits voiding of construction keys without cylinder removal.
 - 1) Provide 10 construction master keys.
 - b. Provide construction keying for exterior doors and primary entrances to construction areas.
 - 1) Construction Manager/General Contractor shall determine which openings will require construction keying based on sequence of construction activities.

2.3 HARDWARE SETS - EXTERIOR

- A. HW-110:
 1. Hinges
 2. Mortise Lockset, storeroom F07
 - a. Vandal resistant, break away outside lever.
 3. Latch Guard
 4. Delayed Action Closer
 5. Weatherstripping and Sweep
 6. Threshold
 7. Head Drip
 8. Stop
 9. Door Position Switch by Security System Installer.

2.4 HARDWARE SETS – INTERIOR

- A. HW-202:
 1. Hinges
 2. Mortise Latchset, passage F01
 3. Stop
 4. Closer
 5. Kickplate
- B. HW-203:
 1. Hinges
 2. Mortise Lockset, privacy F22
 3. Stop
- C. HW-204:
 1. Hinges
 2. Mortise Lockset, privacy F22
 3. Stop
 4. Closer
 5. Kickplate
- D. HW-206.5:
 1. Hinges
 2. Mortise Lockset, office F04
 3. Kickplate
 4. Stop
 5. Closer
- E. HW-210:
 1. Hinges
 2. Mortise Lockset, storeroom F07
 3. Stop
 4. Closer
 5. Kickplate
- F. HW-210.3:

1. Hinges
 2. Mechanical Pushbutton Lockset
 - a. Simplex L1000 Series by Kaba Ilco
 - b. Key bypass and passage set function
 3. Overhead Stop
 4. Closer
 5. Kickplate
- G. HW-259:
1. Cylinder and/or key core to suit lock specified elsewhere.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine scheduled openings for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Coordinate reinforcement or other preparation of doors and frames.
- C. Installation constitutes responsibility for performance.
- D. Coordinate installation power supply and communication wiring to electrically operated devices.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's installation instructions, supervised or inspected by an AHC.
- B. Furnish items of hardware for proper door swing.
- C. Permanently install hardware after finishing operations are complete.
- D. Protect finishes by temporary coverings as required.
- E. Mounting Heights:

Mounting Heights of Hardware	
Item	Height ^{1,2} (to Item Centerline)
Mortise Locksets	40-5/16 IN AFF to Centerline of Strike ³
Cylindrical Locksets	
Patient Latches	
Exit Devices	
Door Pulls	42 IN AFF to Centerline of Pull
Pushplates	45 IN AFF to Centerline of Plate
Auxiliary Deadbolts	48 IN AFF to Centerline of Strike
Butt Hinges (and Pivots)	Top Hinge: Not more than 11-3/4 IN down from frame
	Bottom Hinge: Not more than 13 IN above floor
	Equally spaced between Top and Bottom Hinges. Refer to Part 2 for quantity required.
Other Items	Comply with SDI and DHI Recommendations
Footnotes/Additional Requirements:	

1. Mounting Heights shall also comply with ADA and ICC/ANSI 117.1
2. Mounting Heights shall also comply with Building Code and Fire Codes.
3. Deviation from listed height will be allowed up to + 1-1/2 IN provided this does not cause a conflict between the lock and lite cutouts.

- F. Install hardware with fasteners concealed where not required by code to be exposed.
- G. Coordinate installation of electric access control hardware.
 1. Hardware installer to be responsible for coordination with electrical installer for low voltage installations.
- H. Door Position Switches (DPS):
 1. Coordinate door and frame preparations with door and frame suppliers, and Security System installer as appropriate.
 2. Locate in frame head approximately 4 IN from latching door edge, unless otherwise instructed.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware to ensure proper operation or function.
 1. Lubricate moving parts with lubricant recommended by manufacturer.
 2. Replace units which cannot be adjusted and lubricated to operate smoothly.
- B. Conversion of Construction Keying to Permanent (by Contractor):
 1. Convert cylinders from Construction to Permanent configuration at time of Substantial Completion.
 2. Demonstrate conversion method to Owner's facility personnel, making certain Owner's team understands methodology.
- C. Approximately six months after substantial completion, check and readjust to assure proper function of doors and hardware.
 1. Clean and lubricate operational items.
 2. Replace items which have deteriorated or failed.
 3. Prepare a written report of current and predictable problems in operation of hardware.
 4. Report visit and furnish copy of report to Owner with copy to Architect.
- D. When hardware is installed more than one month prior to final acceptance or occupancy, during week prior to acceptance or occupancy, make a final check and adjustment of hardware items.
 1. Remove temporary coverings.
 2. Clean and lubricate for proper function and finish.
 3. Adjust door control devices to compensate for operation of heating and ventilating equipment.
- E. Instruct Owner's personnel:
 1. Operating and maintenance procedures.
 2. Key control system.
 3. Methodology used to re-key cylinders from Construction to Permanent configuration.
- F. Prior to substantial completion instruct Owner's personnel in systems operation.
 1. Standard system operation and maintenance.
 2. Modification of codes.
 3. Acquisition, monitoring and scheduling of ID cards.
 4. Instruction in software applications.

END OF SECTION

SECTION 08 81 23
EXTERIOR GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Exterior Glass and Glazing in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Glass Standards:
 - 1. Flat glass:
 - a. ASTM C1036 Standard Specification for Flat Glass.
 - b. Float glass: Type I, Quality q3; and Class 1 unless otherwise indicated.
 - c. Figured glass: Type II, Quality q7, Form 3; and Class 1, Finish f1 and Pattern p2 unless otherwise indicated.
 - d. Provide Class 2 or 3 for tinted or integrally colored glass.
 - 2. Flat glass, heat treated (coated/uncoated):
 - a. Tempered safety glass: Conform to ANSI Z97.1 and CPSC 16 CFR 1201.
 - b. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - c. ASTM C1651 Standard Test Method for Measurement of Roll Wave Optical Distortion in Heat-Treated Flat Glass.
 - d. Heat strengthened glass: Kind HS, Type I, Quality q3, Class 1 and Condition A unless otherwise indicated.
 - e. Tempered glass: Kind FT, Type I, Quality q3, Class 1 and Condition A unless otherwise indicated.
 - f. Heat strengthened – tempered glass: Kind HS-FT, Type 1, Quality q3 and Condition A unless otherwise indicated.
 - g. Provide Class 2 or 3 for tinted or integrally colored glass.
 - h. Provide Condition B or C for coated glass.
 - i. Distortion Tolerances:
 - 1) Heat treated flat glass by horizontal, roller hearth process with inherent roller wave distortion parallel to bottom edge of glass as installed.
 - 2) Maximum peak to valley roller wave 0.003 IN in central area and 0.008 IN within 10-1/2 IN of leading and trailing edge
 - 3) Roll Wave (horizontal) distortion to maximum 0.003 IN at center of panel and 0.003 IN at edges of panels as measured from peak to valley.
 - 4) Clear or low-iron glass 1/4 IN to 3/8 IN thick without ceramic frit or ink:
 - a) Maximum plus or minus 100mD millidiopters over 95 PCT of glass surface.
 - 5) Maximum bow and warp 1/32 IN per lineal foot.
 - j. Fully tempered glass:
 - 1) Provide heat soak testing in compliance with EN14179 including 2 HR dwell at 280 DEGC – 300 DEGC.
 - 3. Insulating Glass Units:
 - a. Insulating Glass Certification Council (IGCC), Class CBA.
 - b. ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.
 - c. ASTM E2188 Standard Test Method for Insulating Glass Unit Performance.
 - d. ASTM E2189 Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
 - 4. NFPA 80 Standard for Fire Doors and Windows.

5. ANSI Z97.1 Safety Glazing Materials Used in Buildings.
 6. CPSC 16 CFR 1201 Federal Safety Standard for Architectural Glazing Material.
 7. GANA Glazing Manual.
- B. Glazing Standards:
1. GANA Glazing Manual.
 2. Glazing Guidelines for Sealed Insulating Glass Units, by the Insulating Glass Manufacturers Alliance (IGMA).

1.3 SUBMITTALS

- A. Samples:
1. 12 IN x 12 IN piece of each specified type of glass.
- B. Contract Closeout Information:
1. Warranty.

1.4 WARRANTY

- A. Written five (5) year warranty signed by installer to cover weather tightness of installation including air and water integrity.
- B. Written warranty signed by manufacturer or fabricator of glass units against failure.
1. Include costs associated with glass replacement and installation.
 2. Failure is defined as excessive deterioration under normal conditions, thermal failure of insulating units, or obscured vision.
 - a. Coated glass: 10 years.
 - b. Laminated glass: 5 years.
 - c. Insulating glass (vertical): 10 years.
 - d. Insulating glass (sloped): 5 years.
 - e. Reflective spandrel: 5 years.
 - f. Pyrolytic-coated, self-cleaning glass: 10 years.
 - g. Tempered glass: Heat soaked warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Insulating Glass and Insulating Spandrel Glass Fabricators:
1. Base:
 - a. Viracon
 2. Optional:
 - a. JE Berkowitz
 - b. Oldcastle
 - c. Technoglass
 - d. Trulite
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Glass:
1. Comply with indicated standards.
 2. See Glass Types Schedule for listing of types.
 3. Materials specified in Glass Types Schedule are minimum acceptable products.
 4. Provide individual glass types used in fabrication of insulating units from single manufacturer.
 5. Manufacturer or fabricator determine if materials should be heat strengthened or fully tempered at non-hazardous locations that do not require safety glazing and provide accordingly.
 6. Low-E coating:

- a. Hardcoat.
- B. Glazing Compounds:
 - 1. Non-sag and non-staining.
 - 2. Pigmented to match frame units not requiring painting.
 - 3. Compatible with adjacent surfaces.
 - 4. For use in setting glass: Neutral-cure Silicone sealant.
 - 5. Sealant tape: Butyl rubber sealant tape or ribbon having a continuous neoprene shim.
 - 6. Gaskets:
 - a. Polyvinyl chloride or neoprene.
 - b. Extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.
- C. Installation Setting Blocks and Spacers:
 - 1. Neoprene, compatible with sealants used.
 - 2. Setting blocks: 80-90 durometer.
 - 3. Spacers: 40-50 durometer.
 - 4. Compressible filler: Closed cell jacketed rod stock of synthetic rubber or plastic foam.
- D. Insulating Glass Spacers:
 - 1. 1/2 IN 13 MM thick, nominal.
 - 2. Aluminum, desiccant filled.
 - a. Finish: Mill.
- E. Shims, clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.

2.3 GLASS TYPES SCHEDULE

- A. Glass Type EX-1:
 - 1. Clear float, 6 MM thick.
- B. Glass Type EX-2:
 - 1. Clear, tempered float, 6 MM thick.
- C. Glass Type EX-3:
 - 1. Bronze, float, 6 MM thick.
- D. Glass Type EX-4:
- E. Bronze, tempered float, 6 MM thick. Glass Type EX-5:
 - 1. Float, reflective, 6 MM thick.
- F. Glass Type EX-11:
 - 1. Insulating glass; two sheets of 6 MM thick glass, hermetically sealed together at edges with spacers and sealant, with 12 MM dehydrated air space.
 - 2. Outside glass: Type EX-5
 - 3. Inside glass: Type EX-1 .
- G. Glass Type EX-17 – Laminated Glass:
 - 1. Laminated safety glass complying with ANSI-Z97.1 and CPSC 16 CFR 1201, consisting of 2 plies of heat strengthened ASTM C1036 float glass, and 1.5 MM interlayer.
 - 2. Overall Thickness: 6 MM.
 - 3. Overall Thickness: 10 MM.
 - 4. Overall Thickness: 12 MM.
 - 5. Color: Clear.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be installed.
- B. Field verify glass size for each opening, within tolerances and dimensions established.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Comply with GANA Glazing Manual and IGMA Glazing Guidelines for Sealed Insulating Glass Units.
- C. Do not install glass with edge damage.
- D. Install setting blocks in adhesive or sealant.
- E. Provide spacers inside and out, of proper size and spacing, for glass size, except where gaskets are used for glazing.
- F. Minimum Bite:
 - 1. 6 MM monolithic units: 10 MM.
 - 2. 25 MM insulating units: 12 MM.
 - 3. For other sizes: Refer to Table C of AAMA's Aluminum Curtain Wall Design Manual, Volume 6, Glass & Glazing.
- G. Sealant Depth: Equal to sealant width.
- H. Miter cut and bond gasket ends together at corners.
- I. Remove and replace damaged glass.
- J. Ensure that weep system in frames is not blocked by sealant.

3.3 CLEANING AND PROTECTION

- A. Wash and polish glass on both faces not more than 7 days prior to final completion of work.
- B. Comply with glass manufacturer's recommendations and GANA 01-0300.

END OF SECTION

SECTION 08 81 26
INTERIOR GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Interior Glass and Glazing in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Glass Standards:
 - 1. ANSI Z97.1.
 - 2. CPSC 16 CFR 1201.
 - 3. GANA Glazing Manual.
- B. Flat Glass:
 - 1. ASTM C1036 Standard Specification for Flat Glass.
 - 2. Float glass: Type I, Quality q3 and Class 1 unless otherwise indicated.
 - 3. Figured glass: Type II, Quality q7, Form 3 and Class 1, Finish fl and Pattern p2 unless otherwise indicated.
 - 4. Mirror glass and one-way vision glass: Type I, Quality q1 or q2, Class 1 and coated for purpose.
- C. Flat Glass, Heat Treated, Coated and Uncoated:
 - 1. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - 2. Heat strengthened glass: Kind HS, Type I, Quality q3, Class 1 and Condition A unless otherwise indicated.
 - 3. Tempered glass: Kind FT, Type I, Quality q3, Class 1 and Condition A unless otherwise indicated.
 - 4. Heat strengthened – tempered glass: Kind HS-FT, Type 1, Quality q3 and Condition A unless otherwise indicated.
- D. Mirror Glass:
 - 1. ASTM C1503;
 - 2. Quality: Mirror select.
 - 3. F.S.DD-M-00411B (1).
- E. Fire Rated Assemblies:
 - 1. Where glazing products are used in fire-rated assemblies, comply with requirements of specific assembly specified in other sections of these Specifications.
 - 2. Underwriters Laboratories, Inc. (UL):
 - a. UL 9 – Fire Tests of Window Assemblies.
 - b. UL 10B – Fire Tests of Door Assemblies.
 - c. UL 10C – Positive Pressure Fire Tests of Door Assemblies.
 - 3. Fire Protective Rated Glass:
 - a. Each lite shall bear permanent, non-removable label of UL certifying use in tested and rated fire protective assemblies.
 - 4. Door Assemblies:
 - a. Comply with NFPA 80 and listed and labeled by testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, tested in accordance to NFPA 252.
 - b. Positive Pressure Compliance: UL 10C.
 - c. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per UL 10B, labeled and listed by UL.

- 5. Window Assemblies:
 - a. Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
 - b. Positive Pressure Compliance: UL 10C.
- F. Laminated Glass:
 - 1. ASTM C1172 Standard Specification for Laminated Architectural Flat Glass.
 - 2. Laminated Glass Design Guide, by the Glass Association of North America (GANA).
- G. Glazing Standards:
 - 1. Glazing Manual, by the Glass Association of North America (GANA).

1.3 SUBMITTALS

- A. Samples:
 - 1. Provide one (1) 12 IN x 12 IN example of each specified type of glass.
- B. Contract Closeout Information:
 - 1. Warranties.

1.4 WARRANTY

- A. Written warranty signed by manufacturer or fabricator.
- B. Laminated Glass:
 - 1. Five (5) years against deterioration including edge separation, delamination that materially obstructs vision through glass, and blemishes exceeding those allowed by referenced laminated glass standard.
- C. Fire-rated Ceramics:
 - 1. Five (5) year manufacturer's standard warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Glass Products:
 - 1. Base:
 - a. AGC Industries
 - 2. Optional:
 - a. Guardian Industries
 - b. Pilkington
 - c. Vitro Glass
 - d. Saint-Gobain
- B. Fire Rated Glass Ceramic:
 - 1. Base:
 - a. Technical Glass Products (TGP).
 - 2. Optional:
 - a. Safti First
 - b. Pilkington
 - c. Vetrotech
- C. Radiation Resistant Glass:
 - 1. Base:
 - a. Ray-Bar Engineering Corp.
 - 2. Optional:
 - a. Nelco.
 - b. Corning Inc.
 - c. Schott North America, Inc.

- d. Radiation Protection Products (RPP).
- e. Technical Glass Products (TGP).

D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Glass Materials:
 - 1. Comply with indicated standards.
 - 2. See Glass Types Schedule for listing of types.
 - 3. Materials specified in Glass Types Schedules are minimum acceptable products.
 - 4. Single manufacturer produce individual glass types used in fabrication of insulating units.
 - 5. Manufacturer or fabricator determine if materials should be heat strengthened or fully tempered at non-hazardous locations that do not require safety glazing and provide accordingly.
- B. Glazing Compounds:
 - 1. Nonsag, nonstain type.
 - 2. Pigmented to match frame units not requiring painting.
 - 3. Compatible with adjacent surfaces.
 - 4. For use in setting glass: Neutral-cure Silicone sealant.
 - 5. Sealant tape:
 - a. Butyl rubber sealant tape or ribbon having a continuous neoprene shim.
 - 6. Gaskets:
 - a. Polyvinyl chloride or neoprene.
 - b. Extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.
- C. Installation Setting Blocks and Spacers:
 - 1. Neoprene, compatible with sealants used.
 - 2. Setting blocks: 80-90 durometer.
 - 3. Spacers: 40-50 durometer.
 - 4. Compressible filler stock: Closed cell jacketed rod stock of synthetic rubber or plastic foam.
 - 5. Shims, clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.

2.3 GLASS TYPES SCHEDULE

- A. Refer to Interior Glass Types Schedule for basic description of mark numbers indicated on Drawing.
- B. Refer to Drawings for depiction of unit sizes and locations.
- C. Upgrade basic type conditions in accordance with following rules:
 - 1. Heat treatment upgrade based on physical size of unit:
 - 2. Heat strengthened or fully tempered units between 55 and 70 SQFT .
 - 3. Fully temper units exceeding 70 SQFT .
 - a. Strengthen annealed glass where units exceed length or width limitations or both as recommended by glass manufacturer.
 - 4. Heat treatment upgrade based on locations which are potentially hazardous to occupants:
 - a. Upgrade units to fully tempered, Kind FT, glass as required by any one of following:
 - 1) When required by local Codes.
 - 2) When specifically indicated on Drawings.
 - 3) Locations requiring Safety Glass, Kind FT, by 16 CFR 1201 and ANSI Z97.1:
 - a) Units installed in doors, sash, transom or other operable units.
 - 5. Units where any part of unit is within 18 IN , measured vertically, above a floor line, sidewalk, paver, or other walking surface located within 3 FT of the glass unit, measured horizontally.

6. Units in sidelights and other units located adjacent to and within 48 IN of either jamb of door or other operable units; this includes adjacent lites that are in perpendicular plane to door.
7. Other conditions requiring heat treatment upgrades:
 - a. Units which will be exposed to irregular sun or shade combinations or both shall be Kind HS or better.
 - b. Where glass manufacturer recommends heat treatment coatings or tints specified.
 - c. Where required to resist lateral loads.

2.4 INTERIOR GLASS TYPES SCHEDULE

- A. **Type A** - Annealed:
 1. Clear float, 6 MM thick.
- B. **Type T** - Tempered:
 1. Clear tempered float.
 2. Thickness: 6 MM.
- C. **Type HT** - Heat strengthened tempered glass:
 1. Clear heat strengthened tempered float.
 2. Thickness: 6 MM.
- D. **Type C8** – Laminated Fire and Safety Glass:
 1. Laminated, wireless, UL labeled for assembly indicated.
 2. Impact and safety rated per ANSI Z97.1 and CPSC 16CFR1201.
 3. Thickness: 8 MM laminated.
 4. Surface: Polished.
 5. Base Product: FireLite Plus by Technical Glass Products.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be installed.

3.2 INSTALLATION

- A. Do not install glass with edge damage.
- B. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.
- C. Comply with recommendations of manufacturers, except where more stringent requirements are indicated.
- D. Comply with GANA Glazing Manual.
- E. Install sealants as recommended by sealant manufacturer.
- F. Install setting blocks in adhesive or sealant.
- G. Provide spacers inside and out, of proper size and spacing, for glass size, except where gaskets are used for glazing.
- H. Minimum Bite:
 1. Monolithic, 6 MM glass: 10 MM minimum bite.
 2. For other sizes: Refer to Table C of AAMA's Aluminum Curtain Wall Design Manual, Volume 6, Glass and Glazing.
- I. Sealant Depth: Equal to sealant width.
- J. Prevent sealant exudation from glazing channels.
 1. Leave void at heel or install filler at jambs and head.

- 2. Do not leave void or install filler at sill.
- K. Miter cut and bond gasket ends together at corners.
- L. Immediately after installation, attach crossed streamers to framing held away from glass.
- M. Do not apply anything to surfaces of glass.
- N. Install spandrel units from exterior of building.
- O. Installation of Mirrors:
 - 1. Mastic Attachment: Install mirrors with mirror adhesive applied to back of mirror and pressed against substrate as recommended by mirror supplier.
- P. Remove and replace damaged glass.

3.3 CLEANING AND PROTECTION

- A. Wash and polish glass on both faces not more than 7 days prior to final completion of work in each area.
- B. Comply with glass manufacturer's recommendations and GANA 01-0300.

END OF SECTION

SECTION 08 88 53
SECURITY GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Security Glazing in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Minimum five (5) years' experience manufacturing specified item.
 - 2. Minimum five (5) years successful installation on correctional facilities of like size.
- B. Installer Qualifications:
 - 1. Approved by manufacturer for installation of specified items.
 - 2. Minimum five (5) years' experience installing specified items.
- C. American National Standards Institute (ANSI):
 - 1. ANSI Z97.1 Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test
- D. ASTM International:
 - 1. ASTM C158 Standard Test Methods for Strength of Glass by Flexure (Determination of Modulus of Rupture)
 - 2. ASTM C1036 Standard Specification for Flat Glass
 - 3. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
 - 4. ASTM C1349 Standard Specification for Architectural Flat Glass Clad Polycarbonate
 - 5. ASTM F1915 Standard Test Methods for Glazing for Detention Facilities
- E. Glass Association of North America (GANA) / Pittsburgh Glass Center (PGC):
 - 1. GANA Glazing Manual
 - 2. GANA Guide to Architectural Glass
 - 3. GANA Laminated Glazing Reference Manual
 - 4. GANA/PGC International Protective Glazing Manual
- F. Insulating Glass Manufacturers Alliance (IGMA):
 - 1. IGMA Technical Binder
- G. National Fire Protection Association (NFPA):
 - 1. NFPA 80: Standard for Fire Doors and Other Opening Protectives
- H. UL:
 - 1. UL 752 Standard for Bullet-Resisting Equipment
 - 2. UL 9 Standard for Safety Fire Tests of Window Assemblies
 - 3. UL 10B Standard for Safety Fire Tests of Door Assemblies
- I. HP White TP-0500.02 Test Method for Security Glazing.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. List glass type intended for use in each opening.
 - 2. Installation details of conditions.
- B. Samples:
 - 1. 12 x 12 IN square of each glass type and thickness specified.

- C. Project Information:
 - 1. Reports certifying materials meet specified requirements and test criteria.
 - a. Tests performed and results current within past five (5) years.
 - 2. Manufacturer Certification:
 - a. Compatibility of sealant and setting blocks with glazing products
 - b. Installer qualifications
- D. Contract Closeout Information:
 - 1. Warranty
 - 2. Manufacturer cleaning and maintenance instructions

1.4 SPECIAL WARRANTY

- A. Warranty to be signed by manufacturer and installer against failure including:
 - 1. Weathertightness including air and water integrity.
 - 2. Removal of failed units, furnishing and installation of replacement units.
 - 3. Provide replacement units within 30 days.
- B. Glass Clad Polycarbonate:
 - 1. Provide five (5) year written warranty against:
 - a. Delamination.
 - b. Units becoming opaque under normal conditions.
- C. Laminated Polycarbonate:
 - 1. Provide five (5) year written warranty against:
 - a. Delamination.
 - 2. Provide ten (10) year written warranty against:
 - a. Units becoming opaque or yellowing under normal conditions.
 - b. Coating failure by delamination or flaking from substrate.
- D. Monolithic Polycarbonate:
 - 1. Provide ten (10) year written warranty against:
 - a. Units becoming opaque or yellowing under normal conditions.
 - b. Coating failure by delamination or flaking of coating from substrate.
- E. Fire Rated Glass Clad Polycarbonate:
 - 1. Provide five (5) year written warranty against:
 - a. Delamination.
 - b. Units becoming opaque or yellowing under normal conditions.
- F. Provide additional three (3) year extension of base warranty when Manufacturer Qualifications or Installer Qualifications are not met.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Security Glazing:
 - 1. Base:
 - a. As indicated for individual products.
 - 2. Optional:
 - a. As indicated for individual products.
 - 3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Setting Blocks:
 - 1. Shore A hardness of 85 (+/-5).
 - 2. Verify compatibility with glazing materials and frame.
 - 3. Base: Santoprene by ExxonMobile
 - 4. Optional: TPR by CR Lawrence

- B. Glazing Tape:
 - 1. Pre-shimmed
 - 2. Verify compatibility with glazing materials and frame.
 - 3. Base: Polyshim II by Tremco
- C. Sealant:
 - 1. Silicone, non-sag
 - 2. Comply with FS TT-S-001543A.
 - 3. Verify compatibility with glazing materials and frame.
 - 4. Base:
 - a. Silpruf by General Electric Co.
 - 5. Optional:
 - a. Construction 1200 by General Electric Co.
 - b. 795 or 999 by Dow Corning
 - c. Spectrem II by Tremco

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine framing or glazing surfaces, backing, stop design, and conditions under which glazing is to be installed.

3.2 INSTALLATION

- A. Do not install glass with edge damage.
- B. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.
 - 1. Comply with manufacturers recommendations for edge clearance and minimum bite.
- C. Comply with recommendations of manufacturers, except where more stringent requirements are indicated.
 - 1. As a minimum, comply with GANA Glazing and Sealant Manuals and IGMA recommendations.
- D. Setting Blocks:
 - 1. Install at quarter points in sealant or adhesive bed.
 - 2. Size to provide 0.1 IN of length per square foot of glass area, but not less than 4 IN .
 - 3. Provide blocks that are 1/16 IN less than full channel width.
 - 4. Height should provide the recommended nominal bite and minimum edge clearance.
- E. Glazing Tape:
 - 1. Install continuous glazing tape both sides of glazing of recommended size and thickness.
- F. Silicone Cap Bead:
 - 1. Install continuous bead both sides of glass.
 - 2. Force sealant into channel to eliminate air pockets and voids and to ensure complete bond of sealant to glazing and substrate.
 - 3. Tool exposed surfaces to provide substantial wash away from glass.
 - 4. Color: Black.
- G. Immediately after installation, attach crossed streamers to framing, held away from glass.
- H. Do not apply anything to surfaces of glass.
- I. Remove and replace damaged glass.
- J. Glazing products damaged or scratched prior to final acceptance, due to improper protection or cleaning, will be replaced at no cost to the Owner.

3.3 CLEANING

- A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to the deterioration of other materials.
- B. Wash and polish glass on both faces not more than 7 days prior to Substantial Completion of project.
 - 1. Comply with glass manufacturers recommendations.
 - 2. Protect polycarbonate surfaces from scratching and abrasion.
 - 3. Do not use razor blades to clean polycarbonate.

3.4 SECURITY GLASS TYPES SCHEDULE

- A. Numbers are fixed. Not all listed glass types are used, refer drawings and schedules to determine types noted and required.
- B. Thickness is indicated by last number in glass type. Example: GP-9 is 9/16 IN thick.
- C. Glass Clad Polycarbonates:
 - 1. Glass Type GP-12:
 - a. Clear
 - b. Nominal 3/4 IN thickness
 - c. Two heat or chemically strengthened clear glass sheets, laminated together with bonding interlayers to two-ply polycarbonate core.
 - d. ASTM F1915, Grade 2, 40 MIN Forced Entry
 - e. HP White Level III
 - f. Base: SP 019 by Global Security Glazing
 - g. Optional: GCPHG1316 by LTI
 - 2. Glass Type GP-16:
 - a. Clear
 - b. Nominal 1 IN thickness
 - c. Two heat or chemically strengthened clear glass sheets, laminated together with bonding interlayers to nominal 5/8 IN , two-ply polycarbonate core.
 - d. Comply with ASTM F1915, Grade 1, 60 MIN Forced Entry
 - e. HP White Level IV
 - f. Base: SP 028 by Global Security Glazing
 - g. Optional: GCPHG1616 by LTI Smart Glass, Inc.
- D. Fire Rated Wire Glass Clad Polycarbonates.
 - 1. Glass Type FRWP-16:
 - a. Wire Glass-clad Polycarbonate, labeled.
 - b. Nominal 1 IN thickness.
 - c. Two sheets of fire-rated wire glass sheets, laminated together with bonding interlayers to multi-ply polycarbonate core.
 - d. UL 10B Listed to 45 MIN.
 - 1) Maximum viewing area in Side Lites/Window Frames is 1296 SQIN (Horizontal maximum 39 IN and vertical maximum of 42 IN).
 - 2) Maximum viewing area in Door Lites is 576 SQIN (Horizontal and vertical maximum 24 IN).
 - e. Quality Assurance:
 - 1) Comply with ASTM F1915, Grade 2, 40 Min. Forced Entry
 - f. Acceptable Manufacturers:
 - 1) Global Security FRP 4540
 - 2) LTI Smartglass, GCPFR 1125
 - 2. Glass Type FRWP-18:
 - a. Glass-clad Polycarbonate, labeled.
 - b. Nominal 1-1/8 IN thickness.
 - c. Two sheets of fire-rated wire glass sheets, laminated together with bonding interlayers to multi-ply polycarbonate core.

- d. UL 10B Listed to 45 MIN.
 - 1) Maximum viewing area in Side Lites/Window Frames is 1156 SQIN (Horizontal maximum 39 IN and vertical maximum of 42 IN).
 - 2) Maximum viewing area in Door Lites is 576 SQIN (Horizontal and vertical maximum 24 IN).
 - e. Quality assurance:
 - 1) Comply with ASTM F1915, Grade 1, 60 Min. Forced Entry.
 - f. Acceptable Manufacturers:
 - 1) Global Security Glazing ICGCP 2416WW.
 - 2) No known equal.
3. Glass Type FRWP-20:
- a. Wire Glass-clad Polycarbonate, labeled.
 - b. Nominal 1-1/4 IN thickness.
 - c. Two sheets of fire-rated wire glass sheets, laminated together with bonding interlayers to multi-ply polycarbonate core.
 - d. UL 9/ 10C Listed to 90 MIN.
 - 1) Maximum viewing area in Door Lites is 330 SQIN not to exceed 10 IN x 33 IN
 - 2) May not be used in sidelites
 - e. Quality Assurance:
 - 1) Comply with ASTM F1915, Grade 1, 60 Min. Forced Entry
 - f. Acceptable Manufacturers:
 - 1) Global Security Glazing ICGCP 2416WW90
 - 2) LTI Smartglass, GCPFR 1400
- E. Insulated Glass Clad Polycarbonate:
- 1. Glass Type GPI-24:
 - a. Insulated Glass Clad
 - b. Nominal 1-1/2 IN thickness
 - c. Construction:
 - 1) 1/4 IN Vitro SolarBan R100 Tempered
 - 2) .500 Air space
 - 3) 1/8 IN Heat Strengthened clear glass
 - 4) .050 IN Urethane
 - 5) 3/8 IN Polycarbonate
 - 6) .050 IN Urethane
 - 7) 1/8 IN Heat Strengthened clear glass
 - d. U-Value: 0.26
 - e. Shading Co-efficient: 0.26
 - f. Light Transmission: 0.38
 - g. Quality Assurance
 - 1) Comply with ASTM F1915, Grade 3, 20 Min. Forced Entry
 - h. Acceptable Manufacturers:
 - 1) Global Security Glazing 2116 Insulated.

END OF SECTION



DIVISION 09

FINISHES



**SECTION 09 06 10
COLOR SCHEDULE**

**PART 1 - GENERAL
1.1 DESCRIPTION**

- A. Schedule is for material location and color assignment only:
1. Use in conjunction with the drawings and specifications.
 2. Bring any apparent error, inconsistency, or omission to the attention of the Architect before proceeding.
- B. Abbreviations: See section indicated for description of material.

ABBREVIATION SCHEDULE

FLOOR/BASE	
EXIST	Existing --
PT	Porcelain Tile Section 09 30 00
RB	Resilient Base Section 09 65 13
SR	Sheet Rubber Tile Section 09 65 18
RFT	Rubber Floor Tile Section 09 65 20
SDRT	Static Dissipative Resilient Tile Section 09 65 36
CFSND	Concrete Floor Sealer - Normal Duty Section 09 67 81
CFSHD	Concrete Floor Sealer - Heavy Duty Section 09 67 81
SM LSU	Seamless Urethane Section 09 67 14

WALLS	
EXIST	Existing --
PT	Porcelain Tile Section 09 30 00
PTE	Paint (epoxy) Section 09 91 23

CEILINGS	
EXIST	Existing --
EXP	Exposed to Structure --
GWB	Gypsum Wallboard Section 09 29 00
PTE	Paint (epoxy) Section 09 91 23

MISCELLANEOUS	
PTM	Paint (Metal) Section 09 91 23
PLM	Plastic Laminate Section 12 34 00
SSF	Solid Surface fabrications Section 12 36 63

C. General notes:

1. Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or area. If color or finish is not designated, Architect will select from standard colors or finishes available.
2. Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as, but not limited to metal toilet enclosures, pre-finished partition systems, acoustic materials, architectural woodwork and casework, stainless steel elevator entrance doors and frames, including light fixtures, switchgear and distribution cabinets.
3. Grills, diffusers, electrical panels, access panels, etc., which are exposed in finish spaces shall be painted to match the surface on which they occur.
4. Paint interior surfaces of ducts flat black where surfaces are visible through grills or diffusers.
5. Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.
6. Hollow metal doors and hollow metal door frames shall be painted PTE1 in all areas, unless noted otherwise.
7. Coordinate with concrete curing method, see Section 03 31 10.
8. Provide water vapor emission control system for concrete with applied flooring, see Section 07 26 00.
9. Refer to interior elevations for additional general interior notes.

D. Color Schedule List of Colors:

COLOR SCHEDULE

Porcelain Tile (PT) Section 09 30 00								
Code	Manufacturer	Manuf. #	Color	Size	Series	Finish	Grout Color	Comments
PT1	Stonepeak	USG1212162	Simply Coffee	12x12	Simply Modern Collection	--	TBD	Floor tile.
PT1b	Stonepeak	#162	Simply Coffee	6x12	Simply Modern Collection	--	TBD	Cove base
PT2	Stonepeak	USG1212164	Simply Tan	12x12	Simply Modern Collection	--	TBD	Wall tile

Acoustical Material (AM) Section 09 51 00								
Code	Manufacturer	Style	Size	Manuf. #	Edge	Color	Grid	Comments
AM1	Armstrong	Fine Fissure	24x24x5/8"	1728	Square	White	15/16"	Provide Hold-down security clips in rooms where lay-in ceilings are 12'-0" or lower

Resilient Base (RB) Section 09 65 13

Code	Manufacturer	Manufacturer #	Color	Series	Comments
RB1	Roppe	TP 7P193	Black-Brown	--	4" high

Rubber Floor Tile (RFT) Section 09 65 20

Code	Manufacturer	Series	Color	Manuf #	Comments
RFT1	Nora	Noraplan Environcare	Lace Vine	2945	--

Static Dissipative Tile Flooring (SDT) Section 09 65 36

Code	Manufacturer	Series	Color	Manuf #	Comments
SDT1	Johnsonite	Granite SD	Full Moon	710	--

Seamless Epoxy Flooring (SEF) Section 09 67 26

Code	Manufacturer	Manufacturer #	Color	Comments
SMLSU	Stonhard	URT	Driftwood	--

Paint (PTE) Section 09 91 23

Code	Manufacturer	Manufacturer #	Color	Finish	Comments
PTE1	Sherwin Williams	--	Match existing field color	Match existing	Field
PTE2	Sherwin Williams	SW 6108	Latte	Semi-gloss	Neutral accent
PTE3	Benjamin Moore	HC-86	Kingsport Gray	Semi-gloss	Color accent
PTE4	Sherwin Williams	SW 7729	Edamame	Semi-gloss	Color accent
PTE5	Sherwin Williams	SW 6502	Loch Blue	Semi-gloss	Color accent
PTE6	Sherwin Williams	SW 7005	Pure White	Flat	GWB Ceilings

Paint to Metal (PTM) Section 09 91 23

Code	Manufacturer	Manufacturer #	Color	Finish	Comments
PTM1	PPG	510-1	Garlic Clove	Semi-gloss	Hollow metal doors, door/window frames and hollow metal detention furniture

Plastic Laminate (PLM) Section 12 34 00

Code	Manufacturer	Manufacturer #	Color	Finish	Comments
PLM1	Wilsonart	7949-38	Asian Night	Matte	Base Cabinet
PLM2	Wilsonart	4841-60	Desert Zepher	Matte	Countertop

Solid Surfacing Fabrications (SSF) Section 12 36 63

Code	Manufacturer	Series	Color/Pattern	Finish	Comments
SSF1	Wilsonart	Gibraltar	9032ML Arabian Melange	--	--

END OF SECTION

Wood Paneling (Flush) and Base (WDP & WDB) Section 06421:

Code	Species	Stain Manufacturer	Stain Color	Comments
WDP-1				
WDP-2				
WDB-1				
WDB-2				

Decorative Polymer Fabrication (DPF) Section 06655:

Code	Manufacturer	Manufacturer #	Style	Color	Comments
DPF-1					
DPF-2					
DPF-3					

Polished Plaster (PP) Section 09218

Code	Manufacturer	Manufacturer #	Color	Finish	Comments
PP-1					
PP-2					

Quarry Tile (QT) Section 09312:

Code	Manufacturer	Manufacturer #	Color	Size	Series	Finish	Grout Color	Comments
QT-1	Daltile							
QT-2	Daltile							
QT-3	Daltile							
QT-4	Daltile							

Natural Stone Tile (NST) Section 09380:

Code	Manufacturer	Manufacturer #/Name/Description	Material Size	Thickness	Finish	Comments
NST-G1						
NST-G2						
NST-G3						
NST-M1						
NST-M2						

Custom Acoustical Ceiling System (CAC) Section 09508:

Code	Manufacturer	Manufacturer #	Size	Style	Wall Detail	Color	Comments
CAC-1	Decoustics	Ceilencia/Claro	As indicated	--	L-angle	White	
CAC-2	Decoustics						

Linoleum (LN) Section 09650:

Code	Manufacturer	Manufacturer #	Color	Series	Comments
LN-1					
LN-2					
LN-3					
LN-4					
LN-5					

Resilient Stair Tread (RST) Section 09660 or Section 09678

Code	Manufacturer	Manufacturer #	Color	Series	Comments
RST-1					
RST-2					
RST-3					

RST-4					
RST-5					

Sheet Vinyl (SV) Section 09665

Code	Manufacturer	Manufacturer #	Color	Series	Comments
SV-1					
SV-2					
SV-3					
SV-3					
SV-4					
SV-5					

Cushioned Sheet Vinyl (CSV) Section 09667

Code	Manufacturer	Manufacturer #	Color	Series	Comments
CSV-1					
CSV-2					

Static Conductive Tile (SCT) Section 09675

Code	Manufacturer	Manufacturer #	Color	Series	Comments
SCT-1					
SCT-2					

Static Conductive Sheet Vinyl (SCSV) Section 09676

Code	Manufacturer	Manufacturer #	Color	Series	Comments
SCSV-1					
SCSV-2					

Static Dissipative Rubber or Resilient Tile (SDRT) Section 09677

Code	Manufacturer	Manufacturer #	Color	Series	Comments
SDRT-1	Armstrong			SDT Excelon	

Seamless Epoxy Flooring (SEF) Section 09705

Code	Manufacturer	Manufacturer #	Color	Series	Comments
SEF-1					

Seamless Urethane Flooring (SUF) Section 09706

Code	Manufacturer	Manufacturer #	Color	Series	Comments
SUF-1					

Decorative Laminate Flooring (DLF) Section 09626

Code	Manufacturer	Manufacturer #	Color	Series	Comments
SCSV-1					
SCSV-2					

Broadloom Carpet 12 FT Wide (CPT) Section 09680

Code	Manufacturer	Manufacturer #	Color	Series	Backing	Comments
CPT-1						
CPT-2						
CPT-3						
CPT-4						
CPT-5						

Broadloom Carpet 6 FT Wide (CPT) Section 09691

Code	Manufacturer	Manufacturer #	Color	Series	Backing	Comments
------	--------------	----------------	-------	--------	---------	----------

CPT-1							
CPT-2							
CPT-3							
CPT-4							
CPT-5							

Portland Cement Terrazzo (TERR) Section 09410

Code	Manufacturer	Manufacturer #	Color	Series	Comments
TERR-1					
TERR-2					
TERR-3					
TERR-4					
TERR-5					

Thinset Epoxy Terrazzo (TERR) Section 09735

Code	Manufacturer	Manufacturer #	Color	Series	Comments
TERR-1					
TERR-2					
TERR-3					
TERR-4					
TERR-5					

Waterproof Flooring (WPF) Section 09765

Code	Manufacturer	Manufacturer #	Color	Series	Comments
WPF-1					
WPF-2					

Glazed Coating (GC) Section 09815

Code	Manufacturer	Manufacturer #	Color	Series	Comments
GC-1					
GC-2					

Acrylic Wall Coating (AWC) Section 09830

Code	Manufacturer	Custom Sample #	Series	Finish	Base Color	Tint Color	Comments
AWC-1							
AWC-2							
AWC-3							
AWC-4							
AWC-5							

Textured Plastic Coating (TPC) Section 09835

Code	Manufacturer	Manufacturer #	Color	Comments
TPC-1				
TPC-2				
TPC-3				
TPC-4				
TPC-5				

Paint (PNTLO) Section 09904

Code	Manufacturer	Manufacturer #	Color	Finish	Comments
PNLO-1	Sherwin Williams				
PNTLO-2	Sherwin Williams				
PNTLO-3	Sherwin Williams				
PNTLO-4	Sherwin Williams				
PNTLO-5	Sherwin Williams				

Paint (PNTSR) Section 09904

Code	Manufacturer	Manufacturer #	Color	Finish	Comments
PNTSR-1	Sherwin Williams				
PNTSR-2	Sherwin Williams				
PNTSR-3	Sherwin Williams				
PNTSR-4	Sherwin Williams				
PNTSR-5	Sherwin Williams				

Venetian Plaster (VP) Section 09940

Code	Manufacturer	Manufacturer #	Color	Series	Comments
VP-1					
VP-2					

Vinyl Wall Covering (VWC) Section 09960

Code	Manufacturer	Manufacturer #	Color	Series	Comments
VWC-1					
VWC-2					
VWC-3					
VWC-4					
VWC-5					

Natural Fabric Wall Covering (NFWC) Section 09965

Code	Manufacturer	Manufacturer #	Color	Series	Comments
NFWC-1					
NFWC-2					
NFWC-3					
NFWC-4					
NFWC-5					

Synthetic Fabric Wall Covering (SFWC) Section 09965

Code	Manufacturer	Manufacturer #	Color	Series	Comments
SFWC-1					
SFWC-2					
SFWC-3					
SFWC-4					
SFWC-5					

Composite Fabric Wall Covering (CFWC) Section 09965

Code	Manufacturer	Manufacturer #	Color	Series	Comments
CFWC-1					
CFWC-2					
CFWC-3					
CFWC-4					
CFWC-5					

Fiberglass Reinforced Plastic (FRP) Section 09986

Code	Manufacturer	Manufacturer #	Color	Comments
FRP-1	Kemlite			
FRP-2	Kemlite			

FRP-3	Kemlite			
-------	---------	--	--	--

Metal Toilet Partitions (TP) Section 10162

Code	Manufacturer	Manufacturer #	Color	Comments
FRP-1	Sanymetal			
FRP-2	Sanymetal			

Plastic Laminate Toilet Partitions (TP) Section 10165

Code	Manufacturer	Manufacturer #	Color	Comments
TP-1				
TP-2				

Solid Polymer (HDPE) Toilet Partitions (TP) Section 10168 or Section 10170

Code	Manufacturer	Manufacturer #	Color	Comments
TP-1				
TP-2				

Wall Protections Specialties Section 10260

Code	Manufacturer	Color	Finish	Model #	Comments
WG-1	CS Group				
WG-2	CS Group				
WG-3	CS Group				
CG-1	CS Group				
CG-2	CS Group				
CG-3	CS Group				
CR-1	CS Group				
CR-2	CS Group				
CR-3	CS Group				
HR-1	CS Group				
HR-2	CS Group				
HR-3	CS Group				
BLB-1	CS Group				
BLB-2	CS Group				

Metal Locker (LKR) Section 10500

Code	Manufacturer	Manufacturer #	Color	Comments
LKR-1	Penco			
LKR-2	Penco			
LKR-3	Penco			

Granite Fabrications Countertops Section 12365:

Code	Manufacturer	Stone Name and Color	Finish	Edge	Comments
GF-1					
GF-2					

Engineered Quartz Fabrications (EQF) Section 12369:

Code	Manufacturer	Series	Color/Pattern	Finish	Edge	Comments
EQF-1	DuPont Zodiac					
EQF-2	DuPont Zodiac					

Nylon Entrance Tile (NET) Section 12691

Code	Manufacturer	Manufacturer #	Color	Style	Comments
NET-1					
NET-2					
NET-3					

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Non-Structural Metal Framing in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Member of Certified Steel Stud Association (CSSA), Steel Stud Manufacturers Association (SSMA) or Steel Framing Industry Association (SFIA).
- B. ASTM International (ASTM):
 - 1. ASTM C645 Standard Specification for Nonstructural Steel Framing Members.
 - 2. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - 4. ASTM A1003 Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic-Coated for Cold-Formed Framing Members.
- C. Provide studs and accessories of type tested and listed for construction indicated.
- D. Gypsum Association (GA):
 - 1. GA-216 Application and Finishing of Gypsum Panel Products.
 - 2. GA-234 Control Joints for Fire-Resistance Rated Systems.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Provide copies of manufacturer's specifications and installation instructions for each type of material and accessory required.
 - a. Where fire resistance classification is indicated, submit copies of nationally recognized testing laboratory listings of products proposed for use.
 - b. Include data required to show specification compliance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Non-Structural Metal Framing:
 - 1. Base:
 - a. Telling Industries
 - 2. Optional:
 - a. CEMCO Steel Framing and Metal Lath
 - b. ClarkDietrich Building Systems
 - c. Custom Stud Inc.
 - d. Marino/WARE
 - e. MBA Metal Framing
 - f. MRI Steel Framing LLC.
 - g. The Steel Network
- B. Isolation Strip Material:

1. Base:
 - a. Reflectix, Inc.
 2. Optional:
 - a. Saint-Gobain
- C. Knee Wall Brace:
1. Base:
 - a. Pittcon Industries
- D. Interlocking Grid Support Systems for Gypsum Board Ceilings:
1. Base:
 - a. USG Corporation
 2. Optional:
 - a. Armstrong
 - b. Chicago Metallic
- E. Other manufacturers desiring approval comply with Section 00 26 00.
- F. Products proposed for use in fire-rated assemblies:
1. Approved by nationally recognized testing laboratory.

2.2 DESIGN CRITERIA

- A. Select steel studs in accordance with manufacturer's standard load tables and following design pressures and maximum deflections:

Performance Criteria		
Use Condition ²	Design Pressure	Maximum Deflection
Wall enclosing stairs, elevator hoistways, and other vertical shafts	10 LBS/SF	L/240
Wall enclosing vestibules, ground floor lobbies, and similar spaces subject to intermittent exposure to exterior wind conditions	15 LBS/SF	L/240
Walls scheduled with Tile Backer Board, Moisture-Resistant, Impact-Resistant, or Abuse-Resistant Gypsum Wallboard	5 LBS/SF	L/360
Walls scheduled to receive Tile, lath and plaster, or veneer plaster. ¹		
Typical Interior Walls/Partitions (those not listed above)	5 LBS/SF	L/240
Interior Ceilings, Soffits and Bulkheads	5 LBS/SF	L/360

Footnotes

1. Limit deflection to L/360 where wall cladding on either face is any of the following: Ceramic Tile, Stone Tile, Porcelain Tile, Thin Brick, Lath & Plaster, Simulated Masonry, Adhered-stone, Veneer Plaster and similar brittle finishes which are prone to movement-induced cracking.
2. Where elements meet multiple conditions; Use most stringent Deflection and Design Pressure values.

2.3 MATERIALS

- A. Metal Studs and Floor Tracks:
1. C-shaped, roll-formed studs and tracks conforming to ASTM C645.
 2. Galvanized: G40.
 3. Stud and track depths: As indicated by wall type.
 4. Minimum flange width: 1-1/4 IN .
 5. Minimum thickness: 18 MIL (25 GA), except as follows:
 - a. Increase member thickness to comply with performance criteria.
 - b. Increase member thickness to minimum 30 MIL (20 GA) studs at following conditions:

- 1) Jambs of openings: Two 30 MIL (20 GA) studs or single engineered jamb stud equivalent to double-stud assembly. .
 - 2) One or both sides of walls faced with any of following:
 - a) Wall mounted cabinetry and equipment.
 - b) Tile backing board.
 - c) Adhered stone.
 - d) Plaster.
 - e) Moisture-resistant.
 - f) Abuse-resistant wallboard.
 - g) Lead backed gypsum wallboard.
 - 3) Where walls do not extend to overhead structural deck, and without supporting diagonal bracing, or horizontal stiffeners.
6. In lieu of increased member thickness, design may employ diagonal braces above ceiling to reduce overall span.
- a. Coordinate locations with building services items.
 - b. Do not employ studs with member thickness less than allowed by fire resistance rated assemblies.
7. High strength 50KSI studs shall comply with design criteria of equivalent thickness standard 33KSI studs listed.
8. Base products:
- a. Drywall Framing System by Telling Industries.
9. Optional products, high strength steel:
- a. Viper Stud by Telling Industries.
- B. Head of Wall Accessories:
1. Configure to accommodate deflection of superstructure without inducing axial loading on partition wall.
 2. Maintain structural integrity, fire and smoke-resistance, and sound control as required by each wall.
 3. Slotted top deflection track:
 - a. Deep leg, vertically slotted track.
 - b. Cold-formed sheet steel; galvanized; G60.
 - c. Thickness: 30 MIL (20 GA) minimum.
 - d. Width: As required for studs sizes indicated.
 - e. Depth: Minimum 2-1/2 IN down-standing legs with 1/4 IN wide by 1-1/2 IN high slots spaced 1 IN on center.
 4. Z-bars, cold formed channels and clips:
 - a. Accommodate thickness of spray-applied fire-resistive materials.
 5. UL-listed fire resistant components tested for compliance with requirements indicated.
 6. Firestopping Materials:
 - a. Sealants, sprays, intumescent strips and forming materials.
 - b. Coordinate with sealants specified in Section 07 84 00 and Section 07 92 16.
 - c. Intumescent applications:
 - 1) Factory or field applied.
- C. **Z-bars** used where interior wall abuts fireproofed steel beams or spray fireproofed steel deck above. Z-Bars are attached to structural elements prior to spray fireproofing; subsequently, runners are attached to Z-bars; Allows for continuous Fireproofing. Delete Z-bars if project does not have fireproofed beams and deck.
- D. Z-Bar Standoff Clips:
1. 30 MIL (20 GA) galvanized steel.
 2. Provide Z-bars for attachment of top track to superstructure elements which are to be protected with sprayed fireproofing.
 - a. Size: 2 IN x 2 IN x 2 IN .
 3. Length:
 - a. As required to accommodate beam and deck fireproofing.

- 1) At structural steel member: Length equal to flange width of structural steel member.
 - 2) At steel deck: Minimum length equal to partition width, or as required to span steel deck flutes.
 - b. Extend length of Z-bar to accommodate partition offset that will not clear fireproofed steel beam.
 4. Base product: ZFC by Telling Industries.
- E. Furring Channels:
1. Hat shaped sections.
 2. Galvanized: G40.
 3. Sizes: 7/8 IN and 1-1/2 IN , as indicated.
 4. Minimum Thickness: 30 MIL (20 GA) ; Use heavier gauge as dictated by conditions.
 5. Base product: DWFC by Telling Industries.
- F. Z-Furring:
1. Z-shaped sections, attached to structural parent wall.
 2. Galvanized: G40.
 3. Sizes: 1, 1-1/2, and 2 IN .
 4. Thickness: 18 MIL (25 GA) minimum; Use heavier gauge as dictated by conditions.
 5. XPS foam insulation: Specified in Section 07 21 00.
 6. Base product: ZFC by Telling Industries.
- G. Accessory Items:
1. Wire Ties:
 - a. Minimum thickness: 43 MIL (18 GA) soft annealed, galvanized.
 2. Track Fasteners:
 - a. Power driven type, to withstand minimum 190 LBS shear when driven.
 3. Closure:
 - a. Continuous 30 MIL (20 GA) galvanized closure angle to receive vapor retarder and vapor retarder tape.
 4. Metal Blocking:
 - a. C-shaped modified track runners.
 - b. G40 galvanized.
 - c. Backing height: 6 IN minimum.
 - d. Flange width: 1-1/4 IN minimum.
 - e. Thickness: 30 MIL (20 GA) minimum.
 5. Backing - Flat Plate:
 - a. Flat, sheet metal stock per ASTM A1008.
 - b. G40 galvanized.
 - c. Thickness: 50 MIL (18 GA) minimum.
 6. Knee Wall Brace:
 - a. Steel tube and baseplate bolted to concrete floor slab with tube projecting vertically; concealed within framed walls to provide structural stability for knee walls.
 - b. Design components compatible with wall type.
 - c. Material: Cold-rolled steel tube and base plate, fully welded.
 - d. Overall height: Wall height less 2 IN .
 - e. Spacing as recommended by manufacturer.
 - f. Base product: SKB by Pittcon Industries.
 7. Shower Seat Support: See Section 05 50 10.
- H. Support Systems for Gypsum Ceilings:
1. Interlocking Grid Systems:
 - a. ASTM C635, direct-hung system composed of T-Shaped framing members designed to carry load of screw-applied gypsum ceiling board.
 - b. Tabs on Cross-Tees to interlock into slots in Main Runners where intersections occur.
 - c. Base Product: Drywall Suspension System by USG Corporation.
 2. Track and Channel Systems:

- a. ASTM C645 roll-formed steel with G40 galvanized coating.
- b. Thickness: 30 MIL (20 GA) minimum; Use heavier gauge as dictated by conditions.
- c. Carrying channels:
 - 1) Size: 1-1/2 IN .
- d. Furring channels:
 - 1) Sizes: 7/8 IN and 1-1/2 IN , as indicated.
- 3. Stud-Framed Ceiling/Soffit Systems:
 - a. C-shaped studs or joists; roll-formed.
 - b. Galvanized: G40.
 - c. Frame member depth: 3-5/8 IN minimum, unless otherwise indicated.
 - 1) Use wider stud sections if ceiling span and support requires.
 - d. Flange width: 1-1/4 IN minimum.
 - e. Stud thickness: 33 MIL minimum.
- 4. Tie Wire:
 - a. ASTM A641, Class 1 zinc coating, soft temper.
 - b. Diameter, single-strand: 62 mils (14 GA) minimum.
 - c. Diameter, double-strand: 42 mils (18 GA) minimum.
- 5. Wire Hangers:
 - a. ASTM A641, Class 1 zinc coating, soft temper.
 - b. Diameter: 97 mils (12 GA) minimum.
- 6. Anchors in Concrete:
 - a. Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM E488 or ASTM E1512 as applicable.
 - b. Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.
 - c. Material: Carbon-steel components zinc plated to comply with ASTM-B633, Class Fe/Zn 5 for Class SC 1 service condition.
- 7. Powder-Actuated Fasteners in Concrete:
 - a. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E1190.
 - b. Comply with seismic design requirements where applicable.
- 8. Other items including suspension wire, tie wire, attachment devices: As specified and indicated.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine supporting structure and conditions under which system will be installed.
- B. Correct conditions detrimental to proper installation.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. Layout and install metal framing accurate to dimensions indicated in drawings.
- B. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.
 - 1. Gypsum Board Assemblies: Comply with additional requirements in ASTM C840 relative to framing installation.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- F. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- G. Extend framing full height to structural supports.
 - 1. Exception: Where partitions are indicated to terminate at, or just above, suspended ceilings.
 - 2. Continue framing around ducts and similar items which penetrate partitions.
- H. Position studs vertically engaging floor track and head of wall deflection track.
 - 1. Align stud knockouts to facilitate running of wires and conduit.
- I. Space studs maximum 16 IN on center.
 - 1. Stud spacing at Shaftwall: 24 IN on center.
- J. Provide additional studs at corners, partition intersections and terminations of partitions, and at each side of control joints.
- K. Positively anchor studs to floor tracks with self-tapping pan head screws, or stud clinching tool per ASTM C754.
- L. Anchor studs to deflection track with wafer head screws on both flanges of each stud.
 - 1. Maintain deflection gap between top of stud and top of slotted track.
 - 2. Install screws at centerline of slot and secure allowing vertical movement.
- M. Anchor fire rated partitions as required by fire resistance design, and firestopping design.
- N. Where partitions abut vertical structural elements, provide perimeter relief per Gypsum Association GA-600 Strain Relief System details.
- O. Head-of-Wall:
 - 1. Provide slotted top track for walls extended to structure.
 - 2. Configure to resist lateral loads while accommodating deflection of overhead building superstructure without inducing axial loading on partition framing.
 - 3. Secure deflection track to structure in accordance with industry standards and regulatory requirements.
 - 4. Secure at corners and at ends.
 - 5. Cut vertical studs 5/8 IN short to create a deflection gap when installed into top track.
 - a. Secure vertical studs to top track with framing screw at each stud, screwing through track slots for positive stud connection.
 - 6. Secure Gypsum Wallboard to vertical studs; do not secure Gypsum Wallboard to top track directly.
 - 7. Where partitions attach to structural elements that are scheduled to receive Spray-applied Fire Resistive Materials (SFRM):
 - a. Install Z-bar to underside of steel beams and steel deck before application of sprayed fireproofing.
 - b. Locate Z-bars perpendicular to line of partition, spaced maximum 16 IN on center.
 - c. Attach each Z-bar with two 0.145 IN x 1 IN powder-actuated fasteners located minimum 1 IN from ends of Z-bar.
 - d. After fireproofing, secure top track to Z-bars with No. 8 x 5/8 IN wafer head framing screws spaced maximum 16 IN on center.
 - 8. Where fire-rated partitions are offset and will not clear fireproofed steel beam, extend Z-bar outrigger horizontally from bottom of beam out to minimum 2 IN beyond width of head-of-wall.
 - a. Attach 3/4 IN expanded metal lath continuous, width of top of Z-bar outriggers prior to fireproofing steel beam to accommodate sprayed fireproofing.
 - 9. Prepare wall for installation of seals, firestopping, or both:

- a. Fire-rated Walls: Prepare for fire-resistive joint assemblies specified in Section 07 84 00.
 - b. Non-fire rated partitions including Smoke Partitions: Prepare for Acoustical Sealant specified in Section 07 92 16.
- P. Furring Channels:
- 1. Attach furring channel systems directly to parent walls.
 - 2. Install channels at maximum 16 IN OC.
 - 3. Provide additional framing at openings, cutouts, corners, and control joints.
 - 4. Space fasteners not more than 24 IN OC, staggered on opposite flanges of furring channels.

3.3 FRAMING AT OPENINGS

- A. Control Joints (CJ):
- 1. Install additional stud, maximum 1/2 IN from jamb studs.
 - 2. Do not fasten extra stud to track or jamb stud.
 - 3. Refer to specification Section 09 29 00 for control joint locations.
- B. Prefabricated headers, jambs, and sill framing systems option:
- 1. Proprietary opening framing systems may be used as an alternative to conventionally fabricated framing.
 - 2. Pre-approved Products:
 - a. HDS Framing System by ClarkDietrich.
 - b. Quick Frame Rough Opening System by Marino/ Ware.
- C. Door Openings:
- 1. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section for cripple studs at head and secure to jamb studs. Screw into web of jamb stud.
 - 2. Unless indicated otherwise, extend jamb studs through suspended ceilings and secure laterally to overhead structure.
 - 3. Jamb Studs:
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Minimum thickness of jamb studs: 30 MIL (20 GA) at openings.
 - c. Securely attach jamb studs to door frames.
 - d. Attach drywall to both studs equally.
 - 4. Headers:
 - a. Openings less than 4 FT wide:
 - 1) Cut-to-length section of floor runner above and below wall openings.
 - 2) Split flanges and bend webs at ends.
 - 3) Overlap and screw attach jamb studs to frames.
 - b. Openings over 4 FT wide:
 - 1) Cut-to-length, horizontal box beam studs above and below wall openings.
 - 2) Design for actual span and loading.
 - c. Incorporate miscellaneous steel members, specified in Section 05 50 10, and wood blocking, specified in Section 06 10 53, where indicated.
 - 5. Control Joints at head of jambs:
 - a. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2 IN clearance from jamb stud to allow for installation of control joint in finished assembly.
 - b. Gypsum Wallboard control joints as specified in Section 09 29 00.
- D. Other Framed Openings:
- 1. Frame openings other than door openings the same as required for door openings, unless otherwise indicated.
 - 2. Install framing below sills of openings to match framing required above door heads.
 - 3. Cripple Studs:
 - a. Install cut-to-length intermediate vertical studs above and below openings.
 - b. Spacing: As indicated for typical full-length studs.
 - 4. Incorporate miscellaneous steel members, specified in Section 05 50 10, and wood blocking, specified in Section 06 10 53, where indicated.

3.4 WALL BACKING AND BLOCKING

- A. Metal Wall Backing: Provide in-wall metal wall backing reinforcement where following items are mounted to interior walls and interior face of exterior walls:
 - 1. Crash rails, chair rails, wall bumpers, and similar wall protection devices.
 - 2. Contractor or Owner-furnished equipment indicated to be wall-mounted.
 - 3. Toilet accessories that do not include proprietary backing devices.
 - 4. Toilet partitions and lockers.
 - 5. Markerboards, tackboards, and chalkboards.
 - 6. Other wall-mounted items where backing is indicated by details or specification.
- B. Verify metal stud framing has been installed to support wall-mounted items specified in Section 05 50 10.
- C. Wood Wall Blocking: Specified in Section 06 10 53.
- D. Coordinate mounting height, location, and coverage with item to be supported.
- E. Determine material width according to item to be supported.
- F. Provide in-wall metal wall backing material to interior metal stud walls specified herein and Exterior stud walls specified in Section 05 40 00.
- G. Attachment: Minimum 2 - #10 sheet metal screws at each stud.

3.5 CEILING FRAMING

- A. Install in compliance with manufacturer's recommendations.
- B. Provide required items to support and trim out neatly, flush or recessed mechanical and electrical items.
- C. Frame openings in ceiling support system to accommodate access panels and similar openings and penetrations.
 - 1. Completely frame openings with closed channel side of stud facing opening for support of recessed mechanical and electrical items.

3.6 CEILING SUPPORT SYSTEMS

- A. Install suspension system components in sizes and spacing indicated on Drawings, but not less than required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where abutting or penetrated by building structure.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and secure fasteners appropriate for substrate.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and secure fasteners appropriate for structure and hanger.
 - 5. Do not attach hangers to steel roof deck.

6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Grid Suspension Systems:
1. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces.
 2. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
 3. Install suspension systems that are level to within 1/8 IN in 12 FT measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
 4. Coordinate support requirements for all in-ceiling devices with capacity of ceiling grid system.

END OF SECTION

SECTION 09 22 36
METAL LATH

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Metal Lath, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Wherever a fire resistance classification is indicated or scheduled; provide materials, accessories and application procedures which have been listed by U/L or tested in accordance with ASTM E119 for type of construction.
- B. ASTM International (ASTM):
 - 1. ASTM A353 Standard Specification for Pressure Vessel Plates, Alloy Steel, Double-Normalized and Tempered 9 % Nickel
 - 2. ASTM A641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - 3. ASTM Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 4. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 - 5. ASTM C841 Standard Specification for Installation of Interior Lathing and Furring
 - 6. ASTM C847 Standard Specification for Metal Lath ASTM C933
 - 7. ASTM C1063 Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster
 - 8. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - 9. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials
- C. Expanded Metal Lath Association (EMLA):
 - 1. Guide Specifications for Metal Lathing and Furring

1.3 SUBMITTALS

- A. Product Data:
 - 1. Items to be used, including:
 - a. Manufacturer of listed products.
 - b. Control and Expansion Joints, screeds, reveals, vents, flashing and other pieces.
 - c. Kraft Paper and self-adhering flashing.
 - d. 2-piece flashing.
- B. Samples:
 - 1. 12 IN samples of all linear accessories to be used.
 - 2. 8x10 IN samples of Lath and Weather Barrier.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Metal Lath:
 - 1. Base:
 - a. ClarkDietrich Building Systems.
 - 2. Optional:
 - a. Alabama Metal Industries Corporation (AMICO)

- b. California Expanded Metal Products Company (CEMCO)
 - c. Niles Building Products
 - d. Structa Wire
- B. Air Barrier and Self-adhering Flashing:
- 1. Base:
 - a. Fortifiber.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Air Barrier:
- 1. Vapor permeable.
 - 2. Asphalt saturated, grade D kraft breather paper.
 - 3. Minimum water resistance rating:
 - a. 60 Minutes per ASTM D779.
 - 4. Minimum permeance per ASTM E96: 35 Perm.
 - 5. Base product:
 - a. Fortifiber, 60 Minute Super Jumbo Tex.
 - 6. Install in 2 layers.
 - a. 1 layer of kraft paper may be pre-attached to lath at contractor's option.
- B. Self-adhering Flashing:
- 1. Self-adhesive, self-sealing, rubberized asphalt laminated to HDPE film.
 - 2. Compatible with building paper.
 - 3. Minimum Permeance per ASTM E96: 0.08 Perm (US).
 - 4. Minimum Water Resistance rating: >200 Hours per ASTM D779.
 - 5. Federal Specification: UU-B-790a Type 1, Grade A, Style 4.
 - 6. Base Product: Fortifiber FortiFlash 25.
- C. Primer for Self-adhering Flashing:
- 1. As recommended by manufacturer for substrate conditions.
- D. Furring and Lathing Materials:
- 1. Furring, lathing, and hanger wires:
 - a. Exterior Areas: G60 galvanized steel or zinc alloy.
 - b. Interior: G60 galvanized steel.
 - 2. Kraft paper-faced lath is acceptable where the following conditions are met:
 - a. Performance quality of the facing must meet or exceed criteria listed for Moisture resisting membrane.
 - b. Offset between lath and facing must enable proper shingle-lap installation.
 - c. Facing may only be used in lieu of one of two membrane layers required.
 - d. Second membrane layer must be independent of lath.
- E. Metal Lath:
- 1. Comply with ASTM C847.
 - 2. Self-furring, diamond mesh lath.
 - a. Self-furring design comprised of dimples or crimps designed to hold the lath 1/4 to 3/8 IN away from solid base.
 - b. Rib lath shall not be permitted.
 - 3. Minimum Weight:
 - a. Exterior Plaster: 3.4 LBS/SQ YD
 - b. Interior Plaster: 2.5 LBS/SQ YD
 - 4. Base Product: Self-furring Junior Diamond Lath by ClarkDietrich.
- F. U-channels:
- 1. Exterior Use:
 - a. Cold-formed, C-shaped members.
 - b. Minimum Depth/Height: 6 IN or deeper as indicated or required for load.

- 1) Metal Thickness: 16 GA or heavier as required for load. Select member sizes and attachment mechanisms to resist wind forces, positive and negative.
- c. Base Product: C-Studs by ClarkDietrich.
2. Interior Use:
 - a. Cold-formed, U-shaped members.
 - b. Height: 3/4 IN or 1-1/2 IN , as indicated or required for load.
 - c. Metal Thickness: 16 GA.
 - d. Base Product: CHN U-Channel by ClarkDietrich.
- G. Hat Channels:
 1. Cold-formed, hat-shaped members.
 2. Height: 7/8 IN or 1-1/2 IN, as indicated or required for load.
 3. Exterior Plaster:
 - a. Metal Thickness: 16 GA or 18 GA, as required for load.
 - b. Base Product: FMC Heavy Duty Furring Channel by ClarkDietrich.
 4. Interior Plaster:
 - a. Metal Thickness: 16 GA or 25 GA, as required for load.
 - b. Base Product: FC Furring Channel by ClarkDietrich.
- H. Hanger Wire:
 1. Class I zinc-coated, G60 galvanized, soft tempered wire.
 2. Comply with ASTM A641 and ASTM C1063.
 3. Thickness: 8 GA.
 4. Base Products: HWB8 Hanger Wire by ClarkDietrich.
- I. Tie Wire:
 1. Class I zinc-coated, G60 galvanized, soft tempered wire.
 2. Comply with ASTM A641 and ASTM C1063.
 3. Thickness: 18 GA.
 4. Base Products: TW18 Tie Wire by ClarkDietrich.
- J. Fasteners:
 1. Corrosion-resistant, fasteners specifically suited for attachment of lathing and accessories.
 2. Select fasteners with oversized heads and of a fastener type which is appropriate for substrates encountered.
 3. Steel frame substrates:
 - a. Corrosion-resistant screws, No. 8 modified truss head.
 - b. Length: As necessary to penetrate through sheathing and into steel studs by at least 5/8 IN.
 4. Concrete and masonry substrates::
 - a. Corrosion-resistant, powder actuated fasteners.
 - b. Length: As necessary to penetrate through sheathing and into substrate by at least 5/8 IN.
- K. Sheet Metal Accessories:
 1. Comply with ASTM C1063.
 2. Exterior Areas: Zinc alloy.
 3. Interior Areas, typical: G-60 galvanized steel or zinc alloy.
 4. Interior Wet Areas, high-humidity: Showers, natatoriums, etc.:
 - a. Zinc alloy.
 5. Foundation Weep Screed:
 - a. Solid, protruding V-hem screed and solid vertical wall flange.
 - 1) Weep holes through hem.
 - 2) Fasten top flange to substrate only.
 - b. Depth: As required for plaster thickness.
 - c. Minimum Height: 3-1/2 IN.
 - d. Minimum Thickness: 26 GA.
 - e. Base Product: No.7 Foundation Weep Screed by ClarkDietrich.

6. Casing Bead, Plaster Stop, J-Bead:
 - a. Solid metal, J-shaped edge with expanded metal flange.
 - 1) 1/4 IN return on face edge.
 - b. Flange Size: 2-3/4 IN flanges.
 - c. Depth: As required for plaster thickness.
 - d. Base Product: No.66 Casing Bead by ClarkDietrich.
 7. Outside Corner Bead:
 - a. Straight:
 - 1) Rigid-nosed corner bead with expanded metal flanges.
 - 2) Size: 2-7/8 IN flanges.
 - 3) Base Product: 1-A Expanded Corner Bead by ClarkDietrich.
 8. Inside Corner Reinforcing Mesh:
 - a. Strips of expanded metal reinforcing mesh with flanges at appropriate angles.
 - b. Size: 3 IN flanges.
 - c. Base Product: Cornertite by ClarkDietrich.
 - d. Where internal corners must also function as a control joint, see following paragraph.
 9. Control Joints (CJ):
 - a. Double J Shape:
 - 1) Solid metal center section with opposing J-shaped bends and expanded metal flanges.
 - a) Rolled outer edges of reveal flanges to facilitate keying of plaster.
 - 2) Flanges: 1-1/4 IN.
 - 3) Depth: As required for plaster thickness.
 - 4) Reveal Width: 5/16 IN.
 - 5) Base Product: Double-J Control Joint by ClarkDietrich.
 - b. Control Joints at Internal Corners:
 - 1) Solid metal center section with M-profile bend and expanded metal flanges.
 - a) Use where internal corners are function as control joints.
 - 2) Size: 1-1/4 IN flanges.
 - 3) Depth: As required for plaster thickness.
 - 4) Base Product: No.30 Corner Master by ClarkDietrich.
 10. Expansion Joints (EJ):
 - a. Two piece, slip joint.
 - b. Size: 1 IN flanges.
 - c. Depth: As required for plaster thickness.
 - d. Reveal width: 1/2 IN
 - e. Base Product: No.40 Expansion Joint by ClarkDietrich.
- L. Extruded Aluminum Accessories::
1. Material: 6063 T5 extruded aluminum.
 - a. Thickness: 0.050 IN thick.
 - b. Anodized Finish:
 - 1) Clear.
 2. Shapes: As listed below.
 3. Depth: As required for plaster thickness.
 4. Drip Screed:
 - a. Reveal Width: 7/8 IN.
 - b. Vented.
 - c. Base Product: Drip Screed, Stucco Drip Screed, or Thin Stucco Drip Screed by Fry Reglet.
- M. Soffit Molding:
1. Reveal Width: 2 IN
 2. Vented.
 3. Base Product: Soffit Molding by Fry Reglet.
 4. Column Collar Reveal:
 - a. Flexible PVC reveal with Aluminum vertical flange.

- b. Clamp to column cover.
 - c. Reveal Width: 3/4 IN
 - d. Base Product: Column Collar by Fry Reglet..
- N. 2-Piece Wall Flashing:
- 1. System consisting of fixed, built-in receiver and a snap-in counterflashing flange.
 - 2. Include factory-mitered corner units.
 - 3. 24 GA galvanized steel.
 - 4. Finish: Factory applied Kynar 500.
 - 5. Color: As selected by Architect.
 - 6. Base Product: Fry Springlok Flashing System.
 - 7. Receiver:
 - a. ST or STX configuration which is indicated or most appropriate for conditions.
 - b. Install prior to beginning plaster.
 - c. Install at height indicated, or as recommended by manufacturer.
 - d. Surface applied items not acceptable.
 - 8. Counterflashing:
 - a. Minimum Height: 5 IN

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that substrates and membranes specified are clean, sound, dry, weathertight and suitable to accept installation
- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - FURRING AND SUSPENSION SYSTEMS

- A. Provide complete system including hangers, ties and runners, to provide support for plaster bases, per ASTM requirements.
- B. Where expansion joints are indicated, provide separate supports on each side of joint.
- C. Do not bridge expansion joints with metal furring.
- D. Where curved furring is required, shop fabricate to configurations required.
- E. Hangers:
 - 1. Suspend hangers from structure per ASTM C841.
 - 2. Where anchorage, spacing or location does not provide for acceptable support, provide additional carrying components.
 - 3. Provide hanger inserts to concrete installer, in time to avoid delay in progress of work.
 - 4. Advise concrete installer of specific requirements for placement of inserts.
 - 5. Locate hangers plumb in relation to main runners.
 - a. Avoid contact with pipe and duct insulation.
 - b. Do not pass hangers through ducts.
 - c. Alter spacing of hangers or splay hangers to avoid ducts and other obstructions.
 - d. Do not exceed maximum allowable ceiling areas to be supported by each hanger.
 - e. Offset horizontal forces of splayed hangers by counter splaying, bracing or other suitable means.
 - 6. Provide extra hangers to support light fixtures, diffusers, grilles, access panels and other items resting in or on ceilings.
- F. Framing:
 - 1. Determine span and spacing as required by local building code and to resist loads anticipated.
 - 2. Select member sizes and gauges as appropriate for span and spacing.

3. Provide additional ceiling framing as required to form and frame openings; coordinate with work of other trades.

3.3 INSTALLATION OF ACCESSORIES

- A. Use single length beads wherever length of run does not exceed longest standard stock length available.
 1. Miter or cope at corners.
 2. Set beads with maximum tolerance of 1 IN 100 from plumb or level.
 3. Shim as required and align joints with concealed splices or tie plates.

3.4 INSTALLATION – WEEP SCREEDS

- A. Position so vertical flange overlaps top of foundation.
- B. Position so that bottom of screed is at least 6 IN above soil line.
 1. Exception 1: Minimum 2 IN where adjacent to paved surfaces.
 2. Exception 2: As otherwise indicated.
- C. Pre-flash wall with an 8 to 10 IN wide strip of self-adhering flashing before securing weep screed over it.
- D. Secure weep screed to wall framing using galvanized fasteners.
 1. Maximum spacing: 8 IN 200 MM OC.
 2. Do not secure to foundation.
- E. Lap moisture resisting membrane and metal lath over the vertical flange of the screed.

3.5 INSTALLATION – CASING BEADS

- A. General:
 1. Install in accordance with ASTM C841.
 2. Provide casing beads at edges where plaster meets windows, doors, louvers and other terminal edges and where plaster meets dissimilar materials.
 3. Do not plaster directly to frames of windows, doors, or louvers.
 - a. Separate plaster using appropriate casing beads set 3/8 IN from the frame with provision to receive backer rod and sealant as specified in Section 07 92 13.
- B. Exterior:
 1. Pre-flash wall with a 8 to 10 IN wide strip of self-adhering flashing before securing casing bead over it.
 2. Secure casing bead to wall framing using galvanized fasteners.
 - a. Maximum Spacing: 8 IN OC.
 3. Lap moisture resisting membrane and metal lath over vertical flange of casing bead.
- C. Interior:
 1. Secure casing bead to wall framing using compatible fasteners.
 - a. Maximum spacing: 8 IN OC.
 2. Isolate casing bead from contact with metal window or door frames with minimum 1/4 IN thick foam insulating tape or casing bead with integral compressible foam or vinyl gasket.

3.6 INSTALLATION – MOISTURE RESISTING MEMBRANE

- A. Self-adhering Flashing:
 1. Install concealed flashings at the following locations:
 - a. Perimeter of windows, louvers and other similar openings.
 - b. Pipes and other penetrations thru walls.
 - c. Under expansion joints.
 - d. Sills.
 - e. Horizontal surfaces.
 - f. Tops of parapet and wall caps.
 - g. Door thresholds.

h. Where membrane ties into air barriers or other membranes specified in other Sections.

B. Moisture Resisting Membrane:

1. Install after securing weep screeds and casing beads to wall.
2. Install bottom row of membrane over the vertical flange of weep screed.
3. Install successive rolls horizontally above preceding rows.
4. Horizontal seams: 3 IN shingle lap.
5. Vertical Seams:
 - a. Overlap at least 6 IN.
 - b. Stagger vertical seams in successive rows.
6. Tie-in to penetrations:
 - 1) Maintain shingle laps and avoid conditions which would impede weeping of system.
 - b. Secure membrane to substrate according to manufacturer's recommendations.
7. Install a second layer of membrane.
 - a. Install as described for first layer.
8. Install lath over moisture resisting membrane as outlined below.

3.7 INSTALLATION - LATH

A. General:

1. Comply with ASTM C1063 requirements for installation of lath.
2. Provide intermediate metal furring supports where required.

B. Layout and lapping:

1. Install metal lathing, so that the upper sheets overlap the lower sheets.
2. Install Lath with the long dimension across supports and with end joints staggered between courses.
3. End Laps:
 - a. Minimum Width: 6 IN or as otherwise required by local building code.
 - b. Locate end laps over supports as much as possible, fastening both plies using fasteners spaces 6 IN on center.
 - c. Where end laps do not coincide with studs; wire plies to one another at intervals not exceeding 9 IN on center.
 - d. Stagger successive end laps at least 16 IN apart.
4. Side Laps:
 - a. Minimum Width: 2 IN or as otherwise required by local building code.
 - b. Wire to lath along side lap edges 9 IN on center.
5. Paper-backed Lath:
 - a. Install as recommended by manufacturer.
 - b. When using offset material:
 - 1) Ensure that paper over paper, lath over lath rule is followed as successive courses are installed.

C. Fasteners:

1. Secure lath to substrate at intervals not exceeding 6 IN vertically and 16 IN horizontally.
2. Attach lath using corrosion protected fasteners specifically suited for lath attachment.
3. Ceilings and Soffits: Lath and accessories also may be wire tied to the furring channels for ceiling applications.

D. At metal door frames, insert lath as far as possible into throat space and notch for jamb anchors.

3.8 INSTALLATION – PLASTER ACCESSORIES – SHEET METAL

A. General:

1. Use single length beads wherever length of run does not exceed longest standard stock length available.
2. Miter or cope at corners.
3. Set beads with maximum tolerance of 1 IN 100 from plumb or level.
4. Shim as required and align joints with concealed splices or tie plates.

5. Fully seal splices, terminals, and intersections.
 6. Attach accessories to lath with tie wire, spaced no more than 8 IN OC.
 7. Attach accessories to solid base with galvanized fasteners spaced no more than 8 IN 200 MM OC.
 8. Fasteners: Same type and penetration as specified for lath.
- B. Outside Corner Beads:
1. Install at all outside corners.
 2. Set corner beads in plaster as they are fastened to wall; ensuring the void behind bead is solidly filled. Hollow corner beads will be rejected.
 3. Use flexible units for arches and similar curved corners.
 4. Install using string line and/or level to ensure that nosings are plumb, level, and at proper depth.
- C. Inside Corner Reinforcing Mesh:
1. Lap and secure lath over inside corners and overlay with corner reinforcing mesh.
 - a. Exception: Where control joint occurs at inside corner, install mesh in accordance with following paragraph.
- D. Control Joints (CJ):
1. General:
 - a. Lay out and install control joints as indicated and specified.
 - b. Ensure that lath is not continuous across control joints.
 - c. Ensure sheathing and membrane are continuous across control joints.
 - d. Install control joints at surface penetrations, and at areas of structural stress.
 - e. Secure each flange to lath using wire ties at 6 IN O.C. Secure to substrate with appropriate fasteners.
 - f. Install in accordance with manufacturer's instructions.
 - g. Where control joints intersect control joints other accessories:
 - 1) Vertical joint shall be continuous.
 - 2) Cope flanges of horizontal item to conform to profile of vertical item.
 - 3) Allow 1/4 IN gap to allow for expansion of vertical item.
 - 4) Set intersecting items in sealant.
 - h. Provide sealant at splices, terminals, and intersections.
 2. Control joint locations in Portland Cement Plaster:
 - a. Locate where indicated in drawings.
 - b. Avoid T, L, and X shaped panels.
 - c. Panels shall not exceed 18 FT in length.
 - d. Panel dimensions shall not exceed a 2-1/2:1 ratio.
 - e. Panels shall not exceed the following areas:

Maximum Panel Areas - Portland Cement Plaster	
Orientation	Maximum Area
Walls	144 SQ FT
Ceilings and Soffits	100 SQ FT

- f. If control joint locations not indicated, or panels exceed above listed parameters, notify Architect prior to installation.
3. CJ locations in Gypsum Plaster:
 - a. Locate where indicated on Drawings, where prudent, and as described below:
 - 1) Panels should be relatively square.
 - a) Avoid T, L, and X-shaped panels.
 - 2) No panel should exceed 30 FT in length.
 - 3) Panel dimensions shall not exceed a 5:1 ratio.
 - 4) Panels shall not exceed the following areas:

Maximum Panel Areas - Portland Cement Plaster	
Orientation	Maximum Area
Walls	900 SQ FT 84 sq m
Ceilings and Soffits	With Perimeter Relief: 2500 SQ FT Without Perimeter Relief: 900 SQ FT 84 sq m

- b. If control joint locations not indicated, or panels exceed above listed parameters, notify Architect prior to installation.

E. Expansion Joints (EJ):

1. Install expansion joints at locations indicated and at lines of separation between dissimilar substrate materials.
2. Lay out expansion joints as work starts, as they may affect appearance, framing, sheathing, and lathing procedures.
3. Ensure sheathing and lath are not continuous across expansion joints.
4. Ensure moisture resisting membrane is continuous across expansion joints.
5. Secure each flange to lath using wire ties at 6 IN O.C. Secure flange at edge of expansion joint to substrate.
6. Install in accordance with manufacturer's instructions.
 - a. When installing horizontally, orient female flange down to promote drainage.
7. Pre-flash expansion joints with 6 IN wide strip of self-adhering flashing.
8. Where expansion joints intersect expansion joints, control joints or other accessories:
 - a. Vertical joint should be continuous.
 - b. Cope flanges of horizontal item to conform to profile of vertical item.
 - c. Allow 1/4 IN gap to allow for expansion of vertical item.
 - d. Set intersection items in sealant.
9. Provide sealant at splices, terminals, and intersections.

3.9 INSTALLATION – PLASTER ACCESSORIES – ALUMINUM EXTRUSIONS

A. General:

1. Use single length extrusions wherever length of run does not exceed longest standard stock length available.
 - a. Miter or cope at corners.
 - b. Set beads with maximum tolerance of 1 IN 100 from plumb or level.
 - c. Shim as required and align joints with concealed splices or tie plates.
2. Attachment (where Lath is specified):
 - a. The materials in this article are to be installed over lath.
 - b. Attach accessories to lath with tie wire, spaced no more than 8 IN OC.
3. Attachment to solid bases where no lath is required:
 - a. Attach accessories to base with galvanized fasteners spaced no more than 8 IN OC.

B. Install in accordance with manufacturer's instructions.

C. Provide backing, building paper, and sealant as recommended by manufacturer.

D. Where horizontal items intersect vertical items:

1. Utilize pre-formed, factory-produced intersections.
 - a. Where not available; vertical item should be continuous.

E. Sealant: See Section 07 92 13 and Section 07 92 16.

F. Include splices, reveal terminal end caps and other similar items.

END OF SECTION

SECTION 09 24 23
PORTLAND CEMENT PLASTER (PC)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Portland Cement Plaster (PC), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications:
 - 1. Minimum 5 years experience in cement plaster work on similar size projects.
- B. ASTM International:
 - 1. ASTM C150 Portland Cement
 - 2. ASTM C206 Standard Specification for Finishing Hydrated Lime
 - 3. ASTM C926 Standard Specification for Application of Portland Cement-Based Plaster
 - 4. ASTM C979 Pigments for Integrally Colored Concrete
- C. Portland Cement Association (PCA):
 - 1. Portland Cement Plaster/Stucco Manual
- D. Preinstallation Conference:
 - 1. See Section 01 31 19.

1.3 SUBMITTALS

- A. Samples:
 - 1. Examples of color and texture:
 - a. Three, 12 x 12 x 2 IN , samples color and finish of plaster for approval of appearance.
 - b. Label samples to indicate name of project, finish type, and color.
- B. Project Information:
 - 1. Certification of compliance with product specifications.
 - 2. Manufacturer of listed products.
 - 3. Certification of installer qualifications.
 - 4. Minutes from Preconstruction Conference.
- C. Contract Closeout Information:
 - 1. Maintenance data:
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Portland Cement Plaster:
 - 1. Base:
 - a. Products as listed.
- B. Finish Coat - Cementitious:
 - 1. Base:
 - a. Parex Inc.
 - 2. Optional:
 - a. ProSpec Bonsal
 - b. Expo Stucco Products

- c. Omega Products International.
- C. Elastomeric Topcoat:
 - 1. Base:
 - a. MasterSeal
 - 2. Optional:
 - a. Parex Inc.
 - b. Sto
- D. Surface Applied Bonding Agents:
 - 1. Base:
 - a. Larsen Products.

2.2 MATERIALS

- A. Plaster:
 - 1. Portland cement:
 - a. ASTM C150, Type I or IA.
 - b. Colors:
 - 1) Gray base coat,
 - 2) White finish coat.
 - c. Upgrade to Type III or IIIA as required for cold weather plastering.
 - 2. Hydrated finishing lime:
 - a. Per ASTM C206, Type S.
 - 3. Base coat aggregate:
 - a. Per ASTM C897, natural or manufactured sand.
 - 4. Finish coat aggregate:
 - a. Natural or manufactured sand, graded to pass the No. 16 mesh sieve.
 - b. Light color.
 - 5. Air entrainment agents:
 - a. Per ASTM C260.
 - 6. Integral coloring:
 - a. Per ASTM C979.
 - 7. Water:
 - a. Potable.
- B. Bonding Agents:
 - 1. Surface applied.
 - 2. For use with concrete or masonry
 - 3. Select material from listed manufacturer which are appropriate for conditions.
 - 4. Comply with following:
 - a. ASTM C932 or ASTM C631 for exterior plaster.
- C. Metal Lath:
 - 1. See Section 09 22 36.
- D. Metal Plastering Accessories:
 - 1. See Section 09 22 36.
- E. Air Barrier:
 - 1. See Section 09 22 36.
- F. Sealer:
 - 1. Transparent acrylic permeable protective coating.
 - 2. Product:
 - a. Approved for use by Manufacturer.
- G. Sheathing:
 - 1. See Section 06 11 10.
- H. Mixing and Proportioning:

1. Comply with ASTM C926 Standards.
 2. Use air entrained plaster for Exterior work.
 3. Use ready mixed materials in accordance with manufacturer's instructions.
 4. Accurately measure proportions of materials for each batch.
 - a. Use measuring devices of known volume for materials.
 5. Withhold 10 PCT of mixing liquid until mixing is almost complete then add as needed to produce necessary consistency.
 - a. Keep water to a minimum.
 6. Mix each batch, by machine, for 3-5 minutes.
 - a. Hand mixing not permitted.
 7. Mix each batch of plaster in quantity which can be used before it starts to set.
 - a. Size batches for complete use within one hour after mixing.
 8. Base coat plasters may be tempered once, provided they have not begun to set.
 9. Discard plaster which has started to set.
- I. Plaster Mixes:
1. Utilize optimal plaster mixes as permitted by ASTM C926 according to substrate.
 2. Material proportions: Comply with ASTM C926.
 3. Dash coat:
 - a. For use where substrate is low-absorption concrete.
 - b. 1 part Portland cement and up to 2 parts sand, proportioned by volume.
 4. Base coat:
 - a. Utilize optimal plaster mixes as permitted by ASTM C926 according to substrate.
 5. Cementitious finish coat:-
 - a. Factory-prepared products containing materials required for finish, except water.
 - b. Finish:
 - 1) Float sand finish.
 - c. Color:
 - 1) White.
 6. Acrylic finish coat:
 - a. Factory blended 100 PCT acrylic polymer-based finish.
 - b. Integrally colored and sanded.
 - c. Texture and Color: To be selected by Architect.
 - d. Base Product: Parex DPR Finish by Parex, Inc.
 - e. Primer: Material recommended by manufacturer.
- J. Elastomeric Topcoat:
1. High-build, acrylic polymer coating.

Minimum Physical Properties – Elastomeric Topcoat		
Property	Test Method	Required Value
Water Wind Driven Rain	TT-C-00555B, para 4.4.7	No water penetration at 120 MPH for 8 HRS
Permeance	ASTM E96	12 Perm (US)
Accelerated Weathering	ASTM G26	Passed at 5000 HRS
Tensile Strength	ASTM D412	232 PSI
Sand Abrasion Resistance	ASTM D968	3000 sand= 0 mils abraded
		0 MM

2. Color:
 - a. Color to be selected by Architect.
3. Texture:
 - a. Fine.
4. Base Product:

- a. MasterProtect EL 750 by BASF Master Builders Solutions.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces to receive plaster.
- B. Check lath and furring for completeness and soundness.
- C. Ensure that reglets have been installed.
- D. Correct unsatisfactory conditions.
- E. Start of work constitutes acceptance of substrates and responsibility for performance.

3.2 PREPARATION

- A. Clean surfaces and remove loose and deleterious substances.
- B. Protection:
 - 1. Protect adjacent finished surfaces.
 - 2. Maintain protection until completion of plastering.

3.3 PREPARATION – SOLID SUBSTRATES

- A. Definition of Solid Substrates:
 - 1. Direct application of new plaster to CMU, cast-in-place concrete, brick masonry, existing plaster, and similar materials.
- B. High-suction substrates:
 - 1. Ordinary CMU, porous clay masonry or tile, lightweight concrete.
 - a. Wet substrate with fine water spray to produce a uniformly damp surface.
 - b. Apply Surface-applied Bonding Agent to substrate as recommended by manufacturer.

3.4 INSTALLATION – GENERAL

- A. Make interior corners and angles square.
- B. Finish external corners flush with corner beads.
- C. Built-in items, where plaster is not terminated at metal by casing beads:
 - 1. Cut basecoat free before plaster sets.
- D. Control Joints (CJ):
 - 1. Lay out Control Joints before work starts, as they may affect appearance, framing, sheathing, and lathing procedures.
 - 2. Cut lath behind control joints to ensure that stresses which develop in individual panels are isolated from adjacent panels.
 - 3. Locations: Locate where indicated on Drawings, where prudent, and as described below:
 - a. Panels should be relatively square.
 - 1) Avoid T, L, and X-shaped panels.
 - b. No panel should exceed 18 FT in length.
 - c. Panel dimensions shall not exceed a 2-1/2:1 ratio.
 - d. Panels shall not exceed the following areas:

PC Plaster Maximum Panel Areas	
Orientation	Maximum Area
Walls	144 SQFT
Ceilings and Soffits	100 SQFT

- e. Install Control Joints at surface penetrations, (windows, doors, etc.) and at areas of structural stress.
- E. Expansion Joints (EJ):
 - 1. Install Expansion Joints where dissimilar substrates join.
 - 2. Install where indicated.
- F. Wherever permanent grounds are too far apart to serve as guides for finishing, provide plaster screeds and establish true surface of screeds before screeds are set.
 - 1. Keep grounds clean.
 - 2. Finish plaster level with grounds.
- G. Metal Door Frames:
 - 1. Grout hollow metal frames for doors and other openings using specified base coat.
 - 2. Plaster flush with metal frames:
 - a. Cut basecoat free before plaster sets.
 - b. Groove finish coat at junctures with metal.
- H. Access Panels and Doors: Locate where required by Section 20 05 00 and Section 26 00 10, or where indicated.
 - 1. See Section 08 31 16 for product description.
- I. Apply minimum plaster thicknesses as follows:

Plaster Thickness								
Substrate Condition	Walls and Vertical Surfaces				Soffits and Horizontal Surfaces			
	Scratch	Brown	Finish ¹	Total	Scratch	Brown	Finish ¹	Total
Metal Lath on Framed Walls and Suspension Systems (Metal or Wood)	3/8 IN	3/8 IN	1/8 IN	7/8 IN	1/4 IN	1/4 IN	1/8 IN	5/8 IN
Masonry Substrates (no Lath)	3/8 IN		1/8 IN	1/2 IN	Use 2-coat system with total thickness not more than 1/8 IN. Exception: Where thicker plaster is required to conceal substrate irregularities, use Metal Lath System (below).			
Cast-in-Place Concrete, and Precast Concrete Substrates (no Lath)	1/4 IN		1/8 IN	3/8 IN				
Metal Lath over solid material	1/4 IN	1/4 IN	1/8 IN	7/8 IN	1/2 IN	1/4 IN	1/8 IN	7/8 IN

Notes:

1. Thicknesses indicated are applicable where "Cementitious-type" Finish Coats is specified. Where Acrylic Finish Coats are specified, the thicknesses scheduled will need to be adjusted to compensate for differing finish thickness.
 1. Apply greater thickness if indicated.
 2. For conditions not listed, refer to PCA Portland Cement Plaster Manual.
 3. Exception for Interior PC Plaster:
 - a. Where PC Plaster is scheduled to be installed over Lath, on interior of building: Minimum thickness may be 3/4 IN in lieu of tabular value.
 4. Correctional facility secure ceilings: 1-1/4 IN over double layer of mesh.

3.5 INSTALLATION OVER METAL LATH

- A. Examine wall surface to ensure proper application of lath and accessories.
- B. Nominal plaster base coat thickness:
 - 1. Refer to Table 1 above.
- C. First Base Coat (scratch coat) to completely embed lath.
 - 1. Horizontally cross-rake to provide key for second Base Coat (brown coat).
 - 2. Cement plaster must be applied with sufficient force to develop full adhesion between plaster and the lath.
- D. Second Base Coat (brown coat):
 - 1. Applied so that it meets the required total thickness.
 - 2. Thickness of second coat shall not vary more than 1/4 IN in any direction under a 5 FT straight edge.
 - 3. Second coat of cement plaster must be rodded to the desired thickness and leveled to screeds.
 - a. Wood float or darby the surface.
 - b. Fill voids and dress surface for finish coat.

3.6 INSTALLATION OVER MASONRY

- A. Masonry surfaces:
 - 1. If smooth and in good condition: Apply at least two coats of cement plaster.
 - 2. If surface is not in good condition: Mechanically attach metal lath and install plaster accordingly.
 - 3. Where minor irregularities occur on a masonry wall which is otherwise in good condition: Patch and/or apply metal lath to portions of substrate wall that has offsets and irregularities greater than 1/4 IN to avoid the creation of weakened planes which might lead to cracking in the plaster finish.
 - 4. Masonry surface to be clean and in condition for a direct bond of cement plaster.
 - 5. Pre-wet the wall before plastering.
- B. Apply a Surface-applied Bonding Agent to masonry surfaces per manufacturer's standards.
- C. Minimum thickness of Base Coat:
 - 1. Refer to Table 1 above.
- D. Cement plaster must be applied with sufficient force to develop full adhesion between plaster and the substrate.
- E. Cement plaster Base Coat must be rodded off to a true flat plane.
 - 1. Even and level with screeds.
 - 2. Wood float or darby the surface.
 - 3. Fill voids and dress surface for Finish Coat.

3.7 INSTALLATION OVER CONCRETE

- A. Concrete surfaces:
 - 1. Must be free of dust, loose particles, oil, and other foreign matter, which would affect a bond of cement plaster to concrete.
 - 2. Smooth surfaces: Apply minimum two coats of cement plaster.
 - 3. Rough surfaces: Mechanically attach metal lath and install accordingly.
 - 4. Patch and/or apply metal lath to portions of substrate with offsets and irregularities greater than 1/4 IN .
- B. Apply a Surface-applied Bonding Agent to concrete surface per manufacturer's standards.
- C. Minimum thickness of base coat:
 - 1. Refer to Table 1 above.
- D. Test bond of cement plaster to concrete surfaces.

- E. Cement plaster must be applied with sufficient force to develop full adhesion between plaster and the substrate.
- F. Cement plaster base coat finishing:
 - 1. Even and level with screeds.
 - 2. Wood float or darby surface.
 - 3. Fill voids and dress surface for Finish Coat.

3.8 FINISH COAT APPLICATION

- A. General:
 - 1. Allow adequate time for base coat to cure as prescribed by ASTM C926.
 - 2. Finish without scaffold lines or other marks due to application.
 - 3. Mix and apply in accordance with manufacturer's recommendations.
 - 4. Match approved texture and color as selected by Architect.
- B. Cementitious Finish Coats:
 - 1. Apply minimum thickness of 1/8 IN or as indicated in Table 1.
 - 2. Apply continuously in one operation to entire wall surface.
 - 3. Maintain wet edge.

3.9 ELASTOMERIC TOPCOAT INSTALLATION

- A. Apply elastomeric top coat in accordance with manufacturer's instructions.
 - 1. Minimum dry film thickness: 16 to 20 mils .

3.10 FIELD QUALITY CONTROL

- A. Determine most effective procedures for curing and time lapse between coats, based on climatic and job conditions.
- B. Tolerances:
 - 1. 1/8 IN in 10 FT , as measured from a straight edge placed in any location on surface.
- C. Cracked or crazed plaster is not acceptable.
- D. Remove and replace unacceptable plaster and base.

3.11 REPAIR AND CLEANING

- A. Cut, patch, repair and point plaster as required.
 - 1. Repair cracks and indented surfaces by moistening plaster and filling with new material.
 - 2. Trowel or tamp flush with adjoining surfaces.
 - 3. Point up finish plaster surfaces around items that are built into or penetrate plaster.
- B. Remove misplaced plaster from surfaces not scheduled to be plastered.
 - 1. Remove plaster remnants from control joints, expansion joints and reveals.
 - 2. Repair surfaces which have been stained, marred or damaged during plastering work.
 - 3. Remove unused materials, containers and equipment.
 - 4. Clean floors and other surfaces of plaster debris.

END OF SECTION

SECTION 09 29 00
GYP SUM WALLBOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Gypsum Wallboard in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM C475 Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 2. ASTM C840 Application and Finishing of Gypsum Board.
 - 3. ASTM C841 Installation of Interior Lathing and Furring.
 - 4. ASTM C954 Steel Drill Screws for Application of Gypsum Panel Products or Metal Plaster Bases.
 - 5. ASTM C1002 Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases.
 - 6. ASTM C1047 Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - 7. ASTM C1396 Standard Specification for Gypsum Board.
 - 8. ASTM C1629 Abuse-Resistant Non-decorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
 - 9. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - 10. ASTM E84 Surface-Burning Characteristics of Building Materials.
 - 11. ASTM E90 Sound Transmission Testing.
 - 12. ASTM E119 Fire Tests of Building Construction.
 - 13. ASTM E413 Classification for Rating Sound Insulation.
 - 14. ASTM F2547 Standard Test Method for Determining the Attenuation Properties in a Primary X-ray Beam of Materials Used to Protect Against Radiation Generated During the Use of X-ray Equipment
- B. Gypsum Association (GA):
 - 1. GA-216 Application and Finishing of Gypsum Panel Products.
 - 2. GA-234 Control Joints for Fire-Resistance Rated Systems.
 - 3. GA-238 Guidelines for Prevention of Mold Growth on Gypsum Board.
- C. Fire Resistant Rated Assemblies:
 - 1. For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
 - 2. Provide materials listed by UL, or other approved testing laboratory, for construction and rating type indicated.
- D. STC Rated Assemblies:
 - 1. Provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
 - 2. Facility Guidelines Institute (FGI):
 - a. FGI Guidelines For Design and Construction of Healthcare Facilities:
 - 1) Sound and Vibration Requirements.
 - 3. American National Standards Institute (ANSI):
 - a. ANSI S1.1 American National Standard Acoustical Terminology.
 - b. ANSI S1.4 American National Standard Specification for Sound Level Meters.

- c. ANSI S1.4 American National Standard Specification for Sound Level Meters.
- d. ANSI S1.43 American National Standard Specifications for Integrating-Averaging Sound Level Meters.
- 4. ASTM International (ASTM):
 - a. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - b. ASTM C634 Standard Terminology Relating to Building and Environmental Acoustics.
 - c. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board.
 - d. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - e. ASTM E336 Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.
 - f. ASTM E413 Classification for Rating Sound Insulation.
 - g. ASTM E966 Standard Guide for Field Measurements of Airborne Sound Insulation of Building Facades and Façade Elements.
- 5. American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - a. ASHRAE Handbook: Sound and Vibration Control.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications for each type of material and accessory.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Gypsum Wallboard:
 - 1. Base:
 - a. Georgia Pacific (GP).
 - 2. Optional:
 - a. American Gypsum.
 - b. CertainTeed.
 - c. Continental Building Products.
 - d. National Gypsum Company (NGC).
 - e. Pabco Gypsum.
 - f. United States Gypsum (USG).
- B. Acoustically Enhanced Gypsum Wallboard Composite:
 - 1. Base:
 - a. National Gypsum Company.
 - 2. Optional:
 - a. CertainTeed.
 - b. Pabco Gypsum.
 - c. Supress Products, LLC.
- C. Drywall Trim Accessories:
 - 1. Base:
 - a. United States Gypsum (USG)
 - 2. Optional:
 - a. ClarkDietrich.
 - b. Phillips Manufacturing.
 - c. Structus Building Technologies.
- D. Specialty Drywall Trim:
 - 1. Base:
 - a. Pittcon Industries.
 - 2. Optional:

- a. Fry Reglet Corp.
 - b. Gordon, Inc.
- E. Foam Tape:
- 1. Base:
 - a. As noted.
- F. Sound Attenuation Batts (SAB):
- 1. Base:
 - a. As noted.
- G. Preformed Acoustical Seal for Wall Boxes:
- 1. Base:
 - a. STC Architectural Products.
- H. Pressure Sensitive Fire Tape:
- 1. Base:
 - a. E-Z Taping System.
- I. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Furnish in maximum available lengths, consistent with installation requirements.
- 1. Long Edge: Tapered.
 - 2. Short Ends: Square.
- B. Upgrade listed types to fire rated equivalent products when used in fire rated assemblies.
- C. Provide listed GWB products to mold and moisture resistant types, where wallboard is installed in Electrical, Communication Rooms, Mechanical shafts, Stair Shafts and similar locations where wallboard is installed prior to building being weathertight.
- D. Exterior Gypsum Sheathing: Specified in Section 06 16 43.
- E. Framing and suspension systems for Gypsum Board Ceilings: Specified in Section 09 22 16.
- F. Firestopping: Specified in Section 07 84 00.
- G. Thermal Insulation: Specified in Section 07 21 00 and other Division 07 sections.
- H. Interior Expansion Joint Covers: Specified in Section 07 95 13.
- I. Interior face of exterior walls and rooms where moisture or high humidity is present:
- 1. Mold and moisture resistant gypsum panels (MRGWB).
 - 2. Gypsum panels, with glass mat facer per ASTM C1658.
 - 3. Thickness: 5/8 IN .
 - 4. Mold resistance score: 10 per ASTM D3273.
 - 5. Apply continuously to interior face of exterior stud walls prior to framing interior partitions and ceilings.
 - 6. Where MR wallboard is scheduled in fire rated walls, provide approved fire resistive products with comparable moisture resistance.
 - 7. Base product:
 - a. DensArmor Plus Interior Panel and DensArmor Plus Fireguard Interior Panel Fireguard by Georgia Pacific.
- J. Interior Partitions and Ceilings:
- 1. Gypsum panels - Type X:
 - a. ASTM C1396.
 - b. Thickness: 5/8 IN .
 - c. Type X core.
 - d. Base product:
 - 1) ToughRock Fireguard X Gypsum Wallboard by Georgia Pacific.

2. Tile Backer Board (TBB):
 - a. Moisture resistant treated gypsum core, glass mats on both sides, and acrylic water barrier or water resistant gypsum coating on finished side.
 - b. Provide TBB at walls of showers, tub rooms, toilet rooms, decontamination rooms, and similar walls where tile is scheduled.
 - c. Thickness: 1/2 IN .
 - d. Thickness: 5/8 IN type X at rated walls.
 - e. Mold resistance score: 10 per ASTM D3273.
 - f. Base Products:
 - 1) Non-Rated Walls: DensShield Tile Backer by Georgia Pacific.
 - 2) Fire Rated Walls: DensShield Fireguard Tile Backer by Georgia Pacific.
 - g. Include Level 5 finish at non-tiled portions.
 3. Impact Resistant Gypsum Wallboard (IRGWB):
 - a. Thickness: 5/8 IN .
 - b. Type X core.
 - c. Mold resistance score: 10 per ASTM D3273.
 - d. Tested in accordance with ASTM C1629.
 - 1) Soft Body Impact: Level 2, minimum.
 - 2) Hard Body Impact: Level 2, minimum.
 - e. Upgrade metal studs to 20 GA minimum where used with IRGWB.
 - f. Base product, glass mat facer – ASTM C1658:
 - 1) DensArmor Plus Impact Resistant Interior Panel by Georgia Pacific.
 - g. Access panels for lead-lined ceilings: Specified in Section 08 31 16.
- K. Trim:
1. Interior Trim:
 - a. Material: Galvanized or aluminum coated steel sheet, rolled zinc, paper faced galvanized steel sheet, or paper faced structural laminate.
 - b. Material for wet areas: Zinc.
 - c. Shapes:
 - 1) Corner bead.
 - 2) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - 3) L-Bead: L-shaped; exposed long flange receives joint compound.
 - 4) U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - 5) Control joint.
 - 6) Curved Edge Corner bead: With notched or flexible flanges.
 - 7) Other items as indicated.
 2. Specialty trim:
 - a. Profiles and dimensions indicated.
 - b. Material: 6063-T5 Aluminum.
 - c. Material: _____.
 - d. Finish: Factory primed for field finishing.
 - e. Finish: Class II anodic finish.
 - f. Finish: Factory painted, baked enamel finish.
 - g. Flanges to be embedded: Corrosion resistant primer compatible with joint compound and finish materials indicated.
- L. Joint Treatment Materials:
1. Use product types recommended by wallboard manufacturer for each condition.
 2. Materials compatible with other compounds applied previously or on successive coats.
 3. Provide dust control products in occupied areas or adjacent to occupied areas.
 4. Joint tape:
 - a. Interior gypsum wallboard: Paper.
 - b. Tile backing panels: As recommended by panel manufacturer.
 5. Joint compounds for interior gypsum wallboard:
 - a. Setting type joint compound:
 - 1) Filling open joints and voids.

- 2) Embedding tape and first coat over joints, fasteners and trim flanges.
 - 6. Lightweight setting type joint compound:
 - a. Second coat.
 - b. Final, skim coat on surfaces receiving a Level 5 finish.
 - c. Drying type all-purpose joint compound:
 - 1) Second and third coats.
 - 2) Final, skim coat, on surfaces receiving a Level 5 finish.
 - d. Spray applied coating compound:
 - 1) Final, skim coat, on surfaces receiving a Level 5 finish.
 - 7. Joint compounds for moisture resistant gypsum wallboard:
 - a. Setting type joint compound:
 - 1) Filling open joints and voids.
 - 2) Embedding tape and first coat over joints, fasteners and trim flanges.
 - b. Lightweight setting type joint compound:
 - 1) Second and third coats.
 - 2) Final, skim coat on surfaces receiving a Level 5 finish.
- M. Acoustical Materials:
- 1. Provide where indicated.
 - 2. Minimum nominal thickness: As required to achieve STC indicated for wall systems.
 - 3. Density: As required to achieve STC indicated for wall systems.
 - 4. Sound attenuation batts (SAB):
 - a. Glass or mineral fiber.
 - b. Commercial sound blanket, ASTM C665, Type I, unfaced, produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - c. Surface burning characteristics per ASTM E84:
 - 1) Maximum flame spread: 10.
 - 2) Maximum smoke developed: 10.
 - d. Fire rated assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
 - e. Acoustically rated assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
 - f. Batt insulation products shall contain no added formaldehyde, including urea formaldehyde, phenol formaldehyde, and urea-extended phenol formaldehyde.
 - g. Fiberglass base product: Sound Attenuation Batt Insulation by Owens-Corning.
 - h. Mineral wool base product: Thermafiber SAFB FF by Owens-Corning.
 - 5. Preformed acoustical seal for wall boxes:
 - a. Box Seal by STC Sound Control
 - b. Molded neoprene, durometer A-40 complying with ASTM D2000.
 - c. Formed to fit the electrical device, outlet and service boxes.
 - d. STC improvement: 6 db in accordance to ASTM E90.
 - 6. Provide at electrical and service box penetrations in sound rated walls.
- N. Interior joint sealants, including acoustical sealants:
- 1. See Section 07 92 16.
- O. Fasteners:
- 1. Bugle head screws: ASTM C1002 for use with maximum 22 GA metal stud framing.
 - 2. Self-tapping bugle head screws: ASTM C954 for use with minimum 20 GA metal framing.
 - 3. Type S for gypsum wallboard to metal; Type G for gypsum wallboard to gypsum wallboard.
 - 4. Screws used with backer boards: As recommended by panel manufacturer.
- P. Laminating Adhesive:
- 1. Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- Q. Foam Tape:

1. PVC 1/2 x 1/4 IN : With pressure sensitive adhesive; Norseal.
 2. EPDM 1/2 x 1/4 IN : With pressure sensitive adhesive; Cellular rubber by Gasket Dynamics.
- R. Backing for Control Joints:
1. Fire rated board.
- S. Support straps:
1. Galvanized steel sheet for retaining and bracing in length and width indicated or as required for adequate support of assembly.
 2. Minimum Base-Metal Thickness: 20 gauge.
- T. Sealer for Moisture Resistant Gypsum Wallboard:
1. Manufacturer's standard compound.
 2. Use at joints, cut edges and screw penetrations.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

- A. Examine supporting structure and conditions prior to wallboard installation.
- B. Correct unsatisfactory conditions.
- C. Start of installation constitutes acceptance of conditions and responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Remove loose materials and vacuum cavity of gypsum dust prior to enclosing stud space.
- C. Install wallboard vertically with edges over metal stud framing members and similar framing support members.
- D. Bring boards into contact but do not force into place.
- E. Stagger edge joints on opposite side of partition so they occur on different framing members.
- F. Stagger joints in multi-layer applications not less than one support from previous layer.
- G. Install wallboard over metal framing studs and similar framing support members at interior face of exterior walls full height from floor to structure above.
- H. Wallboard installation prior to building being weathertight:
 1. Replace scheduled GWB products to their mold-resistant counterparts.
 - a. Products proposed are subject to Architect approval.
 2. Exposure time shall be limited by manufacturer requirements.
- I. Sound Insulation:
 1. Install sound insulation in walls from floor to structure above, where sound rated walls are indicated.
 2. Install in thicknesses and densities necessary to achieve sound rating.
 3. Fill cavities where studs are installed nested or toe-to-toe.
 4. Pack spaces around electric boxes and other penetrations to maintain full sound rating.
 - a. Fill small voids that remain with Acoustical Sealant.
 5. Where walls are not finished on both sides, or where insulation does not fill the cavity depth, supplementary galvanized steel support straps must be provided to hold product in place at 24 IN on center or at spacing as indicated by the insulation manufacturer's written installation instructions.
- J. Preformed Acoustical Seal for Wall Boxes:

1. Place preformed seal over exposed outlet box flush with wall surface with device protruding through preformed or precut opening in seal.
 2. Secure in place with outlet cover plate.
- K. Screw Placement:
1. Proceed with attachment from board center toward ends and edges.
 2. Space maximum 8 IN OC at edges and 12 IN OC in field of board.
 - a. Use closer screw spacing if required by UL.
 - b. Fasten wallboard to each stud where multiple studs are installed at door jambs.
 3. Secure wallboard to vertical studs; do not secure to top track directly.
 - a. Follow top track manufacturer's screw pattern requirements.
 - b. Install additional framing if required.
 - c. Top track is specified in Section 09 22 16.
 4. Set screws between 3/8 IN and 1/2 IN from edges.
 5. Drive screws so head rests in slight dimple without cutting face paper or fracturing core.
- L. Access Panels and Doors:
1. Locate where required by Section 20 05 00 and Section 26 00 10, or as indicated.
 2. See Section 08 31 16.

3.3 INSTALLATION - TRIM ACCESSORIES

- A. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Interior Trim:
1. Install in following locations:
 2. Corner Bead: Use at outside corners.
 3. J-Bead or LC-Bead: Use at exposed panel edges.
 4. L-Bead: Use where wallboard abuts dissimilar surfaces and where indicated.
- C. Specialty Trim:
1. Install in locations indicated.

3.4 INSTALLATION - CEILING

- A. Install in compliance with manufacturer's recommendations.
- B. Stagger abutting end joints of adjacent panels' not less than one framing member.
- C. During cold or damp weather, insulate before installing gypsum board on a ceiling with a vapor barrier.

3.5 CONTROL JOINTS

- A. General:
1. Install Control Joints in locations indicated and as described in this article and in specific locations approved by Architect for visual effect.
 2. Install suitable backing material to maintain required rating where Control Joints occur in fire or sound rated assemblies.
- B. Partitions:
1. Extend control joints continuous full height of partition or wall.
 2. Provide vertical control joints on both wall faces which align with door frames, window frames, and similar opening as follows:
 - a. Single Doors and Cased Opening:
 - 1) Locate CJ's at both jambs, from head of opening to top of partition.
 - b. Pair doors:
 - 1) Locate CJ's at both jambs, from head of opening to top of partition.
 - 2) Exception: Control Joints are not required where partition forms a cross-corridor condition.
 - c. Doors with adjacent sidelights:

- 1) Locate CJ's at both jambs from head of opening to top of partition, and, from sill to floor at sidelight jambs.
 - d. Sliding doors:
 - 1) Locate CJ's at both jambs, from head of opening to top of partition.
 - e. Punched windows less than 30 FT in width:
 - 1) Both jambs from head of opening to top of partition, and from sill edge to floor.
 - f. Ribbon windows greater than 30 FT in width:
 - 1) Both jambs from head of opening to top of partition, and from sill edge to floor.
 - 2) Locate additional intermediate CJ's so maximum distance between CJ's does not exceed 30 FT apart.
 - 3)
 3. Provide additional vertical Control Joints, spaced no more than 30 FT apart from each other, from opening related CJ's, or from corners.
 4. Provide horizontal control joints at partitions which are more than one story in height:
 - a. Locate horizontal Control Joints where partitions bypass each intermediate floor.
 - b. Align control joint with floor line, unless otherwise indicated.
- C. Ceilings:
1. Use Control Joints to subdivide ceilings/soffits as indicated, and within the following limits:
 - a. Ceilings with perimeter relief:
 - 1) Subdivide so no area exceeds 2500 SQ FT , and no area has a length which exceeds 50 FT .
 - a) Exception where ceiling occurs at exterior: Subdivide so that no area exceeds 900 SQ FT , and no area has a length which exceeds 30 FT .
 - b. Ceilings without perimeter relief:
 - 1) Subdivide so that no area exceeds 900 SQ FT , and no area has a length which exceeds 30 FT .
 - c. Locate control joints at transitions between areas of different shapes.
- D. Soffits:
1. Use control joints to subdivide ceilings/soffits as indicated, and within the following limits:
 - a. Locate Control Joints at transitions between areas of different shapes.
 - b. Continue lines of soffit Control Joints vertically to top of fascia.
 - c. Subdivide exterior applications so no area exceeds 900 SQ FT , and no area has a length which exceeds 30 FT .

3.6 WALLBOARD FINISHING

- A. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
- B. Pre-fill open joints and voids, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Where bead abuts exterior metal window frames or other metal components, separate from other material by use of foam tape.
- E. Remove residual joint compound from adjacent surfaces.
- F. Apply Joint Compound and Tape in accordance with fire rated design.
 1. Apply joint treatment compound in accordance with manufacturer's directions.
 2. Fill joints, screw heads, and internal corners with compound.
 3. Extend joint system vertically from floor to extent described as follows:
 - a. Fire Walls, Barriers, and Partitions: Extend to full height of wall.
 - b. Smoke Barriers and Partitions: Extend to full height of wall.
 - c. Interior face of exterior wall (non-rated): Extend to full height of wall.
 - d. Other interior partitions (non-rated): Extend to 6 IN 150 MM above ceiling.
 4. Refer to Drawings for indication of partition heights.

- G. Level 4 Finish:
 - 1. After drying, sand or otherwise smooth final coat of compound as needed to eliminate high spots or excess compound to leave smooth, even, and level surface.
 - 2. Draw down final coat of compound to a smooth even plane.
 - 3. Locations:
 - a. Wallboard scheduled to be finished with Gloss Level 1 (flat), Level 2 (velvet), or Level 3 (eggshell) paint, glazed coating, textured coating, or wall covering.
 - b. Where above listed surfaces are to be finished with textured decorative treatments, wall covering, paneling, or wall guard.
 - c. Remaining locations, unless noted otherwise.
- H. Glass Mat, Water Resistant Backing Panels:
 - 1. Finish according to manufacturer's written instructions.
- I. Cementitious Backer Units:
 - 1. Finish according to manufacturer's written instructions.
- J. Repairs:
 - 1. After painter has applied primer to wallboard surfaces, repair and refinish defective areas.
 - 2. If wallboard is damaged, or surfaces are roughened, repair or replace.

3.7 FIRE AND SMOKE WALL IDENTIFICATION

- A. Identify walls indicated on Drawings as having a required fire or smoke rating.
 - 1. Follow guidelines set in Chapter 7 of International Building Code.
 - 2. Permanently identify rating and type of barrier with stencil and paint in contrasting, 3 IN high letters in a manner acceptable to authority having jurisdiction.
 - 3. Text for fire and smoke barriers: "x HOUR FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS".

3.8 PROTECTION

- A. Protect installed wallboard from water damage during construction.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- D. Prior to finishing, walls shall be inspected for visible mold growth.
 - 1. Replace affected portions.

END OF SECTION

SECTION 09 30 00
TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Tile, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Minimum ten (10) years of experience in manufacture of tile, setting and grout materials.
- B. Installer Qualifications:
 - 1. Specializing in tile work having minimum of five (5) years successful documented experience with work comparable to that required for this Project.
- C. Single Source Responsibility:
 - 1. Obtain each type and color tile material required from single source.
 - 2. Provide compatible materials for tile system.
- D. Certifications:
 - 1. Submit Master Grade Certificate for each type of ceramic, quarry, and paver tile in accordance with requirements of ANSI A137.1.
 - 2. Submit manufacturer's certifications that mortars, adhesives, and grouts are suitable for intended use.
- E. Tile Council of North America (TCNA):
 - 1. Handbook for Ceramic, Glass and Stone Tile Installation, latest edition.
- F. Ceramic Tile Institute of America (CTIOA).
- G. ASTM International (ASTM):
 - 1. ASTM C373 Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products.
 - 2. ASTM C623 Young's Modulus, Shear Modulus, and Poisson's Ratio for Glass and Glass-Ceramics by Resonance.
 - 3. ASTM C627 Robinson Floor Test for Tile Service Level.
 - 4. ASTM D4068 Standard Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane.
 - 5. ASTM D4551 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane.
 - 6. ASTM E90 and ASTM E413 for STC (Sound Transmission Class).
 - 7. ASTM E492 and ASTM E989 for IIC (Impact Insulation Class) – Sound Deadening Underlayments.
- H. American National Standards Institute (ANSI):
 - 1. ANSI A108.5 Installation of Ceramic tile with Dry-Set Portland Cement or Latex-Portland Cement.
 - 2. ANSI A108.10 Installation of Grout in Tilework.
 - 3. ANSI A108.13 Installation of Membranes for Thin-Set Ceramic Tile.
 - 4. ANSI A108.17 Installation of Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone.
 - 5. ANSI A118.1 Standard Dry-Set Cement Mortars.

6. ANSI A118.3 Chemical Resistant, Water-Cleanable, Tile-Setting and-Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.
7. ANSI A118.4 Modified Dry-Set Cement Mortar.
8. ANSI A118.7 High Performance Cement Grouts.
9. ANSI A118.10 Load-Bearing, Bonded Waterproofing Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
10. ANSI A118.12 Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation.
11. ANSI A118.15 Improved Modified Dry-Set Cement Mortars.
12. ANSI A136.1 Organic Adhesives for Installation of Ceramic Tile.
13. ANSI A137.1 Ceramic Tile.

1.3 SUBMITTALS

- A. Shop Drawings:
 1. Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, movement joints, thresholds, ceramic accessories, and setting methods and details.
- B. Samples:
 1. Three full size samples of each tile specified in Drawing I-001 Interior Notes and Finish Legend.
 2. Grout: Submit manufacturer's full range of standard and designated color samples for each type for Architect's selection.
 3. Grout: Submit samples mounted in 6 IN long metal channels for each type and color specified.
- C. Project Information:
 1. Installation methods.
 2. Manufacturer's Certificate: For each shipment, type and composition of tile provide a Master Grade Certificate signed by manufacturer and installer certifying products meet or exceed specified requirements of ANSI A137.1-2012.
- D. Contract Closeout Information:
 1. Maintenance Data:
 - a. Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.
 - b. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Ceramic Tile:
 1. Base:
 - a. As specified in Drawing I-001 Interior Notes and Finish Legend.
- B. Porcelain Tile:
 1. Base:
 - a. As specified in Drawing I-001 Interior Notes and Finish Legend.
- C. Accessories:
 1. Base:
 - a. Schluter Systems LP.
 2. Option:
 - a. Custom Building Products.
- D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN CRITERIA

- A. Ceramic Tile:
 - 1. Comply with ANSI A137.1 American National Standard Specifications for Ceramic Tile for types, compositions, and grades of tile indicated.
 - 2. Furnish tile complying with Standard Grade requirements unless otherwise indicated.
 - 3. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
- B. Colors, Textures, and Patterns:
 - 1. Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with following requirements:
 - a. Match Architect's sample.
- C. Factory Mounting:
 - 1. Provide back face or edge mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.
 - 2. Do not use back mounted or edge mounted tile assemblies for swimming pools, exterior applications or wet areas.
- D. Grout Release:
 - 1. Factory applied temporary protective coating.
 - 2. Provide where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
 - 3. Do not coat unexposed tile surfaces.

2.3 MATERIALS

- A. Ceramic Wall Tile:
 - 1. Grade: ANSI A137.1; 5.0 to 10.0 PCT water absorption.
 - 2. Size: 3 x 3 x 5/16 IN nominal.
 - 3. Edge: Cushioned.
 - 4. Finish: Glazed.
 - 5. Color: To be selected.
 - 6. Base: Matching cove base units, 5 or 6 IN high, bullnose top.
 - a. Acceptable Product: As specified in Drawing I-001 Interior Notes and Finish Legend.
- B. Ceramic Mosaic Wall Tile:
 - 1. Grade: ANSI/A137.1; 5.0 to 10.0 PCT water absorption.
 - 2. Size: 2 x 2 x 1/4 IN (nominal).
 - 3. Edge: Cushioned.
 - 4. Finish: Glazed.
 - 5. Color: To be selected.
 - 6. Base: Matching cove base, 5 IN high, bullnose top.
 - a. Acceptable Product: As specified in Drawing I-001 Interior Notes and Finish Legend.
 - 7. Trim: Bullnose.
- C. Ceramic Floor Tile:
 - 1. Grade: ANSI/A137.1; 0.5 to 3.0 PCT water absorption.
 - 2. Size: 6 x 6 x 5/16 IN (nominal).
 - 3. Shape: Square.
 - 4. Edge: Cushioned.
 - 5. Style/Pattern, Color: As specified in Drawing I-001 Interior Notes and Finish Legend.
- D. Ceramic Mosaic Floor Tile:
 - 1. Grade: ANSI/A137.1; 0.5 to 3.0 PCT water absorption.
 - 2. Size: 2 x 2 x 1/4 IN (nominal).
 - 3. Edge: Cushioned.
 - 4. Surface: Smooth.
 - 5. Finish: Unglazed.

6. Style/Pattern, Color: As specified in Drawing I-001 Interior Notes and Finish Legend.
 7. Base: Matching cove base, 5 IN high, bullnose top.
- E. Glass Tile
1. Grade: ANSI A137.2 for types and other characteristics indicated.
 2. Face Size: 3 by 3 IN (76 by 76 MM) nominal.
 3. Tile Color and Pattern: To be selected.
- F. Factory-Mounted Mosaic Glass Tile.
1. Grade: ANSI A137.2 for types and other characteristics indicated.
 2. Module Size: 1/2 by 2 IN (12.7 by 50.8 MM) nominal.
 3. Tile Color and Pattern: To be selected.
- G. Quarry Tile:
1. Acceptable Manufacturer: As specified in IN-series drawings: Finish Legend.
 2. Quarry Tile:
 - a. Material: Vitreous body, frost proof, [unglazed] [glazed], V-backed, square edge four sides after firing.
 - b. Material: Semi-Vitreous body, frost proof, V-backed, square edge four sides after firing.
 - c. Comply with requirements of ANSI A137.1, paragraph 5.2, standard grade.
 - d. Water Absorption: 0.5 to 3 PCT maximum, ASTM C373.
 - e. Water Absorption: 3 to 7 PCT maximum, ASTM C373.
 - f. Dynamic Coefficient Of Friction (DCOF): > 0.42 per ANSI 137.1.
 3. Acceptable Products: As specified in Drawing I-001 Interior Notes and Finish Legend.
- H. Paver Tile:
1. Acceptable Manufacturer: As specified in Drawing I-001 Interior Notes and Finish Legend.
- I. Trim:
1. Provide necessary caps, stops, returns, trimmers and other shapes to complete installation.
 2. Color and finish to match adjacent tile unless shown otherwise.
 3. Ceramic Trim:
 - a. Straight Base: Bullnose top edge. Align joints and set on top of floor tile.
 - b. Cove Base: Bullnose top edge. Align joints and set flush with floor tile.
 - c. Cove Base: Square top edge. Align joints and set flush with floor tile.
 - d. Stair Tread: Non-slip with integral nosing.
- J. Mortar, Grout, and Adhesive Manufacturer:
1. Setting materials: As required by installation Method, See Part 3.
- K. Mortar – Thick Set
1. Portland Cement Mortar with Latex Additive:
 - a. Portland Cement: ASTM C150, Type I, from one source only, non-staining and non-air-entraining.
 - b. Supplemental cementitious materials derived from coal fired power plant wastes shall not have a mercury content >5.5ppb.
 - c. Fly ash shall not be a byproduct of municipal solid waste incinerators
 - d. Mortar Sand: ASTM C144, free of deleterious materials, well graded.
 - e. Setting Bed Sand: ASTM C136, 100 PCT passing No. 4 sieve.
 - f. Latex Additive:
 - 1) Description: Latex additive serving as replacement for gaging water, for use with site mixed portland cement mortar.
 - 2) Quantity: As recommended by latex additive manufacturer to produce workable consistency.
 - 3) Acceptable Products:
 - a) CustomFloat Bedding Mortar by Custom Building Products.
 - b) 3701 Mortar Admix by Laticrete.
 - c) Planicrete AC by Mapei.

- L. Mortar – Thin Set:
 - 1. Portland Cement with Latex Additive:
 - a. Latex additive and site mixed Cement mortar.
 - b. Comply with ANSI-A118.4.
 - c. Acceptable Products:
 - 1) CustomCrete Latex Mortar Admix with site mixed mortar by Custom Building Products.
 - 2) Planicrete AC with 4:1 Mud Bed Mix by Mapei.
- M. Epoxy Adhesive:
 - 1. Multi-component, factory prepared, 100 PCT epoxy resin and hardener with sand or mineral filler material.
 - 2. Comply with ANSI A118.3 for thin-set applications for chemical resistant, water cleanable quarry tile installations.
 - 3. Acceptable Products:
 - a. Kerapoxy 410 by Mapei.
- N. Latex Modified Grout:
 - 1. Description: Latex-modified, factory blended, mildew resistant, sanded, grout consisting of cement, graded quartz and additives; comply with ANSI A118.7.
 - 2. Latex Additive: Type as recommended by latex mortar manufacturer.
 - 3. Acceptable Products:
 - a. Polyblend Sanded Tile Grout by Custom Building Products.
 - b. Sattilo Grout Mix with Acrylic Mortar Admix 1:1 with water by Custom Building Products.
 - c. 500 Series Sanded Grout Mixed with 1776 Grout Admix Plus by Laticrete.
 - d. Ultracolor Plus FA polymer-modified sanded grout by Mapei.
- O. Unsanded Latex Modified Grout for Wall Tile:
 - 1. Description: Latex-modified, factory blended, mildew resistant, non-sanded, grout consisting of cement and additives; comply with ANSI A118.6.
 - 2. Latex Additive: Type as recommended by latex mortar manufacturer.
 - 3. Color: To be selected.
 - 4. Acceptable Products:
 - a. Polyblend Non-Sanded Tile Grout by Custom Building Products.
 - b. White Dry Tile Grout by Custom Building Products.
 - c. 644 White Dry-Set Grout mixed with 17765 Grout Admix Plus by Laticrete.
 - d. 1600 Series Tri-Poly Fortified Non Sanded Grout by Laticrete.
 - e. Keracolor U polymer-modified unsanded grout by Mapei.
- P. Unsanded Urethane Grout:
 - 1. Description: Pre-mixed non-cementitious urethane , factory blended, antimicrobial, mildew resistant, non-sanded, grout; complying with ANSI A118.3-UG..
 - 2. Color: To be selected.
 - 3. Acceptable Products:
 - a. QuartzLock2 by Bostik.
 - b. Flexcolor CQ (acrylic-based) by Mapei.
- Q. Polymer Modified Sanded Grout:
 - 1. Compressive Strength: 3000 PSI at 24 HRS.
 - 2. Color: To be selected
 - 3. Color: As specified in Drawing I-001 Interior Notes and Finish Legend.
 - 4. Acceptable Products:
 - a. Polyblend Sanded Tile Grout by Custom Building Products.
 - b. 1500 Series Tri-Poly Fortified Sanded Grout by Laticrete.
 - c. Ultracolor Plus FA by Mapei.
- R. Waterproofing Membrane:
 - 1. Description: Trowel applied elastomeric compound.

2. Acceptable Products:
 - a. Mapelastic 315 by Mapei.
 3. Accessories:
 - a. Preformed fiberglass mesh coving, inside and outside corners, and drain fittings.
 - b. Preformed expansion joint flashing.
- S. Crack Isolation Membrane:
1. Description: Trowel applied elastomeric compound.
 2. Acceptable Products:
 - a. Mapelastic 315 by Mapei.
- T. Sound Isolation Membrane:
1. Sound deadening underlayment exceeding IIC, Impact Insulation Class, standard of 50 and Sound Transmission Class (STC) standard of 56.
 2. Acceptable Products:
 - a. No.18 Sound Control Underlayment by Laticrete.
 - b. Mapei Mapesonic 2 (with Mapei SM Primer).
 - c. Nobleseal SIS by The Noble Company, Grand Haven, MI.
 - d. Dal Sound by Dal Tile.
- U. Tile Backer Board:
1. Moisture-resistant treated gypsum core, glass mats both sides, and vinyl, water barrier coating on finished side.
 - a. Conventional cement-board and green-board products are not acceptable.
 2. Thickness: 1/2 IN .
 3. Mold-resistance score: 10 per ASTM D3273.
 4. Base Product: DensShield Tile Backer by Georgia Pacific.
 - a. Include Level 5 finish at non-tiled portions.
 5. Optional Products:
 - a. Fiberock Interior Panel, Aqua-Tough by USG.
 - b. GlasRoc Tile Backer by Certaineed.
 6. TBB wallboard scheduled in Fire Rated Walls:
 - a. Approved fire resistive products with comparable moisture-resistance.
 - b. Base Product: DensShield Fireguard Tile Backer by Georgia Pacific.
- V. Accessories:
1. Fasteners: Corrosion resistant type required by board manufacturer for securing units.
 2. Joint Reinforcement Tape: As recommended by board manufacturer.
 3. Vapor Retarder:
 - a. Comply with ASTM D4397.
 - b. Thickness and maximum permeance rating:
 - 1) 4.0 mils, 0.19 perms .
 - c. Vapor retarder tape:
 - 1) For sealing joints and penetrations in vapor retarder.
 - 2) Pressure-sensitive type recommended by manufacturer.
- W. Reinforcing Mesh:
1. Size: 2 IN x 2 IN weave of 16/16 wire size.
 2. Fabric: Welded, galvanized.
- X. Joint Sealant:
1. Two component polyurethane sealant, ASTM C920, Type M, self-leveling, for horizontal joints, Type II, non-sag, for vertical joints as specified in Section 07 92 16.
 2. Color: Match grout.
 3. Sealant:
 - a. Chemically compatible with tile, mortar, and grout.
 - b. Physically and chemically capable to withstand local environmental conditions.
- Y. Joint Backing:

1. Closed cell foam polyethylene.
- Z. Prefabricated Sealant Joint:
1. Prefabricated aluminum joint with two part, chemically curing non-sag polyurethane sealant.
 2. Height as required by tile by 8 FT lengths.
 3. Aluminum: Clear anodized.
 4. Sealant: Match grout.
 5. PolyBlend Ceramic Tile Caulk by Custom Building Products or Mapesil T by Mapei.
- AA. Expansion and Control Joints for Thin-set and/or Thickset Applications:
1. Main Material:
 - a. Solid brass
 - b. Roll-formed stainless steel
 - c. Extruded aluminum
 - d. Extruded rigid PVC
 2. Profiles joined by soft CPE movement joint material, with integral perforated anchoring legs for setting joint into setting bed.
 3. Height: As required to suit application.
 4. Color: As selected by Architect.
 5. Schlüter - DILEX-KS
- BB. Corner Joints:
1. Extruded rigid coved wall corner, with integral perforated anchoring legs.
 2. Floor leg height: As required to suit application.
 3. Wall leg height: As required to suit application.
 4. Material: Aluminum.
 5. Schlüter - DILEX-HK
- CC. Corner Movement Joints:
1. Roll formed stainless steel inside corner, cove-shaped 2-piece joint profile joined by soft thermoplastic rubber movement zone and with perforated anchoring.
 2. Floor leg height: As required to suit application.
 3. Wall leg height: As required to suit application.
 4. Material: Aluminum.
 5. Acceptable Products:
 - a. Schlüter - DILEX-HKW
- DD. Decorative Wall Corner Trim:
1. Aluminum, solid brass, or stainless steel, wide profile, decorative outside wall corner trim, with integral perforated anchoring leg.
 2. Height: As required to suit application.
 3. Material:
 - a. Aluminum.
 4. Acceptable Products:
 - 1) Schlüter – RONDEC
- EE. Edge and Transition Strips:
1. Solid brass, extruded aluminum, or roll-formed stainless steel edge strips, 1/8 IN wide at top edge; height as indicated.
 2. Height: As required to suit application.
 3. Finish:
 - a. Brass.
 4. Schlüter - SCHIENE M
- FF. Stair Nosings:
1. Extruded thermoplastic rubber, heavy-traffic use, slip-resistant stair nosing set into extruded [aluminum support section] [stainless steel support section] with integral perforated

anchoring leg for setting the assembly into the setting material; width, height, and color as indicated.

GG. Setting Buttons:

1. Plastic buttons of thickness required for joint size indicated to maintain uniform joint width.

HH. Grout Release Agents:

1. Protect exposed surfaces of tile against adherence of mortar and grout.
2. Compatible with tile, mortar and grout.
3. Petroleum-Paraffin Wax:
 - a. Fully refined, tasteless, odorless, containing at least 0.5 PCT oil with a melting point of 120 to 140 DEGF per ASTM D87.
4. Manufacturer's standard proprietary liquid coating specially formulated and recommended for use as temporary protective coating for tile.

II. Penetrating Sealer:

1. Water-based sealer capable of repelling dirt, oil and stains from tile and grout surfaces.
2. Low odor, pH-neutral and non-abrasive.
3. Vapor open, non-film forming.
4. Stain Resistance per Ceramic Tile Institute CTI-072: Excellent.
5. Compatible with tile types scheduled.
6. Aqua Mix Sealer's Choice Gold Penetrating Sealer by Custom Building Products or Ultracare Penetrating Plus Stone, Tile, & Grout Sealer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.
- B. Verify concrete floor surfaces are suitable for tile installation.
 1. Firm, dry, clean and free of oily or waxy films, mortar and soil.
 2. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile installed.
 3. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.
 4. Verify limits of moisture and alkalinity are within levels tolerated by Tile manufacturer and setting materials manufacturer.
 5. Verify areas to receive tile installed by thin bed method have wood float finish, are true within 1/4 IN in 10 FT and are pitched to drains where required.
- C. Correct unsatisfactory conditions and proceed with installation only after substrate deficiencies have been corrected and surfaces are acceptable.
- D. Start of work constitutes acceptance of surfaces, and waiver of claim that surfaces are unsuitable.

3.2 PREPARATION

- A. Prepare surfaces in accordance with manufacturers' instructions for setting materials or additives used.
- B. Acid based cleaners are not permitted.
- C. Completely remove curing compounds or other substances that would interfere with proper bond of setting materials.
- D. Do not seal substrate unless required by manufacturer.
- E. Prime substrate when required by manufacturer.
- F. Factory Blending:

1. Blend tile in factory and package accordingly so tile are uniform in color range as those throughout packaging and match approved samples.
 2. If not factory blended, return to manufacturer or blend tiles at project site before installing.
- G. Field Applied Grout Release product, Temporary Protective Coating:
1. Petroleum paraffin wax or proprietary grout release formulation.
 2. Provide where specified or required to prevent adhesion or staining of exposed tile surfaces by grout.
 3. Precoat exposed surfaces of tile with continuous film of temporary protective coating.
 4. Do not coat unexposed tile surfaces.

3.3 INSTALLATION

- A. Membrane:
1. Install membrane with products or methods approved in writing by membrane manufacturer.
 2. Flash membrane to cure prior to setting tile.
 3. Do not allow construction traffic on membrane.
- B. Waterproofing:
1. Install waterproofing in accordance with manufacturer's instructions.
 2. Return waterproofing vertically at adjacent walls in accordance with manufacturer details, to minimum height of 4 IN .
 3. Flood test waterproof membranes after fully cured.
 4. Field Quality Control water test when required.
- C. Tile Installation, General:
1. Install tile materials in accordance with ANSI A137.1-2012, ANSI and TCNA specifications, and TCNA Handbook for Ceramic Tile Installation, with exception of more stringent requirements of manufacturer or these Specifications.
 2. Cut and fit tile tight to penetrations, protrusions and vertical interruptions and seal.
 - a. See Section 07 92 16.
 3. Form corners and bases neatly.
 4. Install ceramic cove base in accordance with TCNA "Flush" style.
 - a. TCNA "Thin-Lip" style installation is not allowed.
 5. Work tile joints uniform in width, subject to variance in tolerance allowed in tile size.
 6. Ensure nominal grout centerlines are straight.
 7. Make joint watertight, without voids, cracks, excess mortar, or grout.
 8. Prepare surface, fit, set, bond, grout and clean in accordance with applicable requirements of ANSI standards and Tile Council of North America.
 9. Where accent tiles are of a lesser thickness than surrounding field tiles, increase bedding thickness as required to achieve flush alignment between finished faces of accent tiles and adjacent field tiles.
- D. Layout:
1. Lay out work to pattern indicated so full tile or joint is centered on each wall.
 - a. Lay out tile to minimize cutting and to avoid tile less than half size.
 2. Continue pattern through openings.
 3. For heights stated in feet and inches, use courses of full tile to produce nearest attainable heights without cutting tile.
 4. Align joints in tile in both directions.
 5. Align joints between wall, floor and base tile.
 6. Make joints between sheets of tile same width as joints within sheet.
 7. File edges of cut tile smooth and even.
 8. Cut and fit tile at penetrations through tile.
 9. Grind edges of tile abutting built-in items.
 10. Fit tile at outlets, piping and other penetrations so plates, collars, or covers overlap tile.
 11. Extend tile work into recesses and under or behind equipment and fixtures, to form complete covering without interruption, except as otherwise indicated.

12. Accurately form intersections and returns.
 13. Form internal corners and external corners square.
- E. Thin Set Method, Floors and Walls:
1. Apply mortar or adhesive with notched trowel using scraping motion to work material into contact with surface to be covered.
 - a. Maintain 90 PCT coverage on back of tile and fully bed corners.
 2. Apply only as much mortar or adhesive as can be covered within time recommended by mortar or adhesive manufacturer.
 3. When installing large tiles, ceramics or mosaics, trowel small quantity of mortar or adhesive onto back of each tile or sheet of tiles.
 4. Set tiles in place and level surface of tile.
 5. Align tile to show uniform joints and set until firm.
 6. Clean excess mortar or adhesive from surface of tile while mortar is fresh.
 7. Sound tile after setting. Replace hollow sounding tiles.
- F. Grouting:
1. Allow tiles to set before grouting.
 2. Install in accordance with grout manufacturer's recommendations and ANSI A108.10.
 3. Clean excess grout from surface as work progresses.
 4. Cure after grouting by covering with kraft or construction paper for 72 HRS.
 5. Install sealant in vertical wall joints at interior corners.
- G. Movement Joints:
1. Comply with TCNA EJ171.
 2. Coordinate with Drawings.
 3. Locate movement joints where indicated.
 4. Where not indicated, locate movement joints directly over following substrate conditions:
 - a. Changes in substrate material.
 - b. Over control joints, expansion joints and seismic joints in substrate.
 - c. Over construction joints in substrate.
 - d. At junctures where floors meet walls and other restraining elements such as curbs, columns, bases, and wall corners.
 - e. At other locations recommended by TCNA EJ171 Movement Joint requirements.
 5. Locate additional movement joints per following:
 - a. Exterior: 12 FT .
 - b. Interior: 25 FT .
 - c. Interior, where exposed to direct sunlight or moisture: 12 FT .
 6. Joint Width: In accordance with TCNA EJ171.
 7. Rake or cut control joints through setting bed to supporting slab or structure.
 8. Maintain joints free of mortar.
 9. Fill joints with self-leveling polyurethane sealant and backing material.
 - a. See Section 07 92 16.
 10. Provide sealant material at items penetrating tile work, unless otherwise indicated.
 11. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
 - a. Seal tile to outlets, piping and other penetrations.
 12. Fill joints around water closets with white silicone sealant.
 - a. See Section 07 92 16.
 13. Use manufacturer's expansion joint flashing when covering expansion joints with waterproof or crack isolation membranes.
- H. Penetrating Sealer:
1. Surface Preparation:
 - a. Verify tile and grout are fully cured.
 - b. Verify surfaces are dry, clean and free of waxes, sealers and finishes.
 - c. Test product in obscure area to produce desirable results.
 2. Apply Penetrating Sealer to tiled surfaces, unless otherwise noted.
 - a. Application of penetrating sealer is not necessary where epoxy grouts are used.

- b. Apply in accordance with Manufacturer's instructions.
- 3. Test after 2 HRS by applying drops of water on surface.
 - a. If water penetrates, apply an additional coat of sealer.
- 4. Remove visible residue within 60 minutes after application.

3.4 CLEANING

- A. Perform cleaning while mortar is fresh before hardening on surfaces.
- B. Wash tile diagonally across joints.
- C. Polish with clean dry cloth.
- D. Remove grout haze following recommendation of mortar additive manufacturer.
- E. Remove residual waxes or grout release agent, temporary protective coatings, by method recommended by coating manufacturer.
 - 1. Confirm acceptability with brick and grout manufacturer.
 - 2. Trap and remove coating to prevent it from clogging floor drains.

3.5 PROTECTION AND REPAIR

- A. Prohibit traffic on floor finish for 72 HRS after installation.
- B. Where temporary use of new floors is unavoidable, supply large, flat boards or plywood panels for walkways over kraft paper.
- C. Replace broken, cracked, chipped, stained, or damaged tile.

	1/2-3/4 IN 13-19 MM	

END OF SECTION

SECTION 09 65 36
STATIC DISSIPATIVE RESILIENT TILE FLOORING (SDRT)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Static Dissipative Resilient Tile Flooring (SDRT), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Manufacturer authorized or approved.
- B. Provide static dissipative adhesive, grounding strips, flooring and polish by one manufacturer.
- C. ASTM International (ASTM):
 - 1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - 2. ASTM F150 Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring
 - 3. ASTM E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - 4. ASTM E662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
 - 5. ASTM F970 Standard Test Method for Static Load Limit
- D. American National Standards Institute (ANSI):
 - 1. ANSI/ESD S7.1 Resistive Characterization of Materials - Floor Materials
 - 2. ANSI/ESD STM 97.2 Floor Materials and Footwear - Voltage Measurement in Combination with a Person
- E. National Fire Protection Association (NFPA):
 - 1. NFPA 101 Life Safety Code
 - 2. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
 - 3. NFPA 258 Recommended Practice for Determining Smoke Generation of Solid Materials
 - 4. NFPA 270 Standard Test Method for Measurement of Smoke Obscuration Using a Conical Radiant Source in a Single Closed Chamber
 - 5. NFPA 99 Standard for Health Care Facilities

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Coving details.
- B. Product Data:
 - 1. Certification of installer qualifications.
- C. Samples:
 - 1. Three samples of each material specified in Drawing I-001 Interior Notes and Finish Legend.
 - 2. Full range of colors for Architect selection.
- D. Project Information:
 - 1. Field test report.
 - 2. Installation instructions.

3. Manufacturer's certification of flooring tests by independent laboratory and compliant with required fire tests.
 4. Statements of compliance with quality assurance requirements.
- E. Contract Closeout Information:
1. Warranty.
 2. Maintenance data:
 - a. See Section 01 78 23.

1.4 WARRANTY

- A. Provide written warranty signed jointly by Manufacturer, Installer, and Contractor:
1. Warrant flooring to remain free of buckling, cracking, lifting, warping, shrinkage, change in color, loosening, disintegration, exuding of adhesives through joints to surfaces, or other defects for a period of five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Static Dissipative Resilient Tile (SDRT):
1. Base:
 - a. Armstrong World Industries, Inc.
 2. Optional:
 - a. Forbo Industries
 - b. Polyflor, Ltd.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Static Dissipative Resilient Tile (SDRT):
1. SDT Excelon Tile Flooring by Armstrong World Industries, Inc.
 2. Static load limit: 75 PSI.
 3. Dynamic coefficient of friction: 0.42 minimum.
 4. Comply with requirements of ASTM F1066, including but not limited to:
 - a. Class 2 - Through-Pattern.
 - b. Dimensional tolerance.
 - c. Square-ness of manufacture.
 - d. Resistance to indentation.
 - e. Impact resistance.
 - f. Dimensional stability.
 - g. Resistance to chemicals.
 - h. Resistance to heat.
 5. Size: 12 x 12 x 1/8 IN nominal.
 6. Critical radiant flux: Class I, 0.45 W/cm² minimum.
 7. Smoke developed: 450 or less.
 8. Flame spread: 75 maximum.
 9. Electrical resistance: 1,000,000 to 1,000,000,000 ohms.
 10. Static generation:
 - a. <10 volts at 40 PCT relative humidity with ESD shoes
 - b. <100 volts at 12 PCT relative humidity with ESD shoes.
 11. Static decay: <0.5 seconds from 5,000 volts to 0.0 volts.
 12. Color and pattern:
 - a. See Interior Notes and Finish Legend, Section 09 06 00.
- B. Static Dissipative Adhesive:
1. S-202 Static Dissipative Tile Adhesive by Armstrong World Industries, Inc.
- C. Static Dissipative Grounding Strips:

1. Manufacturer's standard copper ground connection strips.
- D. Static Dissipative Floor Polish:
1. S-392 SDT Polish by Armstrong World Industries, Inc.
- E. Leveling Compound:
1. Type recommended by tile manufacturer.
- F. Wall Base:
1. Specified in Section 09 65 19.
- G. Joint Sealant:
1. Provide at top of wall base or integral cove cap.
 2. Plastic filler as recommended by SDRT flooring manufacturer.
- H. Accessories:
1. Transition strips and reducing strips tapered to meet abutting materials.
 2. Threshold of thickness and width as shown on drawings.
 3. Resilient edge strips, width as shown on drawings with gauge equal to flooring.
 - a. Tapered edge.
 - b. Color to match flooring.
 4. Metal edge strip:
 - a. Concealed anchorage: Butt-type metal edge strips.
 - b. Material: Extruded aluminum, mill finish.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces for defects, irregularities and conditions under which flooring is to be installed.
- B. Verify substrates are dry, clean, smooth and free of paint, varnish, solvents, wax, oils or foreign matter.
- C. Repair cracks and other surface defects.
- D. Verify floors are level or meet indicated slope.
- E. Do not proceed with installation until unsatisfactory conditions have been corrected.
- F. Installation constitutes acceptance of substrate and responsibility for performance.

3.2 PREPARATION

- A. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.
- B. Prepare substrate in accordance with manufacturer's instructions.
- C. Fill construction joints and other non-moving joints with product approved by manufacturer of flooring system.
- D. Where Static Dissipative Resilient Tile Flooring abuts thicker finish flooring materials, feather leveling compound for approximately 12 IN for each 1/8 IN of rise to align finished surfaces.
- E. Coordinate leveling with vapor emission control system provider.

3.3 INSTALLATION

- A. Provide installation under direct supervision of manufacturer's representative.
- B. Coordinate installation with other floor, wall and ceiling work.
 1. Do not start work until related work of other trades in same area has been completed.
- C. Mix and apply adhesive as recommended by manufacturer.

- D. Install continuous copper grounding strips set in adhesive where recommended by manufacturer for maximum static dissipative performance.
 - 1. Coordinate location of leads with equipment grounding conductor interface provided in Division 26.
- E. Install each tile fully bonded to floor and flush, tight and in true alignment with adjacent tiles, for finished surface free from imperfections.
 - 1. Fit flooring neatly into breaks and recesses, under casework, against walls, around pipes, and other installations and obstructions.
 - 2. Lay out tile in a manner to avoid tiles of less than 1/2 size.
 - 3. Install edging strips where edge of floor covering is exposed.
 - a. Install accent strips in door openings, located directly under door when door is in closed position.
- F. Install tile flooring and base as scheduled for rooms under and behind equipment.
- G. Roll flooring using smooth roller.

3.4 FIELD TESTING

- A. After installation, provide electrical resistance testing of completed floor under observation of Architect.
 - 1. Performed by factory representative in accordance with ANSI/ASTM F150.
 - 2. Perform one test per room per 2500 SQFT.

3.5 CLEANING

- A. Clean floors as recommended by manufacturer just prior to occupancy.

3.6 PROTECTION

- A. Provide non-staining protection for finished flooring until building is ready for occupancy.

END OF SECTION

SECTION 09 67 14
SEAMLESS URETHANE FLOORING (SUF)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Seamless Urethane Flooring (SUF) in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Certified by manufacturer of flooring, with a minimum of seven (7) years experience and minimum of ten (10) completed similar sized projects.
- B. Materials recommended and manufactured by single supplier to ensure compatibility and proper chemical and mechanical bond.
- C. ASTM International (ASTM):
 - 1. ASTM D638 Standard Test Method for Tensile Properties of Plastics
 - 2. ASTM D2240 Standard Test Method for Rubber Property - Durometer Hardness
 - 3. ASTM D4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
 - 4. ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
 - 5. ASTM E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
- D. Mockup:
 - 1. Prior to commencing work, install a 100 SQ FT sample on the job of approved color and texture and will serve as standard for project.

1.3 SUBMITTALS

- A. Samples:
 - 1. Three samples 12 IN square of each material specified in Drawing I-001 Interior Notes and Finish Legend.
 - 2. Samples for review of color and texture .
- B. Contract Closeout Information:
 - 1. Warranty.
 - 2. Maintenance data:
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Seamless Urethane Flooring (SUF):
 - 1. Base:
 - a. Stonhard
 - 2. Optional:
 - a. Crossfield Products, Dex-O-TEX.
 - b. Dudick Inc.
 - c. Dur-A-Flex.
 - d. Tnemec

- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Seamless Urethane Flooring System:
 - 1. Primer, textured, trowel-applied polyurethane undercoat, broadcast texture aggregates and seal coat.
 - 2. Base Product: Stonshield URT by Stonhard.
 - 3. Color: As indicated in Section 09 06 10 Room Finish and Color Schedule.
- B. Primer:
 - 1. Two-component penetrating urethane primer.
- C. Undercoat:
 - 1. Free flowing, solvent free urethane resin.
- D. Texture Aggregate:
 - 1. Quartz of color selected.
- E. Seal Coat:
 - 1. Chemical and UV resistant, two-part polyaspartic resin urethane sealer.
- F. Performance Characteristics:
 - 1. Tensile Strength: Minimum 4,000 PSI.
 - 2. Hardness: Shore D; 60
 - 3. Abrasion Resistance: CS-17 Wheel; maximum 0.10 g weight loss.
 - 4. Impact Resistance: 160 IN/LBS; no cracking, chipping or delamination.
 - 5. Bond Strength: Minimum 300 PSI and 100 PCT concrete failure
 - 6. Flammability: Class I.
 - 7. Coefficient of Friction: >1.0.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces for defects, irregularities and conditions under which flooring is to be installed.
- B. Verify substrates are free of materials that may affect adhesion.
- C. Identify cracks and other surface defects which need repair prior to application of floor system.
- D. Inspect substrate for markers, paint and similar materials used for layout by others and take remedial action as necessary to remove layout line work to prevent bleed-through.
- E. Verify floors are level or meet indicated slope.
- F. Do not proceed with installation until unsatisfactory conditions have been corrected.
- G. Installation indicates acceptance of substrates and responsibility for performance.

3.2 PREPARATION

- A. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.
- B. Prepare substrate in accordance with manufacturer's instructions.
- C. Fill construction joints and other non-moving joints with elastomeric sealant approved by manufacturer.
- D. If necessary, mask or cover adjacent surfaces or both, including fixtures, cabinetwork, equipment and similar items by suitable means.

3.3 INSTALLATION

- A. Apply flooring in accordance with manufacturer's printed instruction, employing qualified and experienced lead mechanic and using equipment specifically designed for this purpose.
- B. Install integral cove base to height of 4 IN with 1 IN radius cove.
 - 1. Install base on painted wall surface.
 - 2. Caulk top edge of base to seal.
- C. Finish work to match approved samples; uniform in thickness, sheen, color, pattern, and texture; and be free from defects detrimental to performance.

3.4 PROTECTION

- A. Provide non-staining protection for finished flooring until building is ready for occupancy.

3.5 CLEANING

- A. Clean floors as recommended by manufacturer just prior to occupancy.

END OF SECTION

SECTION 09 67 81
CONCRETE FLOOR SEALER (CFS)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Floor Sealer (CFS-ND), as indicated, in accordance with provisions of the Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications:
 - 1. Licensee of manufacturer, or approved in writing.
- B. ASTM International (ASTM):
 - 1. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - 2. ASTM C1315 Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.3 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Maintenance data:
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Concrete Floor Sealer – Normal Duty (CFS-ND):
 - 1. Base:
 - a. L&M Construction Chemicals.
 - 2. Optional:
 - a. Dayton Superior
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Concrete Floor Sealer – Normal Duty (CFS-ND):
 - 1. Water-based, low VOC, acrylic copolymer solutions that cure, seal and dustproof concrete with minimal yellowing.
 - 2. Conform to ASTM C1315, Type I, Class B.
 - 3. VOC compliant.
 - 4. Meet local air quality regulations.
 - 5. Minimum Solids Content: 30 PCT by volume.
 - 6. Primer: As recommended by manufacturer.
 - 7. Base Product:
 - a. Dress & Seal WB 30 by L&M.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Cure concrete minimum of 28 days.

- B. Verify concrete is free of fins, ridges, voids and suitable to accept installation.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Verify curing agents used are compatible with coating system or completely remove.
- B. Remove dirt, dust, oil, grease, asphalt and foreign matter.
- C. Patch holes or voids.
- D. Rout out cracks exceeding 1/16 IN wide and caulk.
- E. Caulk non-moving joints up to 1 IN wide with suitable backer and sealant.
- F. Do not caulk or overcoat joints where movement exceeds 25 PCT or joints over 1 IN wide.

3.3 INSTALLATION

- A. Do not apply to surfaces scheduled to receive cementitious coatings or toppings, such as concrete, terrazzo, polyester or epoxy coatings.
- B. Apply in accordance with manufacturer's recommendations; minimum 2 coats.
 - 1. Apply first coat at not over 400 SQFT/GAL.
 - 2. Apply subsequent coat not over 400 SQFT/GAL.
- C. Allow no traffic on sealed surface for 72 HRS after application.

3.4 PATCHING AND CLEANING

- A. Patch areas which fail to match adjacent work.
- B. Broom clean surface after completion of work.

END OF SECTION

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Exterior Painting, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Definitions:
 - 1. "Paint" and "painting" refer to applied coatings.
 - 2. Mechanical work and equipment: Work included in Mechanical Specification Divisions.
 - 3. Electrical work and equipment: Work included in Electrical Specification Divisions.
- B. Work Included:
 - 1. Exterior surfaces scheduled to be painted, unless indicated to be painted under other sections.
 - 2. Exposed exterior and on-site concrete masonry unit surfaces, including areaway walls, backside faces of parapets, screen walls, and retaining walls.
 - 3. Mechanical and electrical work:
 - a. Exterior equipment and items not completely factory finished.
- C. Surfaces not to be painted:
 - 1. Colored, split-face, patterned, ground-face, glazed, and other concrete masonry units with integral architectural finish.
 - 2. Anodized aluminum, stainless steel, chromium plate, glass, copper, bronze or similar materials.
 - 3. Moving parts of valves, operating units, mechanical and electrical parts, such as valve and damper operators, sending devices, motor and fan shafts.
 - 4. Code labels, such as UL, FM that are Mylar or flat, non-embossed, plates.
 - a. Embossed plates and labels stamped into frames will be painted, label and information on label to be readily visible and convenient for identification by authority having jurisdiction.
 - 5. Equipment identification or rating plates.
 - 6. Items having complete factory finish with exception of:
 - a. Exterior mechanical equipment.
 - b. Exterior electrical equipment.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's data for each paint type to be applied indicating conformance to specifications.
- B. Samples:
 - 1. Manufacturer's full palette of colors for selection by Architect.
 - 2. Provide three 8 1/2 IN x 11 IN samples of each color and finish selected.
 - 3. MPI Gloss samples.
- C. Contract Closeout Information:
 - 1. Maintenance data:
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide paint as product of one manufacturer as far as possible.
- B. Paint, stain, and coating systems listed are Sherwin Williams unless noted otherwise.
 - 1. Use comparable performance and aesthetic requirements for Paints by Optional manufacturers.
- C. Paints:
 - 1. Base:
 - a. Sherwin-Williams.
 - 2. Optional:
 - a. Benjamin Moore.
 - b. PPG Paints.
 - c. Pratt & Lambert.
 - d. Tnemec.
- D. Stains:
 - 1. Base:
 - a. Sherwin-Williams.
 - 2. Optional:
 - a. Benjamin Moore.
 - b. PPG Paints.
 - c. Pratt & Lambert.
- E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Paints and Stain Systems:
 - 1. Paint, stain, and coating systems listed are Sherwin-Williams unless noted otherwise.
 - 2. Colors:
 - a. As selected by Architect from manufacturer's full palate and as indicated in Section 20 05 53.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces for defects and correct to prevent unsatisfactory results.
- B. Verify compatibility of intermediate and topcoat finishes applied over surfaces primed by others.
- C. Commencement of work constitutes acceptance of surfaces and responsibility for performance.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Clean substrates of substances that could affect appearance or impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
 - 2. Remove mildew and neutralize surface.
- C. Prior to painting, test surfaces with moisture meter.
 - 1. Paint when moisture is within paint manufacturer's acceptable limits.
- D. Wood:
 - 1. Immediately before applying finish:

- a. Sand surfaces with 180 grit or finer sandpaper, as necessary to accomplish the following:
 - 1) Smooth surface texture.
 - 2) Prepare grain to receive finish.
 - b. Remove dust.
 - 2. Opaque Finishes:
 - a. After priming coat has dried, seal knots, pitch and resinous sapwood.
 - 3. Stained and Clear Finishes:
 - a. Treat wood with compatible wash-coat prior to stain application.
 - b. Putty nail holes and minor defects, to match wood color.
- E. Ferrous Metal and Hollow Metal:
 - 1. Follow requirements of SSPC SP1 and SP3.
 - a. Except where higher prep levels are indicated.
 - 2. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.
 - 3. Touch up damaged shop coats.
 - 4. For surfaces with touched up shop coat, omit first coat.
 - 5. Hollow metal frame joints at intersections of Rabbets, Stops, and Soffit Joints:
 - a. Neatly fill corner seam with painter's caulk (in field) prior to painting.
- F. Galvanized Metal and Non-anodized Aluminum:
 - 1. Follow requirements of SSPC SP1.
 - 2. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.
- G. Gypsum Wallboard:
 - 1. Repair minor irregularities left by finishers.
 - 2. Exercise care to avoid raising nap of paper.
 - 3. Apply prime coat.
 - 4. Notify gypsum wallboard finisher to repair and refinish areas which indicate defects after application of primer.
 - 5. Re-prime refinished areas.
- H. Concrete and Masonry:
 - 1. Repair minor defects.
 - 2. Remove oil from concrete by washing with xylol.
 - 3. Eliminate efflorescence before painting.
- I. Block Filler:
 - 1. Apply masonry to fill pinholes and minor surface defects, and to prime surface for topcoat.
 - 2. Apply by brush, roller or sprayer.
 - a. Where spray-applied: Back-roll with roller or squeegee.
 - 3. Minimum Nominal Thickness: 10 MIL DFT.
 - a. Comply with manufacturer's recommended coverage rates for conditions encountered.
 - 4. Provide complete cover with recommended coating system.
- J. Obtain architect's approval of finish for surfaces to receive high build glazed coatings.

3.3 APPLICATION

- A. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items, or provide ample in place protection.
- B. Touch up abraded areas of shop prime coats, suction or hot spots in plaster, gypsum wallboard, concrete block, and concrete before painting.
- C. Provide coverage to hide.
 - 1. Evenly spread and smoothly flow on for full, smooth cover.
 - 2. Apply additional coats where undercoats show until paint film is of uniform finish and color.

- D. Back prime wood trim with penetrating sealer.
- E. Apply additional coats in accordance with manufacturer's instructions.
- F. Finish closets and semi-exposed surfaces to match nearest adjoining surfaces.
 - 1. Include surfaces behind grills.
- G. Upon completion of painting, replace removed items and remove protection.
- H. Finish colors not indicated shall be selected by Architect from paint manufacturer's standard colors.

3.4 PROTECTION AND CLEANUP

- A. Provide WET PAINT signs.
- B. Protect adjacent work from damage by painting and finishing work.
- C. Remove temporary protective wrappings, after completion of operations.
- D. Clean, repair or replace, and repaint damaged work.

3.5 EXTERIOR PAINT SYSTEMS

- A. Concrete, Concrete Block and GFRC:
 - 1. Latex, Gloss Level 4, Satin:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Concrete and Masonry Primer.
 - 2) Topcoat: Duration Exterior Acrylic Latex, Satin.
 - 2. Elastomeric, smooth:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Concrete and Masonry Primer.
 - 2) Intermediate coat: ConFlex XL Elastomeric High Build Coating, Smooth.
 - 3) Topcoat: ConFlex XL Elastomeric High Build Coating, Smooth.
 - 3. Elastomeric, textured:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Concrete and Masonry Primer.
 - 2) Intermediate coat: ConFlex XL Elastomeric High Build Coating, Smooth.
 - 3) Topcoat: ConFlex XL Texture Elastomeric High Build Coating, Medium.
 - 4. Waterproof:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Block Surfacer, as needed, or Loxon Conditioner, as needed.
 - 2) Intermediate coat: Loxon XP Waterproofing System.
 - 3) Topcoat: Loxon XP Waterproofing System.
- B. Plaster:
 - 1. Elastomeric, smooth:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Concrete and Masonry Primer.
 - 2) Intermediate coat; ConFlex XL Elastomeric High Build Coating, Smooth.
 - 3) Topcoat: ConFlex XL Elastomeric High Build Coating, Smooth.
 - 2. Elastomeric, textured:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Concrete and Masonry Primer.
 - 2) Intermediate coat: ConFlex XL Elastomeric High Build Coating, Smooth.
 - 3) Topcoat: ConFlex XL Textured Elastomeric High Build Coating, Medium.
- C. Direct-Applied Exterior Finish System (DEFS) Soffits:
 - 1. Latex, Gloss Level 4, Satin:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Concrete and Masonry Primer.
 - 2) Intermediate coat: Duration Exterior Acrylic Latex, Satin.

- 3) Topcoat: Duration Exterior Acrylic Latex, Satin.
- D. Metal Doors, Frames and Miscellaneous Metals - Ferrous, Primed, Zinc-coated, and Aluminum:
 - 1. Water based urethane, Gloss Level 4, Satin:
 - a. Sherwin-Williams:
 - 1) Prime coat: Pro Industrial Pro-Cryl Universal Acrylic Primer.
 - 2) Intermediate coat: Waterbased Acrolon 100 Urethane, Satin.
 - 3) Topcoat: Acrolon 100 Urethane, Satin.
- E. Metal Stairs, Handrails, and Guardrails - Ferrous, Primed, Zinc-coated, and Aluminum:
 - 1. Water based urethane, Gloss Level 6, Gloss:
 - a. Sherwin-Williams:
 - 1) Prime coat: Pro Industrial Pro-Cryl Universal Acrylic Primer.
 - 2) Intermediate coat: Waterbased Acrolon 100 Urethane, Gloss.
 - 3) Topcoat: Waterbased Acrolon 100 Urethane, Gloss.
- F. Wood:
 - 1. Sherwin-Williams:
 - a. Latex, Gloss Level 4, Satin:
 - 1) Prime coat: Duration Exterior Acrylic Latex, Satin.
 - 2) Top coat: Duration Exterior Acrylic Latex, Satin.
- G. Stained Wood:
 - 1. Sherwin-Williams:
 - a. Vertical Elements:
 - 1) Prime coat: WoodScapes Exterior Polyurethane Semi-Transparent Stain.
 - 2) Topcoat: WoodScapes Exterior Polyurethane Semi-Transparent Stain.
 - b. Horizontal Elements:
 - 1) Prime coat: Duckback SuperDeck Exterior Oil Based Semi-Transparent Stain.
 - 2) Topcoat: Duckback SuperDeck Exterior Oil Based Semi-Transparent Stain.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Interior Painting, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Definitions:
 - 1. "Paint" and "painting" refer to applied coatings, except Section 09 96 59, Section 09 91 13, and Section 07 19 16.
 - 2. Finished room or space: Room or space indicated to receive a finish on Drawing I-001 Interior Notes & Finish Legend.
 - 3. Mechanical work: Work included in Mechanical Specification Divisions.
 - 4. Electrical work: Work included in Electrical Specification Divisions.
- B. Work Included:
 - 1. Interior surfaces in finished rooms or spaces, unless indicated not to be painted or indicated to be painted under other sections.
 - 2. Mechanical and electrical work:
 - a. Interior mechanical and electrical equipment not completely factory finished.
 - b. In finished rooms and spaces: Exposed ductwork, piping, insulated piping, conduit, busways, raceways, and associated accessories.
 - c. Where duct surfaces are visible through grilles or diffusers, paint visible surfaces of ducts flat black.
- C. Surfaces Not to be Painted:
 - 1. Anodized aluminum, stainless steel, chromium plate, glass, copper, bronze or similar materials.
 - 2. Moving parts of valves, operating units, motor and fan shafts, sending devices or mechanical and electrical parts such as valve and damper operators.
 - 3. Code labels, such as UL, FM that are mylar or flat, non-embossed plates.
 - a. Embossed plates and labels stamped into frames are to be painted.
 - b. Information shall be readily visible and convenient for identification by authority having jurisdiction.
 - 4. Equipment identification or rating plates.
- D. Factory Finishing of Wood Items Specified Elsewhere:
 - 1. Flush Wood Doors: See Section 08 14 16.
- E. ASTM International (ASTM):
 - 1. ASTM D2486 Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints.
 - 2. ASTM D2805 Standard Test Method for Hiding Power of Paints by Reflectometry.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's data for each paint system specified.
- B. Samples:
 - 1. Three 8 1/2 IN x 11 IN samples of each color and finish as noted in Drawing I-001 Interior Notes and Finish Legend.

2. Gloss samples.
- C. Contract Closeout Information:
 1. Maintenance data:
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Paints:
 1. Base:
 - a. Sherwin-Williams
 2. Optional:
 - a. Benjamin Moore
 - b. PPG Paints
 - c. Pratt & Lambert
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Manufacturers listed as noted in Drawing I-001 Interior Notes and Finish Legend are for color reference only.
- B. Provide paint products from one manufacturer as far as possible.
- C. Paints and Stain Systems:
 1. Paint, stain, and coating systems are by Sherwin-Williams unless noted otherwise.
- D. Colors:
 1. As noted in Drawing I-001 Interior Notes and Finish Legend and as indicated in Section 20 05 53.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces for defects and correct to prevent unsatisfactory results.
- B. Verify compatibility of intermediate and topcoat finishes applied over surfaces primed by others.
- C. Commencement of work constitutes acceptance of surfaces and responsibility for performance.
- D. Do not paint items having complete factory finish with exception of items noted in Drawing I-001 Interior Notes and Finish Legend and as indicated in Section 20 05 53.

3.2 PREPARATION

- A. Verify surfaces are clean, dry and free of foreign materials which will affect adhesion or appearance.
- B. Remove mildew and neutralize surface.
- C. Eliminate efflorescence before painting.
- D. Prior to painting, test surfaces with moisture meter.
 1. Paint when moisture is within paint manufacturer's acceptable limits.
- E. Wood:
 1. Sand surfaces receiving finish with 180-grit, or finer sand paper.
 - a. Remove fingerprints and marks.
 - b. Produce smooth texture.
 - c. Prepare grain to receive finish.

2. Remove dust.
 3. Opaque Finishes:
 - a. Back prime wood trim with penetrating sealer.
 - b. Seal knots, pitch and resinous sapwood.
 4. Stain and Clear Finishes:
 - a. Treat wood with compatible washcoat prior to stain application.
 - b. Putty nail holes and minor defects, to match finish wood color.
- F. Ferrous Metal and Hollow Metal:
1. Follow requirements of SSPC SP1 and SP3 except where higher preparation levels are indicated.
 2. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.
 3. Touch up damaged shop coats.
 4. Caulk hollow metal frame joints, corner seams, intersections of rabbets, stops, and soffit joints prior to painting.
- G. Galvanized Metal and Non-anodized Aluminum:
1. Follow requirements of SSPC SP1 except where higher preparation levels are indicated.
 2. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.
- H. Gypsum Wallboard:
1. Repair minor irregularities.
 2. Avoid raising nap of paper.
 3. Apply prime coat.
 4. Correct areas showing defects after application of primer.
 5. Re-prime refinished areas.
- I. Concrete and Masonry:
1. Repair minor defects.
 2. Remove oil from concrete.
 3. Block Filler:
 4. Comply with manufacturer's recommended coverage rates for conditions encountered.
 5. Provide complete cover with recommended coating system.
 6. Fill pinholes and minor surface defects.
 7. Apply by brush, roller or sprayer.
 - 1) Back-roll spray applied filler with roller or squeegee.

3.3 APPLICATION

- A. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items, or provide ample in place protection.
- B. Touch up abraded areas of shop prime coats, suction or hot spots in plaster, gypsum wallboard, concrete block, and concrete before painting.
- C. Provide coverage to hide.
 1. Evenly spread and smoothly flow on for full, smooth cover.
 2. Apply additional coats where undercoats show until paint film is of uniform finish and color.
- D. Back prime wood trim with penetrating sealer.
- E. Apply additional coats in accordance with manufacturer's instructions.
- F. Finish closets and semi-exposed surfaces to match nearest adjoining surfaces.
 1. Include surfaces behind grills.
- G. Upon completion of painting, replace removed items and remove protection.

3.4 PROTECTION AND CLEANUP

- A. Provide WET PAINT signs.
- B. Protect adjacent work from damage by painting and finishing work.
- C. Remove temporary protective wrappings, after completion of operations.
- D. Clean, repair or replace, and repaint damaged work.

3.5 INTERIOR PAINT SYSTEMS

- A. Concrete and Concrete Masonry Walls:
 - 1. Latex (PNTLO), Gloss Level 3, Eggshell:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Concrete & Masonry Primer.
 - 2) Intermediate coat: Harmony Interior Latex Eg-Shel.
 - 3) Topcoat: Harmony Interior Latex Eg-Shel.
 - 2. Latex (PNTL), Gloss Level 2, Velvet:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Concrete & Masonry Primer.
 - 2) Intermediate coat: ProMar 200 Zero VOC Interior Latex Low Sheen.
 - 3) Topcoat: ProMar 200 Zero VOC Interior Latex Low Sheen.
 - 3. Stain Resistant (PNTSR), Gloss Level 4, Satin:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Concrete & Masonry Primer.
 - 2) Intermediate coat: Duration Home Interior Latex Satin.
 - 3) Topcoat: Duration Home Interior Latex Satin.
 - 4. Epoxy (PNTE), Gloss Level 6, Gloss:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Concrete & Masonry Primer.
 - 2) Intermediate coat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.
 - 3) Topcoat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.
- B. Gypsum Wallboard and Plaster Surfaces, Walls:
 - 1. Latex (PNTL), Gloss Level 3, Eggshell:
 - a. Sherwin-Williams:
 - 1) Prime coat: Harmony Interior Latex Primer.
 - 2) Intermediate coat: Harmony Interior Latex Eg-Shel.
 - 3) Topcoat: Harmony Interior Latex Eg-Shel.
 - 2. Low Odor (PNTLO), Gloss Level 3, Eggshell:
 - a. Sherwin-Williams:
 - 1) Prime coat: Harmony Interior Latex Primer.
 - 2) Intermediate coat: Harmony Interior Latex Eg-Shel.
 - 3) Topcoat: Harmony Interior Latex Eg-Shel.
 - 3. Stain Resistant (PNTSR), Gloss Level 4, Satin:
 - a. Sherwin-Williams:
 - 1) Prime coat: Harmony Interior Latex Primer.
 - 2) Intermediate coat: Duration Home Interior Latex Satin.
 - 3) Topcoat: Duration Home Interior Latex Satin.
 - 4. Epoxy (PNTE), Gloss Level 6, Gloss:
 - a. Sherwin-Williams:
 - 1) Prime coat: ProMar 200 Zero VOC Interior Latex Primer.
 - 2) Intermediate coat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.
 - 3) Topcoat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.
- C. Gypsum Wallboard - Ceilings and Soffits:
 - 1. Latex (PNTL), Gloss Level 1, Flat:
 - a. Sherwin-Williams:
 - 1) Prime coat: Harmony Interior Latex Primer.
 - 2) Intermediate coat: Harmony Interior Latex, Flat

- 3) Topcoat: Harmony Interior Latex, Flat.
 - 2. Low Odor (PNTLO), Gloss Level 1, Flat:
 - a. Sherwin-Williams:
 - 1) Prime coat: Harmony Interior Latex Primer.
 - 2) Intermediate coat: Harmony Interior Latex, Flat
 - 3) Topcoat: Harmony Interior Latex, Flat.
 - 3. Stain Resistant (PNTSR), Gloss Level 1, Flat:
 - a. Sherwin-Williams:
 - 1) Prime coat: Duration Home Interior Acrylic Latex.
 - 2) Intermediate coat: Duration Home Interior Acrylic Latex, Matte.
 - 3) Topcoat: Duration Home Interior Latex Matte, A96-100.
 - 4. Epoxy (PNTE), Gloss Level 3, Eggshell:
 - a. Sherwin-Williams:
 - 1) Prime coat: ProMar 200 Zero VOC Interior Latex Primer.
 - 2) Intermediate coat: Pro Industrial Water Based Catalyzed Epoxy, Eg-Shel.
 - 3) Topcoat: Pro Industrial Water Based Catalyzed Epoxy, Eg-Shel.
- D. Concrete Floors:
 - 1. Epoxy:
 - a. Sherwin-Williams:
 - 1) Prime coat: ArmorSeal Floor-Plex 7100 Water Based Epoxy Primer.
 - 2) Intermediate coat: ArmorSeal Floor-Plex 7100 Water Based Epoxy.
 - 3) Topcoat: ArmorSeal Floor-Plex 7100 Water Based Epoxy.
- E. Metal Stairs, Handrails, Guardrails and Miscellaneous Metals - Ferrous, Primed, Zinc-coated, and Aluminum:
 - 1. Waterborne epoxy, Gloss Level 6, Gloss:
 - a. Sherwin-Williams:
 - 1) Prime coat: Pro Industrial Pro-Cryl Universal Primer.
 - 2) Intermediate coat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.
 - 3) Topcoat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.
- F. Duct Surfaces Visible Through Grilles or Diffusers:
 - 1. Interior Latex Gloss Level 1 Flat:
 - a. Sherwin-Williams:
 - 1) Prime coat: ProMar 200 Zero VOC Interior Latex Primer.
 - 2) Topcoat: ProMar 200 Interior Latex, Flat.
 - a) Color: Black.
- G. Metal Doors and Frames:
 - 1. Waterborne epoxy, Gloss Level 5 Semi-gloss:
 - a. Sherwin-Williams:
 - 1) Prime coat: Pro Industrial Pro-Cryl Universal Primer.
 - 2) Intermediate coat: Pro Industrial Pre-Catalyzed Water Based Epoxy, Semi-Gloss.
 - 3) Topcoat: Pro Industrial Pre-Catalyzed Water Based Epoxy, Semi-Gloss.
- H. Painted Wood:
 - 1. Gloss Level 3, Eggshell:
 - a. Sherwin-Williams:
 - 1) Prime coat: Premium Wall & Wood Primer.
 - 2) Intermediate coat: ProMar 200 Zero VOC Interior Latex Eg-Shel.
 - 3) Topcoat: ProMar 200 Zero VOC Interior Latex Eg-Shel.
- I. Stained Wood:
 - 1. Stain:
 - a. Sherwin-Williams:
 - 1) Wood Classics 250 Interior Oil Stain.
 - 2. Clear intermediate and topcoats:
 - a. Premium quality.

- 1) Comply with current edition of AWI Architectural Woodwork Quality Standards.
- b. Sheen:
 - 1) Measured with 60 degree gloss meter.
 - 2) Satin: 31 to 45 points.
- c. Apply product in 2 coats.
 - 1) Lightly sand between coats.
- d. Polyurethane based Varnish:
 - 1) Sherwin-Williams:
 - a) Wood Classics Polyurethane Varnish.

END OF SECTION



DIVISION 10

SPECIALTIES



SECTION 10 14 23
SIGNS, SCHEDULE, AND GRAPHICS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services required for fabrication and installation of Signs as indicated in the drawings.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. 2010 ADA Standards for Accessible Design.
- B. American National Standards Institute, ICC/ANSI A117.1.

1.3 SUBMITTALS

- A. Samples:
 - 1. Color and font samples for approval.

1.4 WARRANTY

- A. Manufacturer shall warrant workmanship and materials for a period of two (2) years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- 1. Signs:
 - a. Base:
 - 1) Poblocki Sign Company.
 - b. Optional:
 - 1) Mohawk Sign Systems.
 - 2) ASI Sign Systems.
 - 3) Best Manufacturing Sign Systems.
 - 4) Innerface Architectural Signage.
 - 5) InPro Corporation.
- 2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Signs:
 - 1. Three-ply plastic laminate, 1-1/2 IN wide x length required for script.
 - 2. Nominal letter height: 3/4 IN .
 - 3. Letters and numbers: Raised 1/32 IN.
 - 4. Uppercase.
 - 5. Letter style: Sans serif.
 - 6. Color: As selected.
 - a. Characters: Dark.
 - b. Background: Light.
 - 7. Finish: Nonglare.
 - 8. Bevel edges.
 - 9. Letters shall conform to following proportional standard:
 - a. The font width of uppercase letter "O" shall be 55 PCT minimum and 110 PCT maximum height of uppercase letter "I".
 - b. Stroke thickness of uppercase letter "I" shall be 10 PCT minimum and 30 PCT maximum height of character.

10. Tactile lettering shall conform to following standards:
 - a. Character height measured vertically from the baseline of character shall be 5/8 IN minimum and 2 IN maximum based on height of uppercase letter "I".
 - b. Stroke thickness of uppercase letter "I" shall be 15 PCT maximum height of character.
 - c. The font width of uppercase letter "O" shall be 55 PCT minimum and 110 PCT maximum height of uppercase letter "I".
 - d. Maintain minimum 1/8 IN font separation between characters.
 11. Braille characters shall conform to the following standard:
 - a. Braille characters shall be separated from adjacent raised characters or symbols 1/2 IN.
 - b. Grade 2 Braille translation to be provided by identification device manufacturer.
- B. Directional and identification signs for communications systems: International symbols.
- C. Adhesive: 3M double-coated urethane foam tape.
1. 4032 for smooth surfaces.
 2. 4016 for rough surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location:
1. Single doors: Install on wall adjacent to latch side of door.
 2. Double doors: Install on nearest adjacent wall.
- B. Mount 5 FT above finish floor to centerline of sign.
- C. Mount using adhesive tape.

3.2 SCHEDULE

- A. Provide signs as follows:
1. "Mechanical Room" at each mechanical space door.
 2. "Men" at each men's toilet.
 3. "Women" at each women's toilet.
 4. "Janitor" at each janitors closet.
 5. "Electrical" at each electrical closet.
- B. Provide international accessibility symbols at:
1. Accessible entrance.
 2. Accessible exit.
 3. Accessible toilets.
 4. At inaccessible elements, provide directional signage to indicate route to nearest accessible element.
- C. Provide directional and identification signs for:
1. Assistance listening systems.

END OF SECTION

SIGN TYPE B: Vinyl Room Name on Door

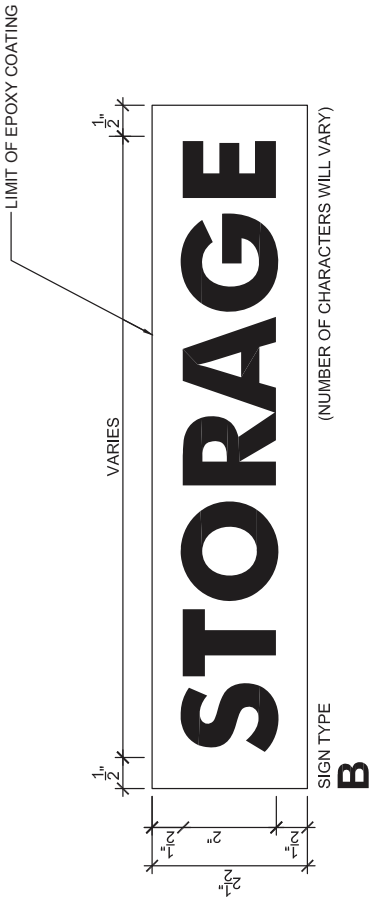
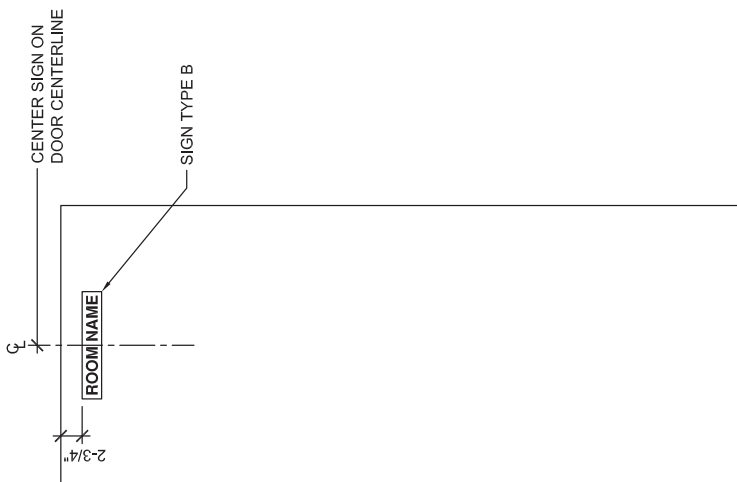
NOTES - Sign Type B:

PRODUCT:
3M 220 SCOTCHCAL VINYL, OR EQUAL AS APPROVED BY ARCHITECT.

COLOR:
GLIDDEN #00NN 16/000 GREY TABBY

TYPEFACE:
FUTURA BOLD

MOUNTING:
MOUNT TO DOOR, CENTERED HORIZONTALLY. SEAL VINYL WITH THIN LAYER OF CLEAR EPOXY TO PREVENT VANDALISM.



HDR Architecture
8700 N. Central Expressway
Dallas, TX 75227

Texas Registered Engineering Firm E-348

PROJECT FOR
Denton County

Denton Co:
Kitchen/Laundry
Troy H Lagrone Drive
Denton, TX 76205



DATE	ISSUE	DESCRIPTION

DATE	ISSUE	DESCRIPTION

NOT FOR
CONSTRUCTION

Preliminary Design Documents
JULY 23, 2018

SIGN TYPE - B
DRAWINGS & NOTES

IG-02

NOT FOR CONSTRUCTION

SIGN TYPE E: Vinyl Warning Sign

NOTES - Sign Type E:

PRODUCT:
3M 220 SCOTCHCAL VINYL, OR EQUAL AS APPROVED BY ARCHITECT.

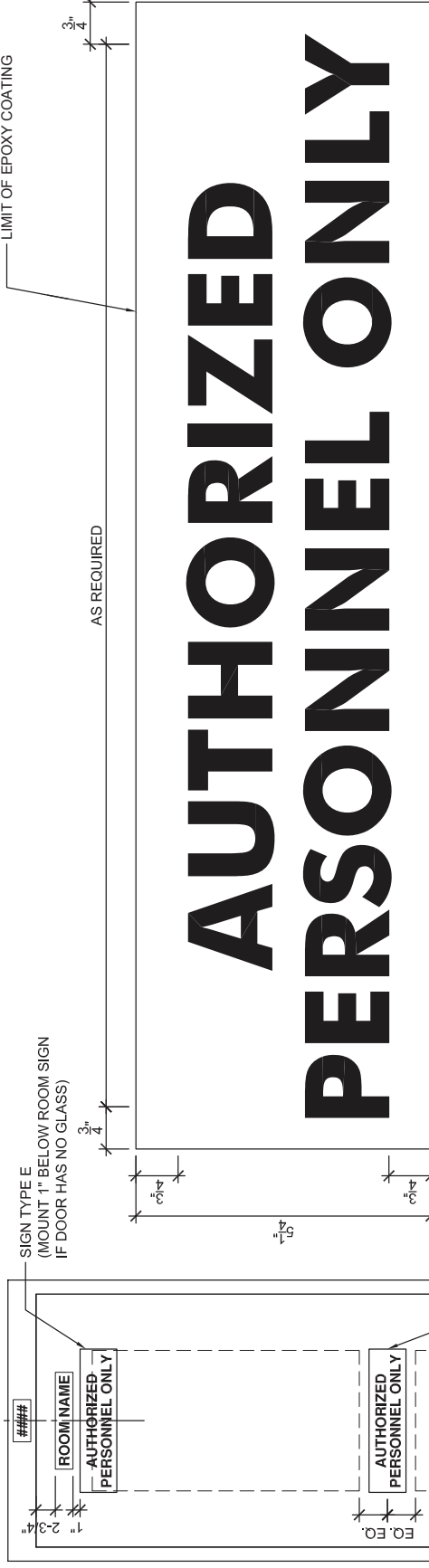
***COLOR:**
COLOR MATCH:
GLIDDEN #00NN 16/000 GREY TABB

TYPEFACE:
FUTURA BOLD

MOUNTING:
MOUNT TO DOOR AS SHOWN. SEAL VINYL WITH THIN LAYER OF CLEAR EPOXY TO PREVENT VANDALISM.

--- CENTER SIGN ON
DOOR CENTERLINE

SIGN TYPE E
(MOUNT 1" BELOW ROOM SIGN
IF DOOR HAS NO GLASS)



SIGN TYPE
E

SIGN TYPE E
(LOCATE HERE IF DOOR HAS GLASS)

PROJECT FOR
Denton County
Denton Co:
Kitchen/Laundry
Troy H Lagrone Drive
Denton, TX 76205



DATE	DESCRIPTION	BY

PROJECT NUMBER:	15088
PROJECT NAME:	Kitchen/Laundry
PROJECT LOCATION:	8700 N. Central Expressway Denton, Texas
DATE DRAWING MADE:	07/23/15
PROJECT ENGINEER:	Troy Lagrone
PROJECT ARCHITECT:	HDR Architecture
PROJECT CHECKER:	HDR Architecture
PROJECT OWNER:	Denton County
DATE OF ISSUE:	07/23/15

NOT FOR
CONSTRUCTION
Preliminary Design Documents
JULY 23, 2015

SIGN TYPE - E
DRAWINGS & NOTES

IG-04
NOT FOR CONSTRUCTION

PS-2

PS-2: Restroom Plaque (unisex)

Notes

Panel:

1/4" thick exterior grade photopolymer
with 1/2" rounded edges

Top Panel:
Matthews MP20082 Pearl Silver Metallic,
Matte Finish

Bottom Panel:
Glidden #00NN 16/000 Grey Tabby

Mounting to Wall:

Vandal resistant pin-mount to wall

Top Font:
Univers LT SD 57 Condensed

Bottom Font:
Univers LT SD 67 Bold Condensed

see IG-3 for dimensions

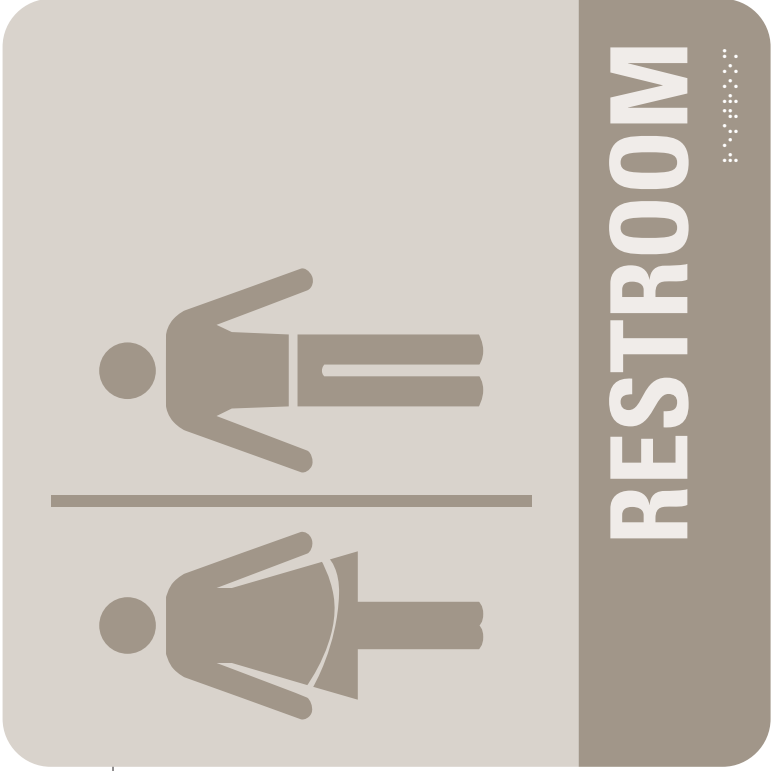
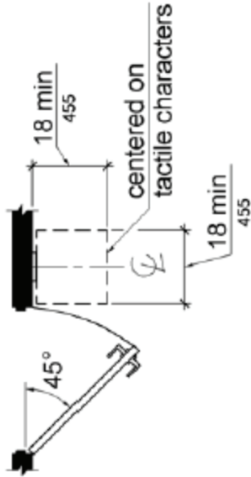
PS = Public Space
SS = Secure Space

Placement Guidelines:

Placement of sign to be located alongside the door at the latch side. Tactile characters on signs shall be located 48 inches (1220 mm) minimum above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches (1525 mm) maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.

Signs containing tactile characters shall be located so that a clear floor space of 18 inches (455 mm) minimum by 18 inches (455 mm) minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.

Note: Artwork for symbols to be provided by Architect.



DATE	ISSUE	DESCRIPTION



HDR Architecture
 8700 N. Central Expressway
 Dallas, TX 75221
 Texas Registered Engineering Firm E-3118

PROJECT FOR
 Denton County

Denton Co.
 Kitchen/Laundry

127 N. Woodrow Ln # 300
 Denton, TX 76205



DATE:	DATE:	DATE:	DATE:
PROJECT NUMBER:	PROJECT NUMBER:	PROJECT NUMBER:	PROJECT NUMBER:
PROJECT MANAGER:	PROJECT MANAGER:	PROJECT MANAGER:	PROJECT MANAGER:
PROJECT ENGINEER:	PROJECT ENGINEER:	PROJECT ENGINEER:	PROJECT ENGINEER:
PROJECT ARCHITECT:	PROJECT ARCHITECT:	PROJECT ARCHITECT:	PROJECT ARCHITECT:
PROJECT CONSULTANT:	PROJECT CONSULTANT:	PROJECT CONSULTANT:	PROJECT CONSULTANT:
PROJECT SUPERVISOR:	PROJECT SUPERVISOR:	PROJECT SUPERVISOR:	PROJECT SUPERVISOR:
PROJECT CHECKER:	PROJECT CHECKER:	PROJECT CHECKER:	PROJECT CHECKER:
PROJECT APPROVER:	PROJECT APPROVER:	PROJECT APPROVER:	PROJECT APPROVER:
PROJECT REVIEWER:	PROJECT REVIEWER:	PROJECT REVIEWER:	PROJECT REVIEWER:
PROJECT DESIGNER:	PROJECT DESIGNER:	PROJECT DESIGNER:	PROJECT DESIGNER:
PROJECT DRAFTER:	PROJECT DRAFTER:	PROJECT DRAFTER:	PROJECT DRAFTER:
PROJECT FILE NO.:	PROJECT FILE NO.:	PROJECT FILE NO.:	PROJECT FILE NO.:

NOT FOR
 CONSTRUCTION

Preliminary Design Documents
 JULY 23, 2018

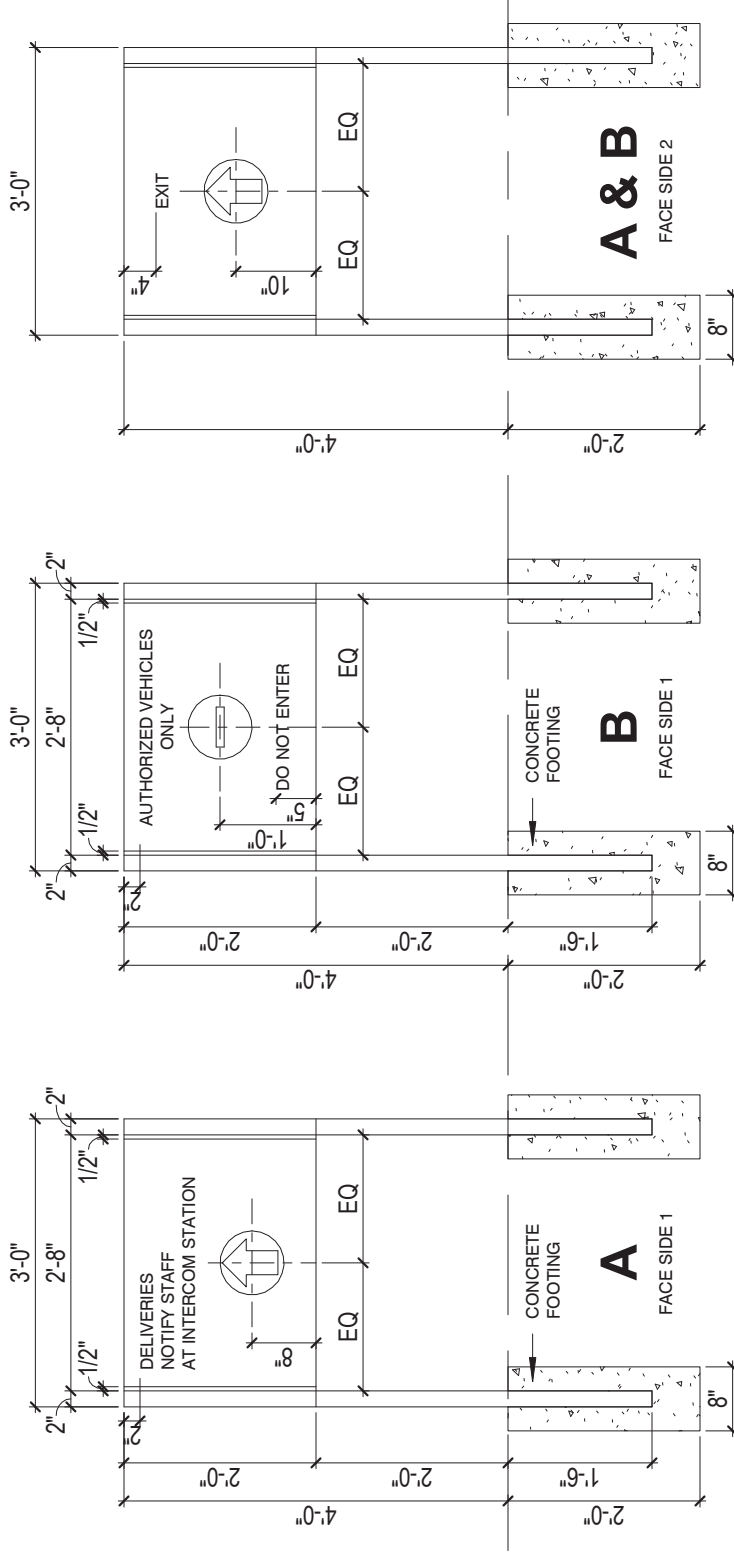
SIGN TYPE - A-D
 DRAWINGS & NOTES

1844

IG-06

NOT FOR CONSTRUCTION

TOP VIEW



NOTE:
 OWNER TO PROVIDE COPY AND ARROW
 DIRECTIONS

NOTE:
 OWNER TO PROVIDE COPY AND ARROW
 DIRECTIONS

SPECIFICATIONS:

- 24" X 36" face, double post-and-panel
- 2" wide aluminum posts and panels
- Stainless steel fasteners, countersunk in reveals between posts and panels
- Painted with premium polyurethane, color bronze to match existing color
- 3M opaque vinyl copy, color: White to match existing
- Font Style: Helvetica, match existing
- Owner to provide copy and arrow directions

SECTION 10 26 00
WALL PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Wall Protection Specialties, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Single source responsibility:
 - 1. Provide all components of the wall protection system manufactured by same company to ensure compatibility of color, texture and physical properties.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's standard literature indicating systems and products specified.
- B. Shop Drawings:
 - 1. Showing locations, extent and installation details of handrails
 - 2. Show methods of attachment to adjoining construction.
- C. Samples:
 - 1. Material samples of full range of standard and optional range of for pre-selection of colors.
 - 2. After color pre-selection furnish two 12 IN long/square samples of each item in selected color.
 - a. Include end cap and mounting hardware.
- D. Contract Closeout Information:
 - 1. Maintenance data

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Wall Protection Specialties:
 - 1. Base:
 - a. Construction Specialties
 - 2. Optional:
 - a. InPro
 - b. Pawling
 - c. Korogard
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 STAINLESS STEEL CORNER GUARDS (SSCG)

- A. General:
 - 1. Material: Type 304 or 430 Stainless Steel w/satin finish.
 - 2. Sheet thickness: 0.0625 IN (16 GA).
 - 3. Unit Length: 48 IN.

- B. Stainless Steel Corner Guards (SSGC):
 - 1. Base Product: "CO-8" by Construction Specialties.
 - 2. Size: 3-1/2 IN x 3-1/2 IN.
 - 3. Nose Radius: 1/8 IN.
 - a. Exception: 3/4 IN Radius "CG-55" by Pawling where indicated over bull-nosed CMU blocks.

2.3 CRASH RAILS

- A. Crashrails/Bumper rail combination (WPS1)
 - 1. Base Product: "SCR-16SSV" surface-mount by Construction Specialties
 - 2. Total Height: Crashrail, 5 1/2 IN.
 - 3. Projection from Wall: 1 13/16 IN.
 - 4. Stainless Steel, 16 gauge, plain faced V groove centered.
 - 5. Mounting Height: As indicated in drawings.

2.4 FABRICATION

- A. Fabricate wall protection systems to comply with requirements indicated for design, dimensions, and detail, finish and member sizes. Coordinate size and type and terminations with existing crash rails.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General:
 - 1. Verify walls are in proper condition to receive installation of protection items.
 - 2. Correct unsatisfactory conditions.
 - 3. Start of installation indicates acceptance of responsibility for performance.
- B. Verify temperature at the time of installation is between 65-75 DegF and will be maintained in this range throughout installation and for at least 48 hours after completion.
- C. Coordinate and direct installation of backing required for Wall Protection Specialties scheduled.
- D. Insure adequate Wall Backing has been installed.
 - 1. Metal Wall Backing: Specified in Section 09 22 16.
 - 2. Coordinate with other trades to ensure backing is installed as walls are framed and prior to installation of gypsum wall board.
- E. Install surface mounted items after wall finishes have been completed.

3.2 INSTALLATION – GENERAL REQUIREMENTS

- A. General:
 - 1. Install in accordance with manufacturer's recommendations, using only approved mounting hardware, and locate all components firmly in position, level and plumb.
 - 2. Install with fasteners suitable for wall substrates encountered, and provide adequate anchoring for anticipated impact loads.
- B. Install items where indicated.
- C. Install end caps, returns, transition etc.

3.3 INSTALLATION - CORNER GUARDS

- A. General:
 - 1. Comply with general requirements in Part 3.2.
 - 2. Unless otherwise indicated: Align bottom edge of corner guards with top of Wall Base.

- B. Stainless Steel Corner Guards (SSCG):
 - 1. Fasten directly to finished wall surfaces using adhesive as recommended by manufacturer.
 - a. Augment with stainless steel fasteners.

3.4 INSTALLATION – CRASHRAILS

- A. General:
 - 1. Comply with general requirements in Part 3.2.
 - 2. Install Wall Protection Systems and Crash Rails where indicated.
- B. Prepare substrates as required to receive Crash Rails.
- C. Coordinate installation with locations of door frames, fire extinguishers, signage and similar items which might interrupt continuity of Handrails and Crash Rails.
 - 1. Terminate Crashrails 4 IN from vertical edges of such intersecting items.
- D. Detail horizontal runs with splices designed to accommodate thermal expansion/contraction.
 - 1. Stagger splices in aluminum retainer from splice in cover.

3.5 ADJUSTING AND CLEANING

- A. Adjust installed end caps as necessary to ensure tight seams.
- B. Remove and replace defective, misaligned or damaged units.
- C. Verify wall protection items are plumb and rigidly secured to substrate; make adjustments required.
- D. Remove protective films.
- E. Clean items adjacent areas, using materials and methods recommended by manufacturer.

3.6 PROTECTION

- A. Protect installed materials to prevent damage by other trades.

END OF SECTION

SECTION 10 28 13
TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Toilet and Bath Accessories in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Provide accessories from one manufacturer as far as practicable.
- B. ASTM A240/A240M Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip
- C. U.S. Department of Justice:
 - 1. ADA Standards for Accessible Design.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's standard literature indicating systems and products specified.
- B. Contract Closeout Information:
 - 1. Maintenance data.
 - a. See Section 01 78 23.
 - 2. Letter stating that extra material has been delivered.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Toilet and Bath Accessories:
 - 1. Base:
 - a. American Specialties, Inc. (ASI)
 - b. As noted for specific items.
 - 2. Optional:
 - a. Bobrick Washroom Equipment
 - b. Bradley
 - c. GAMCO, a Division of Bobrick
 - d. Seachrome
 - e. Tubular Specialties Manufacturing (TSM)
 - f. A & J Washroom Accessories
 - g. Brey-Krause Manufacturing
- B. Other manufacturers of a complete line of stainless steel accessories desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Type 304, 18-8 stainless steel per ASTM A240/A240M , unless noted otherwise.
 - 1. Finish: Satin #4 on exposed surfaces.
- B. Corrosion resistant fasteners and attachment devices, and other fittings necessary to assure function and operation of accessories.
- C. See drawings for items, quantities, and locations required.

- D. Locks:
 - 1. Tumbler locks keyed alike.

2.3 TOILET ACCESSORIES

- A. Hooks:
 - 1. TA1C and TA1D:
 - a. Double Robe Hook.
 - b. Model 7345-S by ASI.
- B. Toilet Tissue Dispensers:
 - 1. TA2:
 - a. Double Roll Tissue Dispenser.
 - b. Cast aluminum with ABS thermoplastic spindle.
 - c. Model 0264-1A by ASI.
 - d. Non-controlled delivery.
- C. Paper Towel Dispensers:
 - 1. TA7:
 - a. Model 0210 by ASI
 - b. Surface mounted
 - c. Capacity: 400 C-fold or 525 multi-fold towels
- D. Waste Receptacles:
 - 1. TA8:
 - a. Model 0828 by ASI.
 - b. Surface mounted.
- E. Soap Dispensers:
 - 1. TA9H:
 - a. Model 0345 by ASI.
 - b. All-purpose valve.
 - c. Surface mounted.
- F. Mop Broom Rack:
 - 1. TA10:
 - a. Model 8215-3 by ASI.
 - b. Three rubber cam mop holders
 - c. Surface mounted.
- G. Mirrors:
 - 1. TA13T:
 - a. Model 0600 by ASI.
 - b. Polished stainless steel framed mirror.
 - c. 24 IN wide x 60 IN high.
- H. Toilet Seat Cover Dispensers:
 - 1. TA20:
 - a. Model by ASI.
 - b. Surface mounted.
 - c. 250 sheets.
 - 2. TA20A:
 - a. Model by ASI.
 - b. Recessed.
 - c. Secure cover with tumbler lock.
 - d. 500 sheets.
- I. Grab Bars:
 - 1. General:
 - a. Base Products: 3800 Series by American Specialties.
 - b. Bar Diameter: 1-1/2 IN OD.

- c. Concealed mounting.
 - d. Include anchoring devices to withstand minimum concentrated load of 250 LB and 1000 LB at bariatric locations.
 - e. Include 3800M spacer to keep grab bar parallel to wall faces at offset conditions.
2. TA36:
 - a. 36 IN horizontal grab bar.
 3. TA37:
 - a. 42 IN horizontal grab bar.

2.4 DETENTION ACCESSORIES

- A. Toilet Tissue Holder:
 1. DTA70C:
 - a. Model ITP-100 by Norix
 - b. Optional: Model SA11 by Bradley
 - c. Chase mounted
 - d. Single roll holder
 - e. Satin Stainless Steel.
 - f. Mount at 32 IN AFF.
- B. Framed Mirror:
 1. DTA73F:
 - a. Model R565-410 by Norix
 - b. Optional: Model SA05 by Bradley
 - c. 11-1/4 IN wide x 17-1/4 IN high.
 - d. Front mounted
 - e. Polished Stainless Steel.
 - f. Mount at 40 IN AFF.
- C. Towel Hook:
 1. DTA78F:
 - a. Model ITH-110 by Norix
 - b. Optional: Model SA31 by Bradley
 - c. Front mounted
 - d. Single, friction hold safety hook
 - e. Breakaway force: 20 LBS
 - f. 14 GA Satin Stainless Steel mounting plate
- D. Detention Grab Bar:
 1. General:
 - a. Bar Diameter: 1-1/2 IN O.D.
 - b. Full length Closure Plate between bottom of rail and wall
 - c. Rear mounting.
 - d. Mounting plate with internally threaded studs, threaded rods, washers and nuts.
 - e. Mount at 35 IN AFF to centerline unless noted otherwise.
 - f. Anchoring devices to withstand minimum concentrated load of 250 LB and 1000 LB at bariatric locations.
 - g. Base: Models IGS-__-3 by Norix
 - h. Optional: Model SA70-001__-2 by Bradley
 - i. Optional: Model WH1110-__ by Whitehall Manufacturing
 2. DTA80:
 - a. Model IGS-18-3 by Norix.
 - b. 18 IN horizontal grab bar.
 3. DTA81:
 - a. Model IGS-24-3 by Norix.
 - b. 24 IN horizontal grab bar.
 4. DTA82:
 - a. Model IGS-36-3 by Norix.

- b. 36 IN horizontal grab bar.
- 5. DTA83:
 - a. Model IGS-42-3 by Norix.
 - b. 42 IN horizontal grab bar.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Coordinate and direct installation of backing where required for toilet accessories.
- C. Verify that adequate wall backing has been installed.
 - 1. Coordinate and direct installation backing where required for toilet accessories.
 - 2. Utilize proprietary backing devices where available.
 - 3. At remaining locations, provide metal backing per Section 09 22 16.
- D. Correct deficiencies before proceeding to install accessories.
- E. Where item is mounted on or in a toilet partition, coordinate interior reinforcing location with partition manufacturer.
- F. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions.
 - 1. Install plumb, level, and rigidly anchored to substrates.
- B. Where drawings or schedule require barrier-free accessibility, install accessories in accordance with applicable regulations.
- C. Coordinate accessory locations to fit spaces.
- D. Coordinate items to avoid mounting conflicts.
- E. Mount items with theft-resistant fasteners.
- F. Seal grab bar mounting plate to shower walls with silicone sealant or gasket prior to installation of bar.

3.3 ADJUSTING AND CLEANING

- A. Protect accessories from damage due to construction.
 - 1. Remove protective coverings when no longer required.
- B. Test accessories and adjust for proper operation.
- C. Clean exposed surfaces.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Fire Protection Specialties in accord with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Provide fire extinguishers, cabinets and accessories by single manufacturer.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 10 Standard for Portable Fire Extinguishers.
- C. Americans with Disabilities Act (ADA):
 - 1. Standards for Accessible Design.

1.3 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Maintenance data.
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fire Protection Specialties:
 - 1. Base:
 - a. JL Industries.
 - 2. Optional:
 - a. Badger.
 - b. Larsen's Manufacturing.
 - c. Nystrom.
- B. Fire Extinguishers:
 - 1. Base:
 - a. JL Industries.
 - 2. Optional:
 - a. Amerex.
 - b. Badger.
 - c. Larsen's Manufacturing.
 - d. Nystrom.
 - 3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Fire Extinguishers:
 - 1. Multi-Purpose Chemical Fire Extinguishers:
 - a. Typical FE, except where more specialized types are required.
 - b. Fluidized and siliconized chemical powder extinguishing agent suitable for class A, B and C fires.
 - c. Construction:
 - 1) Heavy-duty steel cylinder with metal valve and siphon tube with replaceable molded valve stem seal, visual pressure gauge, pull pin and upright squeeze grip.

- 2) Corrosion and impact-resistant, powdercoat finish.
- 3) Color: Red, in accord with OSHA requirements.
- d. Capacity: 10 LBS.
 - 1) UL-rating: 4A-80BC.
 - 2) Base Product Model: Cosmic 10E by JL Industries.
- e. Provide one FE for each:
 - 1) Fire Extinguisher Cabinet (FEC).
 - 2) Fire Extinguisher (FE) location.
- 2. Class K Fire Extinguishers:
- 3. For use at Kitchens.
 - a. Extinguishing Agent: Class K, low pH wet chemical.
 - b. Construction:
 - 1) Stainless steel cylinder with protective nozzle tip orifice seal and non-metallic nozzle tip finger guard.
 - 2) Standard horn and nozzle design.
 - 3) Name plate shows only the class K symbol.
 - c. Base Product, UL-rating: K: Saturn 15 by JL Industries.
 - d. Locations: Furnish where indicated.
- B. Fire Extinguisher Cabinets (FEC):
 - 1. Provide FIRE EXTINGUISHER decal for each cabinet. Orient letters vertically.
 - 2. Provide standard fixed door pull at each cabinet.
 - 3. Keys to Door Locks: Three per lock.
 - 4. FEC-4: Surface-mounted, Stainless Steel, Fire Extinguisher Cabinet:
 - a. Description: Stainless steel cabinet box fully exposed and mounted directly on wall with no trim.
 - b. Material: 0.026 IN (26 GA) stainless steel.
 - 1) Finish: #4 brushed.
 - c. Tub Size, inside clear (WxHxD): 13-11/16 x 27-3/16 x 6-1/2 IN.
 - d. Door Style: Full Glazing; Clear acrylic.
 - e. Lock: Cam lock with emergency break-away release mechanism.
 - 1) Base Product: Saf-T-Lok by JL Industries.
 - f. Base Product: Cosmopolitan series by JL Industries.
- C. Wall Brackets:
 - 1. Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated
 - 2. Finish: Baked-enamel or powder coat.
 - 3. Include mounting accessories suitable for substrate wall type.
 - 4. Locations: Install wall brackets for each fire extinguisher (FE) not indicated to be installed in a cabinet.
- D. Finishes:
 - 1. Comply with NAAMM's Metal Finishes Manual for Architectural and Metal Products.
 - 2. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
 - 3. Finish fire protection cabinets after assembly.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrates to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install extinguishers and cabinets within limitations of NFPA-10 and ADA.

- B. Fasten mounting brackets and cabinets to structure, square and plumb, to comply with manufacturer's instructions.
- C. Provide unistrut or welded steel support where needed to mount cabinets or brackets in mechanical rooms and similar locations.
- D. Provide required closures.
- E. Mounting Height:
 - 1. Fire Extinguisher Cabinets (FEC):
 - a. Locate with centerline of cabinet door handle not more than 48 IN AFF.
 - 2. Fire Extinguishers (FE) not contained in a cabinet:
 - a. Locate wall brackets such that extinguisher release mechanism will not be higher 48 IN AFF.

3.3 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films.
- B. Adjust fire protection cabinet doors to operate easily without binding.
 - 1. Verify that integral locking devices operate properly.
- C. Clean interior and exterior surfaces.

END OF SECTION



DIVISION 11

EQUIPMENT



SECTION 11 13 16
DOCK SEAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Dock Seal, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer literature for specified products.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Dock Seal:
 - 1. Base:
 - a. Rite-Hite
 - 2. Optional:
 - a. Blue Giant
 - b. Chalfant Sewing Fabrications
 - c. Fairborn USA, Incorporated
 - d. W.B. McGuire Company
 - e. Pentalift Equipment Corporation
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Framing:
 - 1. 2 IN nominal kiln dried, preservative treated wood, fully encased with cover fabric, galvanized steel hardware.
- B. Cover Material:
 - 1. 16 OZ Hypalon-coated nylon.
 - 2. Color as selected.
- C. Taper Dock Seal - Top to Bottom:
 - 1. Where ramp slope is less than 2.5 PCT: Face of dock seal shall be plumb.
 - 2. Where ramp slope is 2.5 to 5 PCT: Face of dock seal shall have a 1 IN taper vertically.
 - 3. Taper an additional 1 IN for every 2.5 PCT thereafter.
 - 4. Taper direction according to the inclination/declination of approach ramp.
- D. Side Pads:
 - 1. Bevel side pads from 6 to 12-1/2 IN - back to front.
 - 2. Armor pleat exposure:
 - a. 4 IN.
 - 3. Vertical yellow guide stripe: 3 IN wide.
 - 4. Foam Fit Standard Pads, Series TP-900 by Rite Hite.

- E. Fixed Head Pad:
 - 1. Fabric type and color matching side pads.
 - 2. Vertical Height:
 - a. 12 IN.
 - b. 18 IN.
 - c. 24 IN.
 - d. 30 IN.
 - 3. Counter-flashed, watertight construction.
- F. Metal Hood:
 - 1. Provide manufacturer's standard metal hood.
- G. Bumpers:
 - 1. Include extended bumpers as required to prevent over-compression of the foam dock seals.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Do not start work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install in accord with manufacturers recommendations.
- B. Attach dock seals to the structure in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

3.3 ADJUST AND CLEAN

- A. Make necessary adjustments for safe, efficient operation of loading dock equipment.
- B. After installation, restore marred, abraded surfaces to the original condition.

END OF SECTION

SECTION 11 13 19
DOCK LEVELERS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Dock Levelers and Equipment, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Installer Requirements:
 - 1. Approved by manufacturer of dock equipment.
- B. ASTM International (ASTM):
 - 1. ASTM A36 Standard Specification for Carbon Structural Steel
 - 2. ASTM A501 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
- C. American National Standards Institute (ANSI):
 - 1. ANSI MH30.1 Specification For The Safety, Performance And Testing Of Dock Leveling Devices.
- D. Commercial Standard (CS):
 - 1. CS 202-56, Issue 56: Industrial Lifts and Hinged Loading Ramps.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Include following:
 - a. Pit dimensions and configuration.
 - b. Anchorage of edge angle and embed plates.
 - c. Rough-in requirements.
- B. Contract Closeout Information:
 - 1. Warranty.
 - 2. Operation and Maintenance Data.
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Dock Levelers:
 - 1. Base:
 - a. Rite-Hite
 - 2. Optional:
 - a. 4Front Engineered Solutions.
 - b. Blue Giant
 - c. Chalfant
 - d. Pentlift Equipment Corporation
 - e. Systems, Inc.
- B. Door Track Guards:
 - 1. Base:
 - a. Rite-Hite
 - 2. Optional:

- a. Cubic Designs Inc.
 - b. Omega Industrial Products.
 - c. Overhead Door.
- C. Miscellaneous Dock Equipment:
- 1. Base:
 - a. Rite-Hite.
 - 2. Optional:
 - a. 4Front Engineered Solutions.
- D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Pit Leveler:
- 1. Hydraulic operated ramp and lip.
 - 2. Complete with platform, hinged lip, toe guards, bumpers and safety stop.
 - 3. Nominal Size:
 - a. 7 FT wide x 8 FT long.
 - 4. Vertical travel:
 - a. 12 IN, above and below platform level.
 - 5. Capacity:
 - a. 4,000 LB live load, for rollover and cross traffic, with ultimate static capacity at least 150 PCT of rated capacity without permanent deflection or distortion.
 - 6. Hydraulic Power Unit:
 - a. Electric motor, hydraulic pump and slave cylinder.
 - b. Voltage:
 - 1) 460 VAC, 3 PH.
 - 7. Material:
 - a. Deck steel plate: safety plate, with minimum yield of 55,000 PSI.
 - b. Structural steel plates, shapes and bars: ASTM A36.
 - c. Structural steel tubing: ASTM A501.
 - 8. Finish:
 - a. Factory primed and painted.
 - 9. Model RHH by Rite-Hite.
- B. Frame:
- 1. Steel, welded and reinforced to meet performance requirements and to provide rigid support.
 - 2. Constructed to accommodate easy cleaning on both sides of a single center frame member.
- C. Platform:
- 1. One piece deck steel plate unit with non-skid surface, mounted to frame.
 - 2. Flex to compensate for unlevel trailer beds.
 - 3. Rear hinges shall be fixed and shall not rise above floor level.
 - 4. Hinge shall have grease fittings for maintenance.
- D. Lip:
- 1. Reinforced 1-piece steel plate with non-skid surface and chamfered lip edge.
 - a. Length: Minimum 18 IN x width of platform.
 - 2. Functions as a vertical cover for actuating mechanism when in stored position and as an equipment run-off barrier on front edge of ramp.
 - a. Leveler lip shall provide an integral and automatically- positioned solid barrier 5 IN above building floor.
- E. Toe Guards:
- 1. Provide toe guard at open sides of platform throughout working range.
 - 2. Minimum 3/16 IN thick steel, weld to leveler platform.
- F. Safety Features:

1. Manufacturer's standard safety stop.
 2. Mechanical lock-out.
- G. Steel Edge Angles:
1. 3 IN x 3 IN x 3/16 IN galvanized steel angles with 1/2 IN diameter x 6 IN long headed studs at 12 IN. on center.
 2. Provide at entire perimeter of pit.
- H. Miscellaneous Features:
1. Automatic night locks.
 2. Overhead Door interlock.
- I. Dock Bumpers:
1. Two dock bumpers with each leveler.
 2. Laminated truck tire material.
 3. Size: 12 IN wide x 15 IN high x 4-1/2 IN thick
 4. Include manufacturer's standard embed plates and installation hardware.
- J. Dock Seals:
1. See Section 11 13 16.
- K. Truck Restraint:
1. Solid state, automatic device, which mechanically hooks onto truck's rear impact guard.
 2. Service Range: 9 to 30 IN.
 3. Manufactured by the same manufacturer as the Dock Leveler.
 4. UL-approved.
 5. Self-diagnostics for testing input and output functions.
 6. Supply Voltage: 110/115 VAC, 15 AMP.
 7. Include manufacturer's standard embed plates and installation hardware.
 8. Construction:
 - a. Zinc-plated steel housing.
 - b. Yellow zinc dichromate steel hook.
 9. Operational Features:
 - a. Exterior Lights:
 - 1) Flashing red and green lights with sun visors.
 - 2) Weatherproof housing.
 - b. Interior Lights:
 - 1) Flashing red and green lights to monitor the outside communication lights.
 - 2) Touch pad control:
 - a) Locate in the Control Panel.
 - b) Allow motor to run for a maximum of 1.5 seconds.
 - c. Manufacturer's standard signs on interior and exterior describing use of system.
 10. RHR 1000 Dok-Lok by Rite-Hite.
- L. Control Panel:
1. Control Panel by same manufacturer as dock leveler and truck restraint.
 2. Solid state programming.
 3. UL-approved, gasketed, NEMA-12 enclosure.
 4. Single panel to control dock devices for each bay, including:
 - a. Dock Leveler.
 - b. Overhead Door.
 5. Features:
 - a. Door Control: OPEN, CLOSE, and STOP push buttons.
 - b. Internal step-down transformer for devices requiring voltage different from dock leveler.
 - c. Interconnect and interlock package.
 - d. Integral rotary fused disconnect in compliance with OSHA lock out/tag out and a protective guard.
 - e. Auxiliary 15 AMP duplex outlet.

6. Dok-Commander by Rite-Hite

PART 3 - EXECUTION

3.1 PREPARATION

- A. Field verify dimensions prior to fabrication.
- B. Verify suitability of substrate and opening to accept installation.
- C. Correct unsatisfactory conditions.
- D. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - PIT MOUNTED DOCK LEVELER

- A. Install in accordance with manufacturer's instructions.
- B. Shim as necessary.
- C. Adjust for safe, efficient operation.
- D. Restore marred or abraded surfaces.
- E. Install sealant to seal between concrete and unit.

3.3 INSPECTION

- A. Install dock equipment in accordance with approved shop drawings and manufacturer's recommendations.
- B. Test for proper operation.

END OF SECTION

SECTION 11 19 00
DETENTION EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Detention Equipment in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Minimum five (5) years experience manufacturing specified item.
 - 2. List of institutions where products have been installed.
 - a. Telephone number and contact person.
 - b. Product type and quantity used in project.
- B. Installer Qualifications:
 - 1. Installation by manufacturer or authorized representative under manufacturer's direct supervision.
 - 2. Minimum five (5) years experience installing manufacturers products.
 - 3. Upon request, submit qualifications to Architect for review.
 - 4. Manufacturer's letter stating authorized representative is qualified to install manufacturer's products.
- C. Supply products of one manufacturer for each type of item required.
- D. ASTM International (ASTM):
 - 1. ASTM A36/A36M Standard Specification for Carbon Structural Steel
 - 2. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 - 3. ASTM A627 Standard Test Methods for Tool Resisting Steel Bars, Flats, and Shapes for Detention and Correctional Facilities
 - 4. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
 - 5. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 - 6. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 - 7. ASTM B633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 8. ASTM F1450 Standard Test Methods for Hollow Metal Swinging Door Assemblies for Detention Facilities
 - 9. ASTM F1577 Standard Test Methods for Detention Locks for Swinging Doors
 - 10. ASTM F1592 Standard Test Methods for Detention Hollow Metal Vision Systems
 - 11. ASTM F1643 Standard Test Methods for Detention Sliding Door Locking Device Assemblies
 - 12. ASTM F1758 Standard Test Methods for Detention Hinges used on Detention Grade Swinging Doors
- E. American Iron and Steel Institute (AISI):
 - 1. AISI C1018 Mild/Low Carbon Steel
 - 2. AISI C1010-C1020 Carbon Steel (UNS G10100)

- F. National Association of Architectural Metal Manufacturers (NAAMM) / Hollow Metal Manufacturers Association (HMMA):
 - 1. ANSI A 250.10 Standard Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
 - 2. ANSI/NAAMM Standard, HMMA 863 Guide Specification for Detention Security Hollow Metal Doors and Frames
- G. U. S. General Services Administration Federal Specifications (FS):
 - 1. FF-S-325, Group II, Type 4, Class I for concrete expansion anchors
 - 2. FS TT-C-490 Chemical Conversion Coatings and Pretreatments for Metallic Substrates (Base for Organic Coatings)
 - 3. FS TT-P-664D Rust Inhibiting and Lacquer Resistant Primer
- H. Preinstallation Conference:
 - 1. See Section 01 31 19.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit composite shop drawings for each opening, showing details of construction including glazing, glazing stops, doors, frames, hardware and electronic products whether included as detention equipment or otherwise, reinforcements, joints, connections and related construction.
 - a. Show each opening as a single drawing with items listed above.
 - b. Do not submit door and frame drawings separately.
 - 2. Plans, elevations and large scale details showing fabrication, anchorage and accessories.
 - 3. Plans showing location of units, installation details, and mounting position of components within units.
 - 4. Wiring diagrams showing junction boxes, conduit and wiring locations.
 - 5. Show fastener types.
 - 6. Door and frame assemblies scheduled as fire rated:
 - a. Provide label and certification where indicated.
 - b. Where clean labels are not possible due to security or other considerations, provide list of openings and reason for label conflict.
 - 7. Door and Frame schedule.
 - a. Cross reference Architectural door numbers and Detention Hollow Metal Elevations in schedule.
 - b. Indicate key side of doors.
 - c. Indicate removable glazing stop side of Detention Hollow Metal doors and frames.
 - d. Indicate glazing types at glazing locations.
 - 8. Catalog cut sheets for items.
- B. Product Data:
 - 1. Manufacturer's specifications, installation instructions and recommendations.
 - 2. ASTM test reports for locks, locking devices, hinges, Security Hollow Metal, etc. as specified herein, certifying compliance with these minimum requirements.
 - 3. Independent laboratory test reports:
 - a. Include details of test samples and photographs of testing apparatus.
 - b. Completed within past ten (10) years.
- C. Project Information:
 - 1. Minutes from Preinstallation Conference.
- D. Contract Closeout Information:
 - 1. Letter stating spare parts have been delivered.

1.4 SPARE PARTS

- A. See Section 01 78 43.
- B. 2 per 100 cell locksets supplied on job for use as spare parts.

1. Minimum of 2 locksets with opposite handing.
 2. Include lock, hinges, door position switch, pulls, closer and any other items included in lockset.
- C. 1 per 100 of other locksets supplied on job for use as spare parts.
- D. Minimum of 1 unless fewer than 10 locksets are supplied wherein no spares are required.

1.5 WARRANTY

- A. Warrant items for a minimum period of two (2) years from Substantial Completion of project.
1. Provide repair or replacement parts for on site delivery within 24 HRS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Detention Security Hollow Metal Doors and Frames:
1. Base:
 - a. American Steel Products
 2. Optional:
 - a. Trussbilt
 - b. Titan Steel Door, LLC.
 - c. Slate Security Systems
- B. Detention Door Hardware:
1. Base:
 - a. As noted for individual items.
 - b. Product numbers listed are base.
 - c. Provide functions standard or optional to comply with specifications
- C. Motor Operated Fully Driven Sliding Corridor Devices:
1. Base:
 - a. As noted for individual items.
- D. Motor Operated Sliding Cell Devices:
1. Base:
 - a. As noted for individual items.
- E. Miscellaneous Hardware for Swinging and Sliding Doors:
1. Base:
 - a. As noted for individual items.
- F. Where no manufacturer is indicated, comply with requirements of specification.
- G. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 FABRICATION

- A. Factory assemble items where practical.
- B. Welding:
1. Welders: Certified by American Welding Society.
 2. Comply with American Welding Society standards.
 3. Remove burrs and rough edges.
 4. Where welding is required but no spacing indicated, minimum 1/8 IN weld, 2 IN long, 12 IN 305 on center.
- C. Fastening Devices:
1. Tamper resistant.
 2. Exposed screws and nuts:
 - a. Security type: ASTM A307, Grade A.
 3. Removable screws:

- a. Torx head, 5-lobe with center reject pin, unless indicated otherwise.
 - b. Provide six (6) tools of each size to the Owner upon project completion.
 - 4. See Section 11 19 19 for additional requirements.
- D. Anchoring Devices:
- 1. Stud type with two independent expansion wedges.
 - 2. Zinc plate in accordance with ASTM B633, SC1, Type III.
 - 3. Comply with Requirements of Federal Specification FF-S-325, Group II, Type 4, Class I for concrete expansion anchors.
 - 4. Minimum tension working load of 2000 LBS in 4000 PSI concrete.
 - 5. Acceptable manufacturers:
 - a. Base: Hilti Kwik-Bolt
 - b. Optional: Rawl
- E. Factory Priming:
- 1. Factory apply rust inhibiting primer on detention equipment metal surfaces except finish hardware, aluminum, brass, bronze, stainless steel, enameled steel and plated steel.
 - a. Comply with FS TT-C-490: Steel Surface Preparation for Prime Coat
 - b. Comply with FS TT-P-664: Prime Coat for Steel Surfaces
 - c. Minimum thickness: 1.5 mils
 - 2. Coordinate primer with finish coating specified.
 - a. Verify compatibility.
 - b. Reference Section 09 91 23 for finish coatings.

2.3 MATERIALS

- A. Detention Security Hollow Metal Doors and Frames - General:
- 1. Submit current testing reports certifying compliance with the following Standards and Test Methods
 - a. Testing must have been performed for the named company submitting the information and within the last ten (10) years.
 - 2. Comply with test requirements of Guide Specification NAAMM/HMMA 863 and Test Method ASTM F1450
 - a. Door Static Load Test. (ASTM F1450)
 - b. Door Rack Test. (ASTM F1450)
 - c. Door Assembly Impact Load Test. (ASTM F1450)
 - d. Door Edge Crush Test (ASTM F1450)
 - e. Sidelight and Multi-Light Assembly Impact Test (ASTM F1592)
 - 3. Comply with ANSI A 250.10 Standard Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 4. Grades as indicated on Opening Schedule and Security Perimeter Plans.
 - a. Where conflicts occur, provide most stringent grade.
 - 5. Field primer examination:
 - a. At direction of architect, Contractor shall provide independent testing of three (3) doors and frames and verify compliance with ANSI A 250.10 Standard Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - b. Certify compliance by independent testing laboratory.
 - c. Submit reports.
 - d. If examination reveals primer does not comply with tests, contractor shall strip and re-prime doors and frames shipped to project
 - e. Extend warranty by two (2) years
 - 6. Fabricate from commercial quality leveled face sheets.
 - 7. Exterior, food preparation areas, and shower doors and frames:
 - a. Galvanized steel, ASTM A653, G60 coated or Galvanealed steel, ASTM A653, A60 coated.
 - 8. Interior doors and frames:
 - a. Cold rolled steel, ASTM A1008/ A1008M or hot rolled, pickled and oiled steel, ASTM A1011/ A1011M.

9. UL labels where indicated.
 - a. Reference Opening Schedule and Life Safety Plans for rating information.
 10. Where frame assembly is indicated to be fire rated, but cannot for any reason, notify Architect before fabrication.
 11. Anchor to comply with UL labeling requirements
- B. Detention Security Hollow Metal Doors:
1. Minimum door thickness: 2 IN .
 2. Full flush design.
 3. Face sheets:
 - a. Metal gauges for face sheets:
 - 1) Minimum 0.093 IN 12 GA for Grades 1 or 2
 - 2) Minimum 0.067 IN 14 GA for Grades 3 or 4.
 - b. Join door face sheets at vertical edges with continuous weld extending full height of door.
 - 1) Factory grind and finish weld to conceal seam.
 4. Interior reinforcement:
 - a. Metal gauges for interior reinforcement.
 - 1) As required to comply with ASTM grade indicated.
 - b. Interior vertical reinforcing,
 - 1) Steel formed channels, full height and width of door panel
 - a) Spot weld face sheets to channels, maximum 3 IN on center.
 - b) Spacing: Maximum 4 IN O.C.
 - c. Optional interior vertical reinforcing,
 - 1) Steel structurally shaped truss core, full height and width of door panel
 - a) Spot weld face sheets to channels, maximum 3 IN on center.
 - b) Spacing: Maximum 4 IN O.C.
 5. Insulation:
 - a. Insulate spaces between reinforcing with minimum 6 LB density mineral wool.
 6. Door edges:
 - a. Bevel both vertical edges: 1/8 IN per 2 IN and square edges at top and bottom of swinging doors.
 - b. Square edges, four sides, at sliding doors and panels.
 - c. Vertical reinforcement door edge channel:
 - 1) Full height at both edges.
 - 2) 0.123 IN (3.1 MM) 10 GA minimum
 - d. Close top and bottom of door with a continuous steel channel, spot welded to face sheets at 4 IN minimum.
 - e. End channel to close the top of the door, weld to door, flush.
 - 1) At exterior and shower locations seal top of door.
 - f. Finish edges flush, seamless.
 7. Hardware provision and reinforcement:
 - a. Mortise, cut, reinforce, drill and tap door edges and faces following hardware manufacturer's instructions for flush installation.
 - b. Minimum steel plate reinforcements for hardware as indicated in HMMA 863 and as required to comply with ASTM F1450, welded inside door where required.
 - c. Provide reinforced seats for locks installed through door edge.
 - 1) Weld to edge channel.
 - 2) Cut away edge channel minimum dimension required for lock installation.
 - 3) Provide lock centering clips at each side.
 - 4) Cut away face plate for cylinder.
 - d. Provide reinforced pocket for locks installed through face of door.
 - 1) Weld inside detention side of pocket.
 - 2) Secure lock to mounting plate furnished by lock manufacturer.
 - 3) Rabbet frame opening around mounting plate for flush finish with door face.

- 4) Secure manufacturer furnished mounting plate with minimum of eight 1/4 IN tamper-resistant fasteners.
- e. Hinge reinforcing:
 - 1) Cut edge reinforcing channel minimum dimension necessary for hinges.
- f. Steel boxes at back of keeper and strike cutouts, 26 GA , weld to inside of door.
- g. Electrical items:
 - 1) Detention equipment contractor furnish, install and connect wiring inside door.
 - 2) Factory installed junction boxes, conduit and raceway inside door for electric locks, hinges and limit switches requiring wiring through door.
- 8. Maximum clearances between doors and frames:
 - a. Head, 1/8 IN .
 - b. Jamb, 1/8 IN .
 - c. Vertical meeting edge at pairs of doors, 1/8 IN .
 - d. Sill without threshold, 3/4 IN .
 - e. Sill with threshold, 1/4 IN above threshold.
- 9. Openings in doors:
 - a. Frame openings with minimum 12 GA steel channels.
 - 1) Galvanize channels at food/cuff passes
 - b. Weld channels to both faces.
 - c. Provide flush design on edges of 'open' openings, no applied trim, joints welded, filled with metallic filler and ground smooth to completely conceal seam.
- 10. Integral flush pull:
 - a. Provide on stop side of door where indicated.
 - b. Minimum 14 GA steel.
 - c. Weld inside door to prevent tampering
 - d. Minimum 1-1/2 IN wide x 3-1/2 IN high x 3/4 IN deep .
- 11. Glazing stops:
 - a. Removable steel angle, 12 GA mild steel
 - b. Minimum 1-1/4 IN deep.
 - c. Integrally formed non-removable stop on detention side.
 - d. Attach with minimum 1/4 IN diameter tamper-resistant fasteners, maximum 2 IN from ends and maximum 9 IN OC or closer spacing as required to comply with Impact Load Test specified herein.
 - e. Integral Speaking Device:
 - 1) Passive speaking device punched in door skins where indicated.
 - 2) Mount 54 IN above finished floor unless indicated otherwise.
 - 3) Minimum 3 IN x 3 IN pattern, 3/16 IN holes staggered at 3/8 IN on center punched in both door skins. Align holes.
 - 4) Weld 14 GA galvanized steel baffles inside door to prevent contraband passage. Slope baffles toward inside of room or cell.
- 12. Factory finish:
 - a. Prime painted:
 - 1) Remove mill scale and foreign materials
 - 2) Grind, fill and sand smooth
 - 3) Bonderize or phosphate treat
 - 4) Corrosion resistant primer
 - b. Galvanized:
 - 1) Clean off fabrication and other foreign materials.
 - 2) Repair damaged galvanizing with zinc rich coating.
 - 3) Solvent clean surfaces, apply primer.
- 13. Hardware installation:
 - a. Installed by manufacturer or authorized representative

C. Detention Security Hollow Metal Frames and Lites:

- 1. Metal gauge:
 - a. Minimum 0.093 IN 12 GA for Grades 1

2. Frame joints:
 - a. Miter or cope and continuously weld inside across full width and depth of frame.
 - b. Fill and grind exposed surfaces smooth.
3. Mullions and rails:
 - a. Close tubular shapes with no visible seams or joints in final assembly.
 - b. Weld abutting members and grind smooth.
4. Assembly:
 - a. Furnish frames as single unit where possible.
 - b. Provide large frames in sections with factory splices.
 - c. Indicate splices and details on shop drawings.
5. Hardware Provisions:
 - a. Mortise, reinforce, drill and tap at factory following manufacturer's instructions and recommendations.
 - b. Minimum steel plate reinforcements for hardware as indicated in HMMA 863 and as required to comply with ASTM F1592, welded inside frame where required.
 - c. Lock or keeper preparation:
 - 1) Follow manufacturer's recommendation.
 - 2) Protect reinforcing and cutouts with pressed steel mortar guards inside frame.
 - d. Steel boxes at back of hardware cutouts 26 GA steel, weld to frame.
6. Grout guards:
 - a. Provide grout guards at silencers, lite kit screws and other locations as necessary to prevent grout form interfering with proper installation.
 - b. Reference HMMA 863.
7. Electric lock provisions:
 - a. Increase frame face for lock; increase frame depth at lock if required.
 - b. Locate opening on non-secure side for face installation.
 - c. 14 GA 1.77mm minimum steel lock pocket, welded each side.
 - d. 0.123 IN (3.1mm) 10 GA minimum steel lock mounting plate inside pocket.
 - e. Weld to secure side of frame.
 - f. Provide flush mounted 0.123 IN (3.1mm) 10 GA minimum steel cover plate. Surface mount where frame is located in a fire rated partition.
 - g. Mount with 1/4IN diameter tamper-resistant fasteners spaced 6 IN on center, maximum.
 - h. Cutout rabbet face and provide reinforcing for lock faceplate.
 - i. Provide key cylinder extension for flush lock keyway either side of frame.
8. Cylinder security ring:
 - a. Provide pipe sleeve security ring welded to lock cover plate and/or backside of lock box preparation wherever lock cylinders extend past face of frame.
 - b. Ring shall fit snugly around lock cylinders and extend out from frame to within 1/8 IN of face of cylinder to protect cylinder from twisting.
9. Glazed frame openings:
 - a. Integrally formed, non-removable stop on secure side.
 - b. Removable glazing stops on opposite side.
 - 1) Glazing stops: Steel angles, 0.093 IN (2.3mm) 12 GA, minimum 1-1/4 IN deep.
 - 2) Factory drill glazing stops for 1/4 IN diameter tamper-resistant fasteners, maximum 2 IN from each end and maximum 9 IN OC or closer spacing as required to comply with impact test.
10. Frame anchors:
 - a. Spacing:
 - 1) Jamb anchors: maximum 8 IN from top and bottom and maximum 16 IN OC.
 - 2) Head and sill anchors, maximum 8 IN from ends and maximum 24 IN OC.
 - b. Jamb anchors at masonry:
 - 1) 0.093 IN (2.3mm) 12 GA galvanized steel, strap and stirrup, adjustable, punch for installation of a 1/2 IN diameter rebar.
 - c. Head and sill anchors at masonry:

- 1) Drill and dimple (countersink) frame for 1/2 IN minimum diameter flat head machine screws installed into expansion anchors.
- 2) Provide pipe spacers where necessary.
- 3) Conceal anchors behind stops where possible
- 4) Securely tighten machine screws and tack weld to prevent removal.
- 5) Where exposed, fill and grind smooth to completely conceal.
- d. Head, jamb and sill anchors at concrete:
 - 1) Drill and dimple frame for 1/2 IN minimum diameter flat head machine screws.
 - 2) Provide pipe spacers where necessary.
 - 3) Conceal anchors behind stops where possible.
 - 4) Securely tighten machine screws, tack weld heads to prevent removal.
 - 5) Where exposed, fill and grind smooth to completely conceal.
- e. Head, jamb and sill anchors at steel:
 - 1) 3/16 IN minimum double steel angle clip welded to steel.
 - 2) 1/4 IN minimum steel straps, welded to steel.
 - 3) 0.093 IN (2.3mm) 12 GA steel plate reinforcing in frame at anchors.
- f. Door jamb anchors at sill:
 - 1) 0.093 IN (2.3mm) 12 GA minimum steel angles welded to bottom of jambs.
 - 2) Punch angle for floor anchorage, two places
- g. Sill Anchors at Floor:
 - 1) Minimum 0.093 IN (2.3mm) 12 GA galvanized channel
 - 2) Attach channel to floor with expansion anchors
 - 3) Slide frame over channel, adjust and weld in place.
11. Anchor Access at Clip Angle Anchorage:
 - a. Contractor's option:
 - 1) Full length cover plate, width of frame face with return, same gauge as frame, joint at inside or outside corner, cover overlap frame joint, ship loose, field weld after frame installation.
 - 2) 6 IN long cover plates, width of frame face with jamb return, same gauge as frame, full backer strips at opening edges for full flush installation, ship loose, locate at embed/anchor locations, field weld after frame installation.
 - b. Weld and fill seam with metallic filler and grind smooth to conceal seam.
12. Factory Finish:
 - a. Painted:
 - 1) Clean off mill scale and foreign matter
 - 2) Grind, fill and sand
 - 3) Bonderize or phosphate treat
 - 4) Corrosion resistant iron oxide zinc chromate primer
 - b. Galvanized:
 - 1) Remove fabrication related imperfections and other foreign materials.
 - 2) Repair damaged galvanized coating with heavy zinc bearing coating.
 - 3) Clean surfaces and apply rust inhibitive primer.
13. Field joint finish:
 - a. Weld, fill entire seam with metallic filler and grind smooth to completely conceal seam.
 - b. Treat raw surfaces with corrosion resisting phosphate.
 - c. Apply rust inhibitive primer.
- D. Steel Plate Enclosures and Infill Panels (P1):
 1. Steel plate:
 - a. ASTM A283/A283M-92.
 - b. 3/16 IN thick, minimum.
 2. Infill and closure panels (P1):
 - a. Plate infill panels: Flat 3/16 IN minimum steel plate, weld in openings.
 - b. Plate closure panels: Fabricated and installed as for steel plate enclosures.
 3. Butt joints:

- a. Double 2 x 2 x 3/16 IN angles, 3/16 x 4 IN plain battens, or 3-3/4 x (3/16) x 3/4 IN ribbed battens welded to connecting plates. Battens one side where plate is against wall.
- 4. Bottom edge:
 - a. Frame and stiffen with 2 x 2 x 3/16 IN angle, both sides, 3-3/8 IN above finish floor. Angle one side only where plate is against wall.
- 5. Vertical and horizontal corners:
 - a. Connect with 2 x 2 x 3/16 IN angle on inside and on outside where exposed or accessible.
- 6. Where tops and edges abut concrete, masonry or steel construction, stiffen plates with double 2 x 2 x 3/16 IN angles.
- 7. Ceiling plates: Stiffen and join on outside with double 2 x 2 x 3/16 IN angles and on inside with 3/16 IN batten.
- 8. Frame openings:
 - a. Openings receiving hinged doors 4 IN flange x 3 IN web x 1/2 IN thick tee, fasten one leg of top to plate, other leg forms doorstop.
 - b. Sliding door or cased openings 3 x 3 x 1/2 IN angle, one leg fastened to steel plate.
 - c. Extend jamb members floor to ceiling.
- 9. Accessories:
 - a. Provide implanted and applied accessories to plate doors and panels.
 - b. Per Opening and Frame Schedule
 - c. Per Detention Hollow Metal Frame Elevations
 - d. Specified elsewhere in this Section
- E. Security Hollow Metal Infill Panels for DSHM Frames (P2):
 - 1. Fabricate per requirements of security hollow metal doors
 - 2. Weld openings flush to one side.
 - a. 2 IN weld, 12 IN centers, both sides.
- F. Detention Door Hardware:
 - 1. Hardware finishes:
 - a. US26D finish unless noted otherwise.
 - 2. Manually operated detention locks for swinging doors:
 - a. Lever tumbler style locks - general:
 - 1) Galvanized lock body
 - 2) 6 lever tumblers
 - 3) Keyed, one or both sides, as indicated in hardware sets
 - 4) Provide appropriate lock mounting and stainless steel strike for locks in hollow metal, and plate doors.
 - b. Lever tumbler deadlock - small:
 - 1) Paracentric keyed
 - 2) Acceptable manufacturers:
 - a) Southern Steel 1010A Series
 - b) Folger Adam 10 series
 - c) Airteq 5016 Series
 - d) Airteq 5010M
 - c. Lever tumbler deadlock - large:
 - 1) Paracentric keyed
 - 2) Acceptable manufacturers:
 - a) Southern Steel 1080 Series
 - b) Folger Adam 80 Series
 - c) Airteq 5086 Series
 - d) R.R. Brink 7080 Series
 - e) Comply with ASTM F1577, Grade 1
 - d. Lever tumbler automatic spring and deadlock :
 - 1) Paracentric keyed
 - 2) UL Listed

- 3) Acceptable manufacturers:
 - a) Southern Steel 1070A Series
 - b) Folger Adam 70 Series
 - c) Airteq 5076 Series
 - d) R.R. Brink 7070 Series
- 4) Comply with ASTM F1577, Grade 1
- e. Institutional grade mortise locks and latches
 - 1) Mogul Keyed
 - 2) UL Listed
 - 3) Provide zinc coated/galvanized bodies at locks with stainless steel face plates
 - 4) Solid stainless steel lever handles
 - 5) Lock function as indicated in hardware set.
 - 6) US32D Finish
 - 7) Provide appropriate stainless steel strike for use in hollow metal or wood doors.
 - 8) Acceptable manufacturers:
 - a) Southern Steel 10500 Series
 - b) Folger Adam A9300 Series
 - c) Airteq 9000 Series
 - d) R.R. Brink 1000 Series
 - 9) Comply with ASTM F1577, Grade 2
3. Jamb mounted electro-mechanical hardware for swinging doors:
 - a. Lock:
 - 1) Product numbers listed are base and may not include all options. Provide necessary components, standard or optional, as required to comply with functions indicated and specified herein.
 - 2) Half-cycle switch at locks, regardless of function indicated.
 - 3) Internal switches to monitor lock bolt and deadlock actuator.
 - 4) G90 galvanized lock body.
 - 5) Provide appropriate lock mounting for locks in hollow metal frames
 - 6) Provide appropriate stainless steel strike for mounting in hollow metal, plate or wood doors
 - 7) Key cylinder extension at locks keyed both sides or stop side.
 - 8) Integral Local Electric Key Option as Scheduled.
 - 9) UL 10B Listed to 3HR
 - b. Molex connectors:
 - 1) Provide prewired molex connectors at electrical locks.
 - c. Lock voltage:
 - 1) 24 VDC lock unless indicated otherwise.
 - 2) Remote switch or Local Electric Key Switch shall retract latchbolt.
 - 3) Latchbolt shall remain retracted for a predetermined period of time (as defined by Architect), and then latchbolt shall extend and automatically deadlock.
 - d. Remote emergency operation:
 - 1) Remote switch or Local Electric Key Switch shall retract lockbolt,
 - 2) Lockbolt shall remain retracted until a separate action has been taken at the remote location to relock the door, then the latchbolt will extend and automatically deadlock.
 - e. Manual emergency operation:
 - 1) By manually operated key at door.
 - f. Coordinate with electrical security systems contractor.
 - g. 8 IN motorized wide jamb mounted lock
 - 1) Mogul keyed, one or both sides as indicated
 - 2) Quality assurance:
 - a) Comply with ASTM F1577, Grade 1
 - 3) Acceptable manufacturers:
 - a) Airteq 9912M
 - b) R.R. Brink 5020M

- c) Southern Steel Co. 10120AM
 - d) Folger Adam 120M
- G. Motor Operated Fully Driven Sliding Corridor Devices:
1. Rack and pinion, fully driven sliding corridor device.
 2. Acceptable manufacturers:
 - a. Southern Steel 3165LX.b
 - b. Folger Adam D5B
 - c. Airteq 7350
 3. Quality assurance:
 - a. Comply with ASTM F1643, Grade 1
 4. Components:
 - a. Hanger guides: 1/4 IN thick steel plate
 - b. Lock column: 0.123 IN (3.1mm) 10 GA steel full height of door
 - c. Rear locking bar
 - d. Manual release column
 - e. Door receiver: 0.123 IN (3.1mm) 10 GA steel channel full height of door
 - f. Hanger support rollers to be turned from solid steel, 3-3/4 IN OD grooved 3/8 IN deep to engage 1/2 IN cold drawn track.
 - g. Rollers to have anti-friction ball bearing with hardened members and grease shield on both sides.
 - h. Door hanger bolts to be high alloy treated steel with eccentric bushing for adjustment and an automatic type self-locking nut.
 - i. Paint, lockhead assembly, rollers, and drive mechanism with rust inhibiting primer.
 - 1) Do not paint track
 5. Mechanism housing:
 - a. Construct horizontal mechanism housings from 0.0167 IN (4.2mm) 7 GA mild sheet steel.
 - b. Sloped top unless indicated otherwise
 - c. Continuous housing
 - d. Provide welded battens and cover plates where sections are joined.
 - e. Construct bottom hinged housing covers from 0.123 IN (3.1mm) 10 GA sheet steel.
 - f. 1/4 IN pin x 2 IN wide x 0.123 IN (3.1mm) 10 GA steel continuous hinge.
 - g. Conceal hinge except for barrel by welding inside housing.
 - h. Provide 3/8-16 button head tamper-resistant fasteners spaced 6 IN from each end and maximum 16 IN OC.
 6. Electrical components:
 - a. Motor, minimum 1/20 HP, 120VAC, 60 Hertz
 - b. Half-cycle switch and other electrical or mechanical components required for normal and emergency operation as indicated.
 - c. Limit switches to monitor door position and deadlocked condition of both lock bar and hip high key release lock.
 - d. Prewired Molex Connector to connect to field wiring
 - e. Mechanically secure connections
 - f. Coordinate with Electrical Specification Divisions.
 7. Normal operation:
 - a. Unlock, open and deadlock open a 2 FT - 0 IN wide door in not more than five seconds.
 - b. Unlock, close and deadlock closed a 2 FT - 0 IN wide door in not more than five seconds.
 - c. Stop the movement of any door in mid- travel leaving the door fixed at that point, so the door cannot be moved by hand in either direction.
 - d. Automatically deadlock closed at two concealed points at rear of each door.
 8. Remote control emergency operation:
 - a. When unlocked remotely in an emergency, move door to fully opened or closed position without relocking.

- b. Door shall not automatically relock until a separate action has been taken at remote location to relock.
- 9. Manual emergency operation:
 - a. Manual release device within full height release column at each door
 - 1) Paracentric keyed, lever tumbler lock, key one or both sides as indicated in Hardware Set.
 - 2) Mount release between 40 IN and 48 IN above floor.
 - b. When unlocked in an emergency, door may be moved to fully opened or closed position without relocking.
 - c. Door shall not automatically relock until a separate action has been taken at door to relock.

H. Miscellaneous Hardware for Swinging and Sliding Doors:

- 1. Institutional grade full mortise hinges:
 - a. Full mortise, stainless steel leaves, 4 1/2 x 4 1/2 x 3/16 IN thick.
 - b. UL Listed for rated door applications
 - c. Hospital tip with non-removable, stainless steel hinge pin
 - d. Ball Bearing Hinges with hardened tool steel ball races.
 - e. 1/4-20 stainless steel, tamper resistant screws.
 - f. Minimum 3 hinges for doors up to 85 IN high or up to 37 IN wide.
 - g. Minimum 4 hinges for doors 85 IN high and higher and for doors 37 IN wide and wider.
 - h. 1/2 IN diameter Security Studs on the back side of both leaves of hinges.
 - i. Acceptable manufacturers:
 - 1) Southern Folger 204FMSS
 - 2) Airteq 604 FMCS
 - 3) Stanley IHTCB1995R
 - 4) Brookfield Industries I-8508
 - 5) Folger Adam 4-1/2 FM-ICS
 - j. Certify compliance with ASTM-F1758, Grade 1.
- 2. Door stop:
 - a. Provide wall mounted stop at swing doors, except at doors with closers, and where conditions prevent wall mounting.
 - b. Provide floor stops where wall mounting is not possible.
 - c. Mount stops where door is held a minimum of 6 IN from wall when fully opened.
 - d. Install using two part epoxy intended for fixing rebar and/or threaded rod into concrete or filled CMU substrates
 - 1) Acceptable Product:
 - a) Powers T308+ two-part epoxy
 - e. Acceptable manufacturers:
 - 1) Wall stops:
 - a) Stanley 3002
 - b) Don-Jo 1462
 - c) Airteq 651
 - 2) Floor stops:
 - a) Stanley 3001
 - b) Don-Jo 1463
 - c) Airteq 650
- 3. Weatherproofing package:
 - a. Provide at exterior doors and where indicated.
 - b. ADA compliant
 - c. Acceptable manufacturers:
 - 1) Rigid jamb weatherstripping
 - a) Reese DS70C
 - b) Pemko 305CR
 - c) Zero No.50A

- d) National Guard Products 127NA
 - 2) Saddle threshold:
 - a) Reese S205A
 - b) Pemko 171A
 - c) Zero 8655A
 - d) National Guard Products 426
 - 3) Rain drip:
 - a) Reese R201A
 - b) Pemko 346C
 - c) Zero series 148
 - d) National Guard Products 16AD
 - 4) Sill sweep:
 - a) Reese R362C
 - b) Pemko
 - c) Zero 39A
 - d) National Guard Products 200NA
- 4. Tamper resistant interlocking threshold:
 - a. Provide where indicated.
 - b. Provide additional 0.123 IN 10 GA steel bent angle hook attached to bottom of door with tamper resistant fasteners, as detailed.
 - 1) Slot holes in angle to make adjustable.
 - 2) Align angle hook with slot in threshold, tighten screws, and then weld in place for proper fit.
 - 3) Angle should interlock with threshold when door in closed position.
 - c. ADA compliant
 - d. Acceptable manufacturers:
 - 1) Pemko 114
- 5. Smoke gaskets:
 - a. Provide at smoke/fire labeled doors:
 - b. U.L. listed
 - c. Acceptable manufacturers:
 - 1) Pemko S88D
 - 2) Reese F-897B
 - 3) National Guard Products 5050B.
- 6. Concealed door closer:
 - a. Closers on smoke/fire labeled doors and as scheduled.
 - b. Full rack and pinion hydraulic closer with adjustable spring.
 - c. Detention grade arm and track.
 - d. U.L. listed for fire door applications.
 - e. Size closer to width of door.
 - f. Acceptable manufacturers:
 - 1) LCN 2210
 - 2) No known equal
- 7. Concealed door closer with integral DPS:
 - a. Closers on smoke/fire labeled doors and as scheduled.
 - b. Integral Door Position Switch, adjustable without removing closer body.
 - c. Full rack and pinion hydraulic closer with adjustable spring.
 - d. Detention grade arm and track.
 - e. U.L. listed for fire door applications.
 - f. Size closer to width of door.
 - g. Acceptable manufacturers:
 - 1) LCN 2210 DPS
 - 2) No known equal
- 8. Closer, surface mounted:
 - a. Closers on smoke/fire labeled doors and as scheduled.
 - b. Full rack and pinion hydraulic closer with adjustable spring.

- c. Detention grade arm and track.
 - d. U.L. listed.
 - e. Size closer to width of door.
 - f. Acceptable manufacturers:
 - 1) LCN 4110/4510
 - 2) No known equal
9. Door position switch, recessed magnetic:
- a. Provide at swinging doors with electric locks and where scheduled or indicated.
 - b. Magnetic reed switch, triple biased to prevent tampering
 - c. Adjustable in the X and Y axis.
 - d. Acceptable manufacturers.
 - 1) GE Sentrol 2767
 - 2) Southern Folger 220MRS-TB
 - 3) Airteq 6200- Triple Biased
10. H monitor strike
- a. Provide at monitored manually operated doors and as scheduled
 - b. Internal switch monitors position of lock bolt
11. Head and foot bolts:
- a. Provide at both head and foot of each inactive leaf of double doors.
 - b. Mortise head bolt keeper.
 - c. Provide dust proof floor receptacles.
 - d. Acceptable manufacturers:
 - 1) Southern Steel 10105
 - 2) Folger Adam 105
12. Cylinder shield:
- a. Provide on exterior side of exterior doors with spring lever tumbler locks.
 - b. Stainless steel.
 - c. Acceptable manufacturers:
 - 1) Southern Steel 219
 - 2) Folger Adam 2CS
 - 3) Airteq 602CS
13. Escutcheons:
- a. Provide for interior key slots on spring lever tumbler locks.
 - b. Stainless steel.
 - c. Acceptable manufacturers:
 - 1) Southern Steel 218
 - 2) Airteq 601
 - 3) Folger Adam No.1
14. Silencers:
- a. Provide at all doors.
 - b. Locate and size holes in accord with UL 63.
 - c. Use plastic plugs to keep holes clear during construction.
 - d. Single frames: 3 on strike jamb stop.
 - e. Double frames: 2 on head stop.
 - f. Acceptable manufacturers:
 - 1) Quality 1337-A
 - 2) Ives No.20
15. Loop pulls:
- a. Provide where scheduled or indicated on Hinge side of door.
 - b. Surface Mounted.
 - c. 3/8 IN x 16 tamper resistant machine screws
 - d. US26D finish.
 - e. Acceptable manufacturers:
 - 1) Southern Folger 212
 - 2) Airteq 612
 - 3) R. R. Brink 300021

- 4) Hagar P8N.
- 16. Monitor strike:
 - a. Provide appropriate monitor strike where indicated for monitoring position of lock bolt.
 - b. US26D or US32D finish.
 - c. Minimum 26 GA dust-proof boxes welded to back of frame for monitor strikes
- 17. Strikes and keepers:
 - a. Provide appropriate strikes/keepers at swinging door locks.
 - b. US26D or US32D finish.
 - c. Minimum 26 GA dust-proof boxes, welded to back of frame for strikes/keepers.
- 18. Security pushbutton switch:
 - a. Provide where scheduled or indicated.
 - b. Mount inside cell or room on lock side jamb.
 - c. Mount maximum 48 IN above finish floor unless indicated otherwise.
 - d. Coordinate with Electrical Systems Contractor.
 - e. Acceptable manufacturers:
 - 1) Southern Folger 906
 - 2) R.R. Brink 201010
 - 3) Airteq 6300
- 19. Kickplates:
 - a. Stainless steel, US32D finish.
 - b. 8 IN high x 2 IN less than width of door.
 - c. .050 IN minimum thickness.
 - d. Acceptable Manufacturers:
 - 1) Hagar CD190.
 - 2) Quality
 - 3) Baldwin
 - 4) Hiawatha
 - 5) Rockwood
- I. Hardware Sets for Manually Operated Swinging Doors (100 Series):
 - 1. General:
 - a. Set numbers are fixed.
 - b. Break in numbering sequence indicates hardware sets not used.
 - 2. DHW-127MR
 - a. Institutional Grade Full Mortise Hinges
 - b. Lever Tumbler Automatic Spring and Deadlock
 - c. Keyed both sides
 - d. Concealed Door Closer with integral DPS
 - e. Monitor Strike
 - f. Loop Pull, hinge side
 - g. Recessed flush pull by door manufacturer, strike side
 - h. Gasketing
 - i. Door Stop
 - j.
 - 3. DHW-127MX
 - a. Institutional Grade Full Mortise Hinges
 - b. Lever Tumbler Automatic Spring and Deadlock
 - c. Keyed both sides
 - d. Concealed Door Closer with integral DPS
 - e. Monitor Strike
 - f. Loop Pull, hinge side
 - g. Recessed flush pull by door manufacturer, strike side
 - h. Weatherstripping Package
 - i. Door Stop
 - 4. Wide 8 IN jamb locks:
 - a. DHW-320R

- 1) Institutional Grade Full Mortise Hinges
 - 2) 8 IN Motorized Wide Jamb Mounted Lock
 - 3) Keyed both sides
 - 4) Institutional Grade Mortise Passage Set- ANSI F01 Function
 - 5) Concealed Door Closer with integral DPS
 - 6) Gasketing
 - 7) Door Stop
 - b. DHW-320X
 - 1) Institutional Grade Full Mortise Hinges
 - 2) 8 IN Motorized Wide Jamb Mounted Lock
 - 3) Keyed both sides
 - 4) Concealed Door Closer with integral DPS
 - 5) Loop Pull, hinge side
 - 6) Recessed flush pull by door manufacturer, strike side
 - 7) Door Stop
 - 8) Weatherstripping Package
 - 9) Institutional Grade Full Mortise Hinges
- J. Hardware Sets for Motor-Operated Remotely Controlled Sliding Doors:
1. General:
 - a. Set numbers are fixed.
 - b. Break in numbering sequence indicates hardware sets not used.
 2. Locks (800 Series):
 - a. DHW-820
 - 1) Motorized Fully Driven Sliding Corridor Device
 - 2) Manual release at door via hip high key release
 - 3) Key both sides
 - 4) Loop Pull, hinge side
 - 5) Recessed flush pull by door manufacturer, stop side
 - 6) Door Skirt
 - b. DHW-820R
 - 1) Motorized Fully Driven Sliding Corridor Device
 - 2) Manual release at door via hip high key release
 - 3) Key both sides
 - 4) Loop Pull, hinge side
 - 5) Recessed flush pull by door manufacturer, stop side
 - 6) Door Skirt
 - 7) Gasketing as required to comply with UL requirements
- K. Sliding Gate Operators/Gate Locks:
1. GDHW-1001
 - a. Motor Operated Sliding Gate Operator, Southern Steel 9100
 - b. Components:
 - 1) Gate weight not to exceed 1,000 LBS.
 - 2) Operators are designed to operate gates up to a 24 FT maximum width.
 - 3) 1/3 HP, 208 VAC, 60 hertz, 3 phase, 4 wire motor
 - 4) Protect motors from overload with thermal safety devices.
 - 5) I-beams to be provided along entire length of gate travel.
 - 6) Sink I-beam in ground with forged and welded steel guides flush with roadway.
 - 7) Locking pilaster to be provided with 7 GA removable cover plate.
 - 8) Paint entire assembly, except track, rollers and drive mechanism with rust inhibiting primer.
 - c. Mechanism housing:
 - 1) Housing shall be constructed of 7 GA sheet steel plate. Housing covers shall be hinged and fastened with tamper resistant fasteners.
 - 2) Weatherproof cover shall be constructed of 10 GA sheet steel.
 - d. Controls:

- 1) Control switches with 3 pushbutton stations marked open, closed, and stop.
 - 2) Red and green indicator lamp at each switch to show condition of gate.
 - 3) Conceal wiring.
 - 4) Provide emergency manual control mechanism to permit unlocking and mechanical operation by means of a crank in case of power failure.
- e. Function:
- 1) Gate to move from the open position to closed and deadlocked position at not less than 30 FT per minute.
 - 2) Keyless locking device engaging each gate in three places located in the locking pilaster.
 - 3) When gate is in the open position, openings in the locking pilaster shall be covered.
 - 4) Two or more gates (or pairs of gates) shall be electrically interlocked so that it shall be impossible to unlock and operate more than one gate unit at a time.
 - 5) When operator is in the closed position, it shall be impossible to move the gate to the open position except by electric or mechanical operators provided.
2. GDHW-1251
 - a. Lever Tumbler, Solenoid Operated Gate Lock, Southern Steel 1050SD-2
 3. GDHW-1253
 - a. Lever Tumbler, Solenoid Operated Gate Lock, Southern Steel 1050RD-2
- L. Keys and Keying:
1. Establish separate master key system for security hardware.
 - a. Determine keying, master keying and grand master keying at joint meeting of Architect/Owner and Detention Equipment Contractor.
 - b. Following meeting, Detention Equipment Contractor will submit complete keying schedule for Architect/Owner review and approval.
 - c. 3 master keys for each master key set.
 - d. 6 day keys for each change key identified in Keying Schedule.
 - e. Detention Equipment Contractor shall deliver keys for security locks directly to Owner at Substantial Completion.
 2. Key Control System:
 - a. Cabinet:
 - 1) High security Paracentric spring lever 6 tumbler lock
 - 2) Provide appropriate leaves for system.
 - 3) Provide fillings and accessories.
 - b. Install in Central Control Room, and/or where indicated.
 - 1) Provide filler panels, surrounds and anchors.
 - c. Complete system set up.
 - 1) Install keys.
 - 2) Provide dual tag system.
 - 3) Provide 3 way cross index system.
 - 4) Instruct Owner's personnel in proper usage.
 - d. Capacity:
 - 1) Provide sufficient space in cabinets to accommodate keys to be kept at that location including master and extra keys.
 - 2) Cabinet to accommodate paracentric, mogul and standard sized keys.
 - 3) Provide for 25 PCT expansion of each key type kept in cabinet.
 - 4) Provide a key cabinet to store key blanks.
 - e. Acceptable manufacturers:
 - 1) Telkee
 - 2) Southern Steel 6 Series
 - 3) Folger Adam 505
- M. Detention Access Doors/Panels (Steel Plate):
1. Hinged Style, Custom:
 - a. Fabricate from 3/16 IN thick steel sheet.
 - b. Fabricate from 3/16 IN thick galvanized sheet in exterior or shower applications.

- c. Provide 10 series paracentric lever tumbler lock and two No. 3 hinges (welded).
 - d. Size: 24 IN x 48 IN unless indicated otherwise.
 - e. Acceptable manufacturers:
 - 1) Southern Steel 590, custom.
 - 2) Folger Adam 416, custom.
- N. Detention Steel Gratings/Barrier Grilles:
- 1. Tool Resistant steel gratings and barrier grilles:
 - a. Vertical bars:
 - b. 2-1/4 IN x 3/8 IN TR flat steel bars, ASTM A627.
 - c. Produced especially for security use.
 - d. Mild Steel AISI 1018
 - e. Horizontal bars:
 - f. 7/8 IN diameter TR ribbed steel bars, ASTM A627.
 - g. Mild Steel AISI 1018
 - 2. Barrier Grille, Fabrication:
 - a. Space ribbed round bars at 6 IN OC.
 - b. Space flat bars at 12 IN OC.
 - c. Pass ribbed round bars through flat bars.
 - d. Interlock intersections without reducing bar diameter.
 - e. Pipe sleeves, swedging, caulking, friction or welding at intersections of bars is not permitted.
 - f. Provide grating frame fabricated of flat bars to match other flat bars.
 - g. Weld bars to frame.
 - h. Flat bar length of gratings and or grilles not to exceed 6 FT. For greater spans consult structural for design and sizing of intermediate independent supports.
 - i. When flat bar length exceeds 4 FT provide WT 4 x 6.5 intermediate support member at right angles.
 - j. Add the following three paragraphs if grating is used for a partition. Delete if not required.
 - k. Where grating forms partition, locate bottom flat horizontal member 3 IN above finish floor.
 - l. Extend every fifth ribbed round vertical bar below finish floor to 1/2 IN above rough slab.
 - m. Anchor vertical bars to rough slab.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contract Documents show arrangement and location of items of equipment.
 - 1. If it is necessary to vary from arrangement shown, because of structural, mechanical, electrical or other considerations, make such variations only after approval of Architect and at no additional expense to Owner.
- B. Verify rough in and field dimensions prior to fabrication or installation.
 - 1. Measure recesses and openings.
 - 2. Provide trim pieces, fillers, closures in sizes required.
- C. Provide coordination drawings to assure coordination between related trades.
- D. Examine areas, substrates, anchors and grounds to receive detention equipment.
 - 1. Where no anchorage has been provided, install embed plate and weld item to embed.
 - 2. Expansion bolts not allowed.
- E. Report unsatisfactory conditions.

- F. Do not begin installation until unsatisfactory conditions have been corrected and areas to receive Detention Equipment are broom cleaned, lighted, exterior walls in place, exterior windows glazed and roof installed.

3.2 INSTALLATION

- A. Install work in accordance with manufacturer's recommendations, instructions and shop drawings.
- B. Grout fill of Detention Hollow Metal frames:
 - 1. Grout fill heads, jambs and sills.
 - 2. Grout fill intermediate mullions where they form part of a door opening.
 - 3. Where grouting is done after frame installation, replace frame material removed, weld, fill with metallic filler and grind smooth to completely conceal seam.
 - 4. Grout: See Section 04 05 13.
- C. Welding:
 - 1. Comply with American Welding Society standards.
 - 2. Certify each welder as qualified by American Welding Society.
 - 3. Remove burrs and rough edges.
 - 4. Where welding is required but no spacing indicated, minimum 1/8 IN fillet weld, 2 IN long, 12 IN on center.
 - 5. Submit certification when requested by Architect.
- D. Fastening Devices:
 - 1. Install tamper resistant fasteners: Torx Plus, 5-lobe with center reject pin, unless indicated otherwise.
 - 2. Provide one style fastener throughout.
 - 3. Provide fasteners spaced maximum 2 IN from ends and 12 IN on center unless indicated otherwise.
- E. Anchoring Devices:
 - 1. Minimum 3/8IN x 3IN unless otherwise specified.
 - 2. Install in holes drilled by bits recommended by manufacturer.
 - 3. Install anchors per manufacturer's recommendations.
 - 4. Weld heads of anchors after installation to prevent removal.
- F. Installation constitutes acceptance of responsibility for performance.
- G. Touch up Primers in Preparation for Finish Painting.
 - 1. Remove scale, splatter burns, abrasions and foreign materials.
 - 2. Galvanized material:
 - a. Touch up with high zinc dust content paint.
 - b. Base Product: Galvilite by ZRC Worldwide.
 - c. Optional: Tnemec.
 - 3. Other primed material:
 - a. Touch up with rust inhibiting primer.
- H. Finish Painting:
 - 1. See Section 09 91 23.
- I. Protect installed work from damage or soiling.
 - 1. If materials are damaged or soiled, Architect reserves right to:
 - a. Require extended three year warranty.
 - b. Require removal and replacement of damaged items at no cost to Owner.
 - c. Require Testing of damaged equipment by qualified independent testing laboratory to ensure fitness of equipment to perform as specified at no cost to Owner.

3.3 EQUIPMENT - OPERATIONAL TESTING PERIOD

- A. Prior to Substantial Completion of the Project, DEC shall coordinate with General Contractor and Electrical Systems Contractor a 14 day Testing period.

- B. Work of this Section shall be complete before commencement.
- C. Check daily and emergency operation of equipment.
 - 1. Remote Control and manual.
 - 2. Keys and keying.
- D. Keep log of anomalies, malfunctions and repairs made during this period.
 - 1. Turn over to Owner and/or Architect for review if requested.
- E. Turnover Training Program may be scheduled during this period, but not before.

3.4 EQUIPMENT - DEMONSTRATION AND PERSONNEL INSTRUCTION

- A. Turnover Training Program at job site for minimum of 40 working hours.
 - 1. Demonstrate equipment.
 - 2. Instruct Owner's personnel in operation, repair and maintenance.
 - 3. Divide Training into two levels
 - a. Operational: for staff and maintenance personnel
 - b. Maintenance and Repair: specific training for Maintenance personnel.
- B. Additional in-factory training of 2 Owner personnel for minimum of 5 working days.
 - 1. Instruct Owner's personnel in repair and maintenance.
 - 2. Include airfare, if project is more than 200 miles from factory
 - 3. Include Hotel and meals, not to exceed \$150.00 per day.
- C. Record audio and video training sessions.
 - 1. When complete, turn over to Owner in DVD format.

END OF SECTION

SECTION 11 19 19
TAMPER RESISTANT FASTENERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Tamper Resistant Fasteners, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Provide fasteners of a single design throughout.
- B. Restrict tool sales to OEM and authorized service technicians.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Submit current manufacturer's data showing license number.
 - a. Upon request, submit complete test reports from independent testing laboratory confirming data shown in manufacturer's product data.
- B. Contract Closeout Information:
 - 1. Submit copies of receipts for maintenance materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Tamper Resistant Fasteners:
 - 1. Base:
 - a. Textron.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Tamper Resistant Fasteners:
 - 1. Appearance: Five lobe socket with center pin.
 - 2. TORXplus Tamper Resistant drive system, licensed by Camcar Division of Textron, Inc.
 - a. Known licensees include Tamper-Pruf Screw Co.; 8808 Somerset Blvd.; Paramount CA 90723; (310/531-9340); Fax: (310/531-2464).
 - 3. Tools: From manufacturer licensed by fastener manufacturer.
 - 4. Provide 18-8 stainless steel fastener assemblies at exterior and at wet areas.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine areas to receive work.
- B. Correct unsatisfactory conditions.
- C. Start of work constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install fasteners in accordance with manufacturer's recommendations, with uniform contact against materials being fastened.

- B. Add thread-grip compound equal to Lok-Tite where specified, and where fasteners can be removed with fingers.

END OF SECTION

SECTION 11 40 00
FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the contract including general and supplementary conditions and general requirements apply to the work specified in this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Plumbing: Refer to Division 22, including:
 - 1. Rough-in piping for gas and water supply and waste lines.
 - 2. Piping for supply and waste lines.
 - 3. Traps, grease traps, line strainers, tail pieces, valves, stops, shut-offs and miscellaneous fittings required for complete installation.
 - 4. Final connections.
 - 5. Indirect drains for sink compartments.
- B. Mechanical: Refer to Division 23.
 - 1. Roof mounted fans and connecting ductwork not shown as part of the kitchen equipment.
 - 2. Final connections, including approved welded duct connections to hoods.
- C. Electrical: Refer to Division 26, including:
 - 1. Rough-in conduit, wiring, line and disconnect switches, safety cut-offs and fittings, control panels, fuses, boxes and fittings required for complete installation.
 - 2. Final connections, including mounting and wiring of switches furnished as part of the food service equipment (unless otherwise indicated on the drawings).

1.3 WORK INCLUDED THIS SECTION

- A. Furnish and install all food service equipment as specified herein, including that which is reasonably inferred, with all related items necessary to complete work shown on contract drawings and/or required by these specifications.
- B. Electrical Work:
 - 1. Inter-wiring of food service equipment between components within equipment, such as heating elements, switches, thermostats, motors, etc., complete with junction box as is applicable, ready for final connection.
 - 2. Voltages shall be as indicated on contract drawings. Any differences in electrical characteristics at job site from those shown on contract documents must be submitted to Architect for consideration prior to ordering equipment.
- C. Plumbing Work:
 - 1. Furnish all equipment with faucets, sink waste assemblies, and trim as specified in this section.
 - 2. Other than sink compartments, extend all indirect waste lines to nearest floor receptor. All such drain lines to be properly sized. Drain shall terminate with proper air gap above flood rim of floor receptor. Drain lines to be copper with silver paint unless specified otherwise. Drain lines in public areas to be chrome plated where exposed to view.

- D. Mechanical Work:
 - 1. Provide exhaust hoods with connection collars ready for final connection by HVAC Section.
 - 2. Provide stainless steel exposed ducts to ceiling for dishmachine.

1.4 QUALITY ASSURANCE

- A. It is required that all custom fabricated equipment such as food serving units, tables, sinks, counter tops, etc., be manufactured by a food service equipment fabricator who has the plant, personnel and engineering equipment required. Such manufacturer shall be subject to approval of Architect.

All work in above category shall be manufactured by one manufacturer, and shall be of uniform design and finish.

- B. Manufacturer of this equipment must be able to show that he is now and for the past five years has been engaged in manufacture or distribution of equipment, as required under this contract, as his principal product.
- C. Manufacturer of equipment herein specified shall be a recognized distributor for items of equipment specified herein which are of other manufacture than his own.
- D. Only manufacturers who can meet the foregoing qualifications will be acceptable.
- E. All work shall be done in an approved workmanlike manner, to the complete satisfaction of the Owner.

1.5 SUBMITTALS

- A. Submit shop drawings as required by General Conditions. All shop drawings and rough-in drawings shall be CAD drafted, and must be submitted in .DWF or .PDF electronic format. Multiple hard copies are not acceptable.
- B. Shop drawings and bound brochures covering manufactured or "buy-out" items covering all work and equipment included in this contract shall be submitted to Architect as soon as possible after award of contract. After approval, Food Service Equipment Contractor shall furnish to Architect electronic files of shop drawings and brochures, corrected as required by virtue of review comments, for distribution to various interested trades on project. All costs of reproduction and submission shall be part of contract.

Bound brochure and cut sheet submittals must be copied to Owner for review and comment.

- C. Provide fully dimensioned rough-in plans at 1/4" scale, consisting of a separate drawing for each discipline. Each drawing shall show equipment shaded down 50%. Rough-in set shall include all required mechanical, electrical, plumbing, services for equipment and dimensioned rough-in

location for same. Rough-in locations shown shall make allowances for required traps, switches, etc., thereby not requiring interpretation or adjustment on the part of other Contractors.

Drawings shall indicate dimensions for floor depressions, wall openings, etc., for equipment.

Food Service Equipment Contractor shall visit site to verify all rough-in and sleeve locations prior to installation of finished floors and shall cooperate with other Contractors involved in proper location of same. Food Service Equipment Contractor shall be responsible for any required relocations of rough-in due to errors or inaccuracies on those rough-in plans which he prepares.

- D. Rough-in plans shall include all required services which relate to equipment, but which may not directly connect thereto, such as convenience outlets at walls, hose stations, floor drains, etc.
- E. Rough-in plans shall also include all required outlet services for equipment which is designated on drawing schedule, even though such equipment may not be included in this contract.
- F. Fully dimensioned and detailed shop drawings of custom fabricated equipment items shall be submitted, drawn at 3/4" and 1 - 1/2" scale for plans, elevations and sections respectively.

Drawings shall show all details of construction, installation, and relation to adjoining and related work where cutting or close fitting is required. Drawings shall show all reinforcements, anchorage, and other work required for complete installation of all fixtures.

- G. Do not begin fabrication of custom manufactured equipment until approvals of shop drawings have been received and until field measurements have been taken by Food Service Equipment Contractor, where such measurements are necessary to assure proper conformance with intent of contract drawings and specifications.
- H. Make field measurements, giving due consideration to any architectural, mechanical, or structural discrepancies which may occur during construction of building. No extra compensation will be allowed for any difference between actual measurements secured at job site and dimensions indicated on contract drawings. Any differences which may be found at job site during field measurements shall be submitted to Architect for consideration before proceeding with fabrication of equipment.
- I. Submit illustrative brochures for manufactured or "buy-out" equipment items, complete with illustrations, specifications, line drawings, rough-in requirements, and list of accessories or other specified additional requirements. Brochures shall be bound and shall include data on all equipment which is to be provided, arranged in numerical sequence which conforms to item numbers of specifications. Omission of data does not reduce obligation to provide items as specified.
- J. Approval of shop schedules and brochures will be in general and shall be understood to mean that Architect has no objection to use of materials or processes shown. Approval does not relieve Food Service Equipment Contractor from responsibility for errors, omissions, or deviations from contract requirements.

1.6 SUBSTITUTIONS - STANDARDS

- A. Refer to Instructions to Bidders and Division 01 for requirements.
- B. All unspecified substitutions after bid must be submitted to Owner for written approval prior to acceptance.

1.7 DRAWINGS

- A. Drawings which constitute part of contract documents indicate general arrangement of piping and location of equipment. Should it be necessary to deviate from arrangement indicated in order to meet structural conditions, make such deviations without expense to Owner.
- B. Specifications and drawings are reasonably exact, but their extreme accuracy is not guaranteed. Drawings and specifications are for assistance and guidance of Contractor, and exact locations, distances and levels shall be governed by the building.

1.8 MANUFACTURER'S DIRECTIONS

- A. Follow manufacturer's directions in all cases where manufacturers of articles used in this contract furnish directions or prints covering points not shown on drawings or specifications.

1.9 INDUSTRY STANDARDS

- A. Electric operated and/or heated equipment, fabricated or otherwise, shall conform to latest standards of National Electric Manufacturers Association and of Underwriters Laboratories, Inc., and shall bear the U.L. label.
- B. Cooking and hot food holding equipment shall meet minimum construction standards as noted by NSF #4.
- C. Refrigeration equipment shall meet minimum construction standards as noted by NSF #7.
- D. Items of food service equipment furnished shall bear the N.S.F. seal.
- E. Food service equipment shall be installed in accord with N.S.F. standards.
- F. Work and materials shall be in compliance with requirements of applicable codes, ordinances and regulations, including but not limited to those of Occupational Safety and Health Act (OSHA), National Fire Protection Association, State Fire Marshal, State Accident Commission, U.S. Public Health Service, State Board of Health, local health codes, etc.
- G. No extra charge will be paid for furnishing items required by regulations, even though such may not be shown on drawings or called for in these specifications.

- H. Rulings and interpretations of enforcing agencies shall be considered part of regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURED EQUIPMENT

- A. All like types of equipment such as all refrigerated and heated cabinets, all ovens, and all mixers shall be by the same manufacturer.
- B. Except as may be specified otherwise under individual item specifications in "Equipment Schedule", all items of standard manufactured equipment shall be complete in accord with manufacturer's standard specification for specific unit or model called for, including finishes, components, attachments, appurtenances, etc., except as follows:
- C. All items of standard equipment shall be that manufacturer's latest model at time of delivery.
- D. Substitutions for manufactured equipment specified will be accorded consideration under terms set forth in "Substitutions - Standards".

2.2 FABRICATED EQUIPMENT

- A. Stainless steel shall be U.S. standard gauges as called for, 18-8, Type 302, or 304 type, No. 4 finish.
- B. Galvanized iron shall be Armco or equal. Framework of galvanized iron shall be welded construction, having welds smooth, and where galvanizing has been burned off, touched up with high grade aluminum bronze.
- C. Legs and crossrails shall be continuously welded, unless otherwise noted, and ground smooth.
- D. Bottom of legs at floor shall be fitted with sanitary stainless-steel bullet type foot, with not less than 2" adjustment.
- E. Legs shall be fastened to equipment as follows:
 - 1. To sinks by means of closed gussets. Gussets shall be stainless steel, reinforced with bushing, having set screws for securing legs.
 - 2. To tables and drainboards with closed gussets which shall be welded to stainless steel hat sections or channels, 14 gauge or heavier, exposed hat sections having closed ends. Bracing shall be welded to underside of tops.
- F. Closed gussets shall be a 3" minimum diameter at top, continuously welded to frame members or to sink bottom.
- G. Sinks, unless otherwise specified, shall be furnished with rotary type waste outlets, without connected overflows: Atlantic Brass Works Model 772-RB; Fisher Brass Foundry Model 250A; T&S; or approved equal. Where exposed, furnish wastes chromium plated.

- H. Rolls shall be 1 1/2" diameter, except as detailed contrary, with corners bull-nosed, ground and polished.
- I. Seams and joints shall be shop welded. Welds to be ground smooth and polished to match original finish. Materials 18 gauge or heavier shall be welded.
- J. Metal tops shall be one-piece welded construction, unless specified otherwise, reinforced on underside with stainless steel hat sections or channels welded in place. Cross-bracing to be not more than 30" on centers.
- K. Hardware shall be solid materials and except where unexposed or specified contrary, of cast brass, chrome plated. Stampings are not acceptable. Identify all hardware with manufacturer's name and number so that broken or worn parts may be ordered and replaced.
- L. Fabricate sink compartments with fully coved vertical and horizontal corners. Multiple compartment partition to be double thickness, continuously welded where sheets join at top. Front of multiple compartment sinks to be continuous on exterior. Bottoms shall be creased to drain.
- M. Ends of all fixtures, splash-backs, shelves, etc., shall be finished flush to walls or adjoining fixtures.
- N. Dish tables, drain tables, splash-backs and turned-up edges shall have radius bends in all horizontal and vertical corners, coved at intersections.
- O. Rounded and coved corners or radius bends shall be 1/2" radius or longer.
- P. Shelves in fixtures with enclosed bases shall be turned up on back and sides and feathered slightly to insure tight fit to enclosure panels. Bottom shelves shall be made for easy removal unless otherwise noted.
- Q. Undersides of tops to be coated with heavy-bodied resinous material compounded for permanent, non-flaking adhesion to metal, 1/8" thick, applied after reinforcing members have been installed, drying without dirt-catching crevices.
- R. Metal components, unless specified or noted otherwise, to be the following gauges:

Counter and table tops	14 ga.	Stainless Steel
Wall shelves	16 ga.	Stainless Steel
Pipe leg undershelves	16 ga.	Stainless Steel
Drawer fronts	16 ga.	Stainless Steel
Enclosed cabinet bases	18 ga.	Stainless Steel
Sinks and drainboards	14 ga.	Stainless Steel
Legs 1 - 5/8" diameter	16 ga.	Stainless Steel

2.3 HEATING EQUIPMENT

- A. Wherever electric heating equipment or thermostat control for such equipment is specified, it shall be complete, and of the materials, size and rating specified within equipment item or details.
All such equipment shall be designed and installed to be easily cleaned or to be easily removed for cleaning.
- B. Electrical appliances or heating element circuits of 120 volts shall not exceed 1650 watts, unless specifically shown contrary.

2.4 SWITCHES AND CONTROLS

- A. Food Service Equipment Contractor shall supply on each motor driven appliance or electrical heating unit suitable control switch of proper type in accord with Underwriter's Code.
- B. All internal wiring for fabricated equipment items included, all electrical devices, wiring, controls, switches, etc., built into or forming an integral part of these items shall be furnished and installed by Food Service Equipment Contractor in his factory or building site with all items complete to junction box for final connection to building lines by Electrical Contractor.
- C. Provide standard 3-prong plugs to fit "U" slot grounding type receptacles, similar to No. 5262, for all equipment items powered by plugging into 110-120 volts, single phase AC. Also, provide suitable length 3-wire cord for equipment.

2.5 CONNECTION TERMINALS

- A. All equipment shall be complete with connection terminals as standardized by equipment manufacturers, except where specified otherwise.

2.6 LOCKS

- A. Fit all doors for reach-in refrigerated compartments with locking type latches. Provide master keys.

2.7 GAS EQUIPMENT

- A. Equipment to be suitable for use with gas available at site, and to be furnished by F.S.E.C. with pressure regulators designed to work with incoming pressure.

2.8 GAS QUICK DISCONNECTS

- A. Where specified, gas quick disconnects shall be furnished complete with gas valve, gas connector hose, quick disconnect fitting elbows, and restraining cable, all AGA approved. Gas hose shall

be flexible, braided or corrugated stainless steel with smooth plastic exterior coating or sleeve of heat shrink tubing (provide on all caster mounted gas equipment).

- B. All mobile cooking equipment requiring surface protection by fire suppression nozzles shall be secured in place by stainless steel cradle type wheel stops as manufactured by the Eagle Group or Select Stainless products. Plastic wheel stops are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Work under this contract and covered under this section of specifications includes but is not limited to:
 - 1. Cutting of holes and/or ferrules on equipment for piping, drains, electrical outlets, conduits, etc. as required to coordinate installation of food service equipment with work of other Contractors on project.
 - 2. Field checking of building and rough-in requirements, and submission of brochures and shop drawings, all as required hereinbefore under "Submittals".
 - 3. Repair of all damage to premises as result of this installation, and removal of all debris left by those engaged in this installation.
 - 4. Having all food service equipment fixtures completely cleaned and ready for operation when building is turned over to Owner.

3.2 INSTALLATION PROCEDURES

- A. Food Service Equipment Contractor shall make arrangements for receiving his custom fabricated and "buy out" equipment and shall make delivery into building as requisitioned by his installation superintendent. He shall not consign any of his equipment to Owner or to any other Contractor unless he has written acceptance from them and has made satisfactory arrangements for the payment of all freight and handling charges.
- B. Food Service Equipment Contractor shall deliver all of his custom fabricated and "buy out" equipment temporarily in its final location, permitting Trades to make necessary arrangements for connection of service lines; he shall then move equipment sufficiently to permit installation of service lines, after which he shall realign his equipment level and plumb, making final erection as shown on contract drawings.
- C. All portable or counter mounted equipment weighing in excess of 25 pounds shall be mounted on 4" stainless steel adjustable legs.

- D. This Contractor shall coordinate his work and cooperate with other trades working at site toward the orderly progress of the project.
- E. Architect or Owner's Agent shall have access at all times to plant or shop in which custom fabricated equipment is being manufactured, from time contract is let until equipment is shipped, in order that progress of work can be checked, as well as any technical problem which may arise in coordination of equipment with building. Any approval given at this point of manufacture shall be tentative, subject to final inspection and test after complete installation.
- F. Food Service Equipment Contractor shall assist Architect, Owner, and/or Owner's Agent in making any desired tests during or prior to final inspection of equipment; he shall remove immediately any work or equipment rejected by Architect, Owner, and/or Owner's Agent, replacing same with work conforming with contract requirements, and shall reimburse mechanical and/or other contractors involved for extra work made necessary by such replacement.
- G. This Contractor shall keep premises free from accumulation of his waste material and rubbish, and at completion of his work shall remove his rubbish and implements, leaving areas of his work broom clean.
- H. This Contractor shall provide and maintain coverings or other approved protection for finished surfaces and other parts of his equipment subject to damage during and after erection. After removal of protective coverings, all field joints shall be grounded, polished and entire work shall be thoroughly cleaned and polished.

3.3 TRIMMING AND SEALING EQUIPMENT

- A. Seal completely spaces between all units to walls, ceilings, floors, and adjoining (not portable) units with enclosed bodies against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material best suited to nature of equipment and adjoining surface material.
- B. Close ends of all hollow sections.
- C. Equipment butting against walls, ceilings, floor surfaces and corners to fit tightly against same; backsplashes or risers which fit against wall to be neatly scribed and sealed to wall with DowCorning # 732 RTV or General Electric clear silicone sealant, wiping excess sealant out of joint to fillet radius. Where required to prevent shifting of equipment and breaking wall seal, anchor item to floor or wall.
- D. Treat enclosed spaces (inaccessible after equipment installation) for vermin prevention in accord with industry practice.

3.4 TESTING AND DEMONSTRATION OF EQUIPMENT

- A. After completion of installation, all equipment using water, gas, and electricity shall be performance inspected and tested by factory certified service agent, including wet test of hood fire suppression systems, if so required. Food Service Equipment Contractor shall document that these inspections have been performed prior to scheduling demonstrations and Owner acceptance of equipment.
- B. Food Service Equipment Contractor shall arrange to have all manufactured, mechanically operated equipment furnished under this contract demonstrated by authorized representatives of equipment manufacturers, these representatives to instruct Owner's designated personnel in use, care and maintenance of all items of equipment after same are in working order. Demonstration and instruction shall be held on dates designated by Owner.

- C. Food Service Equipment Contractor shall provide a competent service representative to be present when installation is put into operation.

3.5 EQUIPMENT HANDLING AND STORAGE

- A. Deliver equipment to site, properly crated and protected, and store in safe place, protected from damage until time for installation.

3.6 GUARANTEE

- A. Special Project Warranty: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required, provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. This warranty shall be in addition to, and not limitation of, the rights the Owner may have against the Contractor under the Contract Documents.

- B. Warranty Period:

1 year from date of Substantial Completion, all new equipment furnished. However, manufacturer's warranty shall prevail when the period is longer than one year.

5-year warranty period on refrigeration compressors.

10-year warranty period on walk-in panels.

3.7 OPERATING AND MAINTENANCE MANUALS

- A. After completion of installation, Food Service Equipment Contractor shall present to Owner three sets of all operating and maintenance manuals, covering all mechanically operated equipment furnished under this contract, each set being neatly bound in looseleaf binder having durable cover.
- B. Include in each binder a list of names, addresses and telephone numbers of local servicing agencies authorized to make necessary repairs and/or adjustments of equipment furnished under this contract.

PART 4 – EQUIPMENT SCHEDULE

ITEM 01 PLASTIC SHELVING UNIT QUANTITY AS SCHEDULED

Provide four-tier polymer 16-gauge stainless steel louvered/embossed shelving unit complete with tubular uprights and having the following features:

- A. Arrange using quantities and sizes as shown on Plan Drawings.
- B. 800 lbs. max weight per shelf.
- C. -40° to 140° F (-40° to 60° C) operating temperature range.
- D. Adjustable composite feet.
- E. Tool free assembly.

- I. Stainless-steel H-frame legs with adjustable stainless-steel bullet feet, undershelf on left.
- J. Pre-Rinse spray with faucet.
 - Splash mount,
 - Wall bracket
- K. Add-A-Faucet, Select Stainless Model PR-AF (or Chicago Faucet, Fisher)
- L. (1) Twist handle lever drain, 1-1/2" drain outlet with overflow.

Sink to be as manufactured by Select Stainless, Model 1B24-2D36-14, Eagle, SCF, or fabricated equal.

ITEM 10 TWO COMPARTMENT SINK QUANTITY AS SCHEDULED

Provide two-compartment sink with drainboards as follows:

- A. Two compartment, 110"W x 30"D, SEE DETAIL DRAWINGS.
- B. 14/300 stainless-steel construction.
- C. 24" x 24" x 14" deep compartments.
- D. 30" drainboards, see direction of operation as shown on Plan.
- E. 9"H backsplash.
- F. 8" OC splash mount faucet hole.
- G. Marine edge on front & sides.
- H. (2) Lever waste
- I. Stainless-steel H-frame legs with adjustable stainless-steel bullet feet.
- J. Heavy Duty Faucet:
 - Splash-mount
 - 8" centers
 - 12" long

Sink to be as manufactured by Select Stainless, Model 2B24-2D30-14, Eagle, SCF, or fabricated equal.

ITEM 11 PLANETARY MIXER QUANTITY AS SCHEDULED

Provide 80-quart floor model mixer having the following features:

- A. 3 HP motor, voltage characteristics as scheduled.
- B. Standard finish.
- C. Stainless steel bowl and guard; bowl truck.
- D. Two stainless steel 40-quart bowls and one adaptor.

- E. (4) fixed speeds plus stir speed.
- F. Gear-driven transmission.
- G. 50-minute digital timer.
- H. Power bowl lift.
- I. Accessories:
 - "B" beater
 - "ED" dough hook
- J. 3 HP.
- K. Voltage as scheduled, direct connection.

Mixer to be as manufactured by Hobart, Model HL800-1STD, Varimixer, or Univex.

ITEM 12 WORKTABLE QUANTITY AS SCHEDULED

Provide stainless steel worktable having the following features:

- A. 72"W x 30"D.
- B. 14/300 stainless steel top with turned down edges.
- C. 18-gauge stainless-steel undershelf.
- D. 16-gauge stainless steel legs & adjustable stainless-steel feet.
- E. (2) Pot Rack:
 - Table mount
 - 60"W x 24"D x 12"H
 - Triple bar circular design
 - 3/16" x 2" 300 series stainless-steel flat bar
 - Stainless-steel adjustable tubular table support with adjustable height
 - (3) stainless-steel double-prong pot hooks per foot
 - Select Stainless 5CPR-TS

Worktable to be as manufactured by Select Stainless, Model 6SU-30-14, Eagle, SCF, or fabricated equal.

ITEM 13 NOT USED

ITEM 14 FLOOR TROUGH QUANTITY AS SCHEDULED

Provide floor trough with removable grate having the following features:

- A. 120"W x 15"D, 6" deep receptacle.
- B. (2) 4" OD tailpieces.
- C. Stainless-steel beehive strainer.
- D. Locking device welded on trough for grating.

- E. 14/304 stainless-steel, brushed satin finish.
- F. (PFG-SEC) security pultruded fiberglass grating.
- G. ADA spacing.
- H. Equivalent to IMC/Teddy Duradek, Model PFG.
- I. See plan for clarification. Coordinate with General Contractor and Plumbing Contractor to assure proper installation.

Grate to be IMC/Teddy Food Service Corp., Model SEC-ASFT-15120-PFG, Eagle, SCF, or fabricated equal.

ITEM 15 KETTLE, GAS QUANTITY AS SCHEDULED

Provide gas-fired kettle having the following features:

- A. Capacity of 60 gallons.
- B. Gas:
 - Field verify type
 - Quick disconnect
 - Pressure regulator
- C. Stainless-steel spring assisted cover.
- D. 2" plug draw-off valve with perforated strainer.
- E. Graduated measuring rod.
- F. Stainless-steel construction with 316 series stainless-steel liner.
- G. Flanged feet.
- H. Voltage as scheduled, cord and plug, electric ignition.
- I. Double Pantry Deck Mount Faucet:
 - Backflow preventer
 - Pot filler
 - L faucet bracket

Kettle to be as manufactured by Vulcan, Model GS60E, Market Forge, or Groen.

ITEM 16 TILT SKILLET, GAS QUANTITY AS SCHEDULED

Provide gas-fired tilting braising pan having the following features:

- A. Capacity of approximately 40 gallons.
- B. Gas:
 - Field verify type
 - Quick disconnect
 - Pressure regulator

- Set of 4 casters (2 locking)
- Connecting strip and hardware
- Ceramic Heat lamp

K. Stainless-steel tank cover/work surface top.

Fryers as manufactured by Vulcan, Model LG500-4/VX15-FW-2/MF-1, Dean, or Pitco.

ITEM 18 COUNERTOP GRIDDLE, GAS QUANTITY AS SCHEDULED

Provide gas counter top griddle with the following features:

- A. Countertop, 72" W x 30" D cooking surface.
- B. Gas:
- Field verify type
 - Quick disconnect
 - Pressure regulator
- C. 1" thick polished steel griddle plate.
- D. Embedded mechanical snap action thermostat every 12".
- E. Millivolt pilot safety, manual ignition.
- F. Low profile.
- G. Stainless-steel front & sides.
- H. Front grease trough.
- I. 4" back & tapered side splashes.
- J. 4" adjustable legs.
- K. Equipment Stand:
- Universal
 - 73" W x 24" H
 - 1/2" marine edge
 - Undershelf
 - Stainless-steel
 - 5" casters
 - Vulcan STAND/C-72

Griddle to be as manufactured by Vulcan, Model MSA72-30, Garland, or Southbend.

ITEM 19 RANGE, GAS QUANTITY AS SCHEDULED

Provide gas-fired range with convection oven base, having the following features:

- A. 36" wide one-piece, 3/4" thick steel plate griddle top.
- B. Gas:
- Field verify type
 - 1-1/4" rear gas connection (cap and cover, both ends)

- C. Manual controls.
- D. Convection oven.
- E. Stainless-steel front, top front ledge, sides, base, burner box & stub back.
- F. 6" adjustable legs.
- G. Voltage as scheduled, 7' cord and plug.

Range to be as manufactured by Vulcan, Model VGM36C, Garland, or South Bend.

ITEM 20		NOT USED
ITEM 21	HD RANGE, GAS	QUANTITY AS SCHEDULED

Provide gas-fired range, having the following features:

- A. Heavy duty range, 18", modular.
- B. Gas:
 - Field verify type
 - 1-1/4" rear gas connection (cap and cover, both ends)
- C. (2) 35,000 BTU open burners, cast iron grates.
- D. Individual pilots & controls.
- E. Stainless-steel front, front top ledge, sides, base, burner box & stub back.
- F. 4" flanged feet.

Range to be as manufactured by Vulcan, Model V2B18, Garland, or South Bend.

ITEM 22	UTILITY CHASE	QUANTITY AS SCHEDULED
---------	---------------	-----------------------

Provide island utility chase to serve items under exhaust hood, having the following features:

- A. Stainless steel construction.
- B. UL label.
- C. Designed to include electrical wire way.
- D. Water tight electrical receptacles to match equipment.
- E. 1 1/2" gas manifold with tees and shut-off valves.
- F. 3/4" hot water and cold-water manifold with tees and shut-off valves.
- G. Gas and water quick disconnects and appropriate cord and plug sets as required by equipment.
- H. Manual gas shut-off valve for installation under Division 22.

- D. Installation in accord with N.F.P.A. 17A code requirements and coordinate with exhaust hood construction and installation.
- E. Four contacts for use by E.C., one contact for alarm, one for supply fan shut-off, one for shunt trip actuation, and one spare.
- F. Provide mechanical gas solenoid valve loose for installation by plumber.

Fire system to be as manufactured by Ansul, Model R-102, Range Guard, or Pyro-chem.

ITEM 25 EXHAUST HOOD QUANTITY AS SCHEDULED

Provide wall-mount type canopy exhaust hood of size, shape and content as shown on detail drawings, having the following features:

- A. All exposed surfaces of 18-gauge 304 Series, 18-8 stainless steel construction.
- B. N.F.P.A. 96 construction, including all joints and seams welded externally, continuous and liquid tight.
- C. 5/8" diameter hanger rods to structural ceiling, approximately 96" on center.
- D. Stainless steel high-efficiency baffle type U.L. classified grease extracting filters, with handles.
- E. Integral grease gutter sloped to drain to grease receptacle.
- F. Vapor-proof U.L. listed recessed fluorescent light fixtures.
- G. Coordinated installation of Fire System as specified for Item 24, provide cabinet at end of hood.
- H. Integral make-up air plenum along front as shown.
- I. Insulated wall set-off.
- J. Removable stainless-steel perimeter trim and/or closure panels from top of hood to ceiling.
- K. Food Service Equipment Contractor shall provide and install any secondary supporting members required to suspend exhaust hoods. Hood supports shall include seismic bracing, if required, installed in accord with SMACNA guidelines.
- L. Food Service Equipment Contractor to furnish and install stainless steel wall panels run full length of hood from bottom rear edge to top of floor curbing.
- M. Fire cabinet with pre-wired control package and switches with variable speed fan control.

Exhaust hood to be as manufactured by Captive-Aire, Model ND2-PSP, Gaylord, or Avtec.

ITEM 26 COMBI-OVEN QUANTITY AS SCHEDULED

Provide roll-in combi-oven with the following features:

- A. Combi Oven/Steamer, electric, boiler-free, floor model with roll-in cart.
- B. (20) non-tilt support rails.

- C. (20) 18" x 26" full size sheet, (20) 2/1 GN pans, or (40) 12" x 20" full size hotel pan (1/1 GN) capacity.
- D. Classic control with steam/convection/combi cooking modes.
- E. Safety steam venting.
- F. Auto cleaning system with (1) cleaning level.
- G. Cool-to-touch glass window d.
- H. Door, see hinging as shown on Plan.
- I. High efficiency LED lighting.
- J. Stainless-steel construction.
- K. Seismic legs.
- L. Technology for reduced energy usage.
- M. Drain water tempering kit.
- N. Water Filtration System EV997625.
- O. Water tested, and if required, treated to not damage equipment.
- P. Voltage as scheduled, direct connection.
- Q. Back flow preventer.

Combination oven steamer to be as manufactured by Alto-Shaam, Model CTC20-20E, Rational, or Cleveland.

ITEM 27 CONVECTION OVEN QUANTITY AS SCHEDULED

Provide gas-fired convection oven having the following features:

- A. Double-deck, standard depth.
- B. Gas:
 - Field verify type.
 - Manifold piping included with stacking kit to provide single point gas connection
- C. Solid state controls.
- D. Electronic spark igniters.
- E. 60-minute timer.
- F. Casters in lieu of 8" high legs.
- G. Stainless-steel front, top and sides.

- H. Stainless-steel doors with windows.
- I. Energy efficient.
- J. Voltage as scheduled, (2) 6' cords with plugs.

Convection oven to be as manufactured by Vulcan, Model VC44GD/ VC44GD, Southbend, Blodgett, or Garland.

ITEM 28 REACH-IN REFRIGERATOR QUANTITY AS SCHEDULED

Provide two-section reach-in refrigerator with bottom mounted air-cooled condensing unit, exterior digital thermometer, cylinder door locks and bottom mounted condensate evaporator, having the following features:

- B. Full-height, stainless-steel doors, see hinging as shown on Plan.
- C. Stainless-steel front.
- C. Aluminum sides, aluminum interior with stainless-steel floor.
- D. (6) adjustable PVC-coated wire shelves.
- E. LED interior lighting.
- F. 4" casters (adds 5" to OA height).
- G. Self-contained refrigeration, R290 Hydrocarbon refrigerant.
- H. 1/2 HP.
- I. Voltage as scheduled, with cord and plug.

Refrigerator to be as manufactured by True, Model T-49-HC, Norlake, or Beverage-Air.

ITEM 29 REACH-IN FREEZER QUANTITY AS SCHEDULED

Provide one-section reach-in freezer with bottom mounted air-cooled condensing unit, exterior digital thermometer, cylinder door locks and bottom mounted condensate evaporator, having the following features:

- A. Reach-in, -10° F, one-section.
- B. Stainless-steel door, see hinging as shown on Plan.
- C. Stainless-steel front.
- D. Aluminum sides, clear coated aluminum interior with stainless steel floor.
- E. (3) adjustable PVC-coated wire shelves.
- F. Interior lighting.
- G. 4" casters (adds 5" to OA height).

- H. Self-contained refrigeration, R290 Hydrocarbon refrigerant.
- I. 1/2 HP.
- J. Voltage as scheduled, cord and plug.

Freezer to be as manufactured by True, Model T-23F-HC, Norlake, or Beverage-Air.

ITEM 30 NOT USED

ITEM 31 WORKTABLE QUANTITY AS SCHEDULED

Provide stainless steel worktable with the following features:

- A. 108"W x 36"D.
- B. 14/300 stainless-steel top with 5" backsplash.
- C. Stainless-steel legs with side & rear cross-rails & adjustable stainless-steel feet.
- D. All-welded construction.
- E. Cantilever Shelf:
 - Table mount
 - 12" x 108"
 - Ends turned down, back turned up 2"
 - (3) stainless-steel tube legs
 - 16/300 stainless-steel
 - Select Stainless 8CS-12

Worktable to be as manufactured by Select Stainless, Model 9SLB-36-14, Eagle, SCF, or fabricated equal.

ITEM 32 INGREDIENT BIN QUANTITY AS SCHEDULED

Provide polyethylene ingredient bin with the following features:

- A. Mobile, 37-gallon capacity.
- B. 1-piece seamless polyethylene bin.
- C. 2-piece sliding polycarbonate lid.
- D. (4) 3" heavy duty casters (2 front swivel, 2 fixed).

Ingredient bin to be as manufactured by Cambro, Model IBS37148, Rubbermaid, or Carlisle.

ITEM 33 SHELVING UNIT MOBILE QUANTITY AS SCHEDULED

Provide four-tier mobile shelving unit complete with tubular uprights and having the following features:

- A. Nom. 60"W x 24"D x 69"H.
- B. (4) posts and (4) polymer grid shelves.

- C. Adjustable shelf clips
- D. Plastic split sleeves.
- E. Casters.

Shelving to be as manufactured by Metro, MetroMax Q, Eagle Group, or SPG.

ITEM 34 BEVERAGE DISPENSER, ELECTRIC (HOT) N.I.K.C.

This item is to be furnished by Owner.

ITEM 35 BEVERAGE COUNTER QUANTITY AS SCHEDULED

Provide stainless steel beverage counter having the following features:

- A. Worktable, cabinet base with open front & center shelf.
- B. 144"W x 30"D.
- C. 18/300 stainless-steel cabinet base.
- D. 16/300 stainless-steel top with 5"H backsplash.
- E. 7" stainless-steel legs with adjustable feet.
- F. All-welded construction.
- G. TWO Weld-In Sinks:
 - 24" x 24" x 12" deep
 - 16/300 stainless steel
- H. Pre-Rinse Spray with swing spout faucet at each sink:
 - Splash mount
 - Wall bracket
- I. (2) Twist handle lever drain, 2" drain outlet.

Counter to be as manufactured by Select Stainless, Model 12TCB-30, Eagle, SCF, or fabricated equal.

ITEM 36 ICE MAKER, CUBE STYLE QUANTITY AS SCHEDULED

Provide cube ice maker and bin having the following features:

ICE MAKER:

- A. Capacity: 1213 lb./24 hours at 70°/50° (950 lb. AHRI certified at 90°/70°).
- B. Self-contained, air cooled.
- C. Voltage as scheduled, direct connection.
- D. Stainless-steel finishes.
- E. Arrange to make half dice cube ice.

F. Water Filter Kit, Series AR-4000.

G. Remote compressor.

BIN:

H. Bin to have capacity of approximately 970 pounds.

I. Welded stainless steel construction.

J. 48"W x 31"D, 63-1/2"H.

K. Top hinged front-opening door.

L. Sliding window & sliding ice gate.

M. (4) 6" stainless steel legs.

N. Ice scoop.

O. Stainless-steel adaptors.

P. Ice deflector.

Mount ice maker on Manitowoc F-1300 bin and install at location shown on Plan.

Ice machine to be as manufactured by Manitowoc, Model IYT-1200A, Ice-O-Matic, or Scotsman.

ITEM 37 PASS-THRU REFRIGERATOR QUANTITY AS SCHEDULED

Provide two-section pass-thru refrigerator with top mounted air-cooled condensing unit, exterior digital thermometer, cylinder door locks and top mounted condensate evaporator, having the following features:

A. Stainless-steel front & sides.

B. (4) Stainless-steel half doors, front & rear with locks, cam-lift hinges, see hinging as shown on Plan.

C. Aluminum interior.

D. (6) chrome shelves.

E. LED interior lights.

F. (4) 5" casters.

G. 1/2 HP.

H. Voltage as scheduled, cord and plug.

Refrigerator to be as manufactured by True, Model STA2RPT-4HS-4HS, Norlake, or Beverage-Air.

ITEM 38 PASS-THRU HEATED CABINET QUANTITY AS SCHEDULED

Provide two-section pass-through hot cabinet having the following features:

- J. Vent openings with 7" stainless steel stacks & locking dampers - both ends.
- K. Anti-jam & reverse switch.
- L. Energy efficient.
- M. Drain water tempering kit.
- N. Scheduled Supervision of Re-Assembly and Start-Up.
- O. Direction of operation as shown on Plan.
- P. A-2.5 ft. load section.
- Q. B-2.5 ft. pre-wash section with external scrap tank with basket.
- R. C-4 ft. wash section.
- S. D-5 ft. dual rinse-unload section.
- T. Electric booster heaters with thermostat & positive low water cut-off.
- U. Voltage as scheduled, direct connection, machine electric tank heat.

Dishwasher to be as manufactured by Champion, Model EUCCW8, Stero or Hobart.

ITEM 47		NOT USED
ITEM 48	THREE COMPARTMENT SINK	QUANTITY AS SCHEDULED

This item to be custom fabricated in accord with General Requirements of specifications and with plan and detail drawings.

ITEM 49	COLD STORAGE ASSEMBLY	QUANTITY AS SCHEDULED
---------	-----------------------	-----------------------

Provide pre-fabricated cold storage room assembly of size and shape shown on plan and detail drawings. Exact overall size to be field verified prior to fabrication.

A. Insulation:

Panels shall be insulated with 4" thick urethane, foamed or poured in place using HCPC (no CFC) blowing agent. Foam shall be 2.25 lb. density, 95% closed cell. Panels shall meet ASTM E-84 (UL-723) and be listed by Underwriters laboratories. Panels shall have a maximum flame spread of 25, maximum smoke developed of 450 minimum. Flash ignition of 600 degrees and minimum self-ignition of 800 degrees F.

B. Coved corners:

Assembly shall be constructed so that all interior wall, floor and ceiling intersections shall comply with N.S.F. requirements.

C. Cam lock fasteners:

All panel intersections and wall, floor and ceiling intersections shall be secured by cam lock fasteners.

D. Finishes:

Exterior and interior finishes shall be as shown on drawings.

E. Doors:

Door size and finish shall be as shown on drawings, and shall be furnished complete with sill wiper gasket, lift type hinges.

Door to be equipped with automatic door closer.

Door to be equipped with heavy duty padlocking pull-handle lever, with inside safety release.

F. Thermometer:

Provide exterior flush mounted thermometer mounted at eye level to each door.

G. Lights:

Each compartment to be furnished complete with manufacturer's standard light fixture, having protective cover, mounted and pre-wired to switch with pilot light in door section. Extra lights as needed to provide 30-foot candles 30" above floor. Lights to be furnished and set in place by this section.

H. Ceiling panels to be one piece, self-supporting and span full width of assembly.

I. Floor:

Integral floor by Food Service Equipment Contractor, with aluminum diamond tread finish.

Reinforced floor panels to support minimum 2000 pounds per square foot.

The floor and ceiling shall have maximum length panels to span full length of box if possible, otherwise stagger joints so there are no common "four corner" intersections and no joints occurring in doorways.

J. Refrigeration System:

Shall be furnished by manufacturer as part of cold storage room assembly, provide each compartment with complete refrigeration system sized to maintain appropriate temperature.

Provide temperature alarm system with remote read-out and recording capability.

Condensing unit to be air-cooled, remote. Units to have performance and wiring characteristics as scheduled on drawings. Refrigeration systems to be designed for use with R404A or R-507 refrigerant only.

Condensing unit to be provided with painted galvanized steel all-weather housing, controls, and crankcase heaters, all suitable for outdoor conditions, and located on building roof.

Unit coolers to be low-silhouette type, mounted at locations shown on drawings. Performance and wiring characteristics to be as scheduled on drawings. Freezer system to be provided with timed electric defrost.

Evaporator drain lines to be provided by this section and extended to floor receptors outside assembly.

Refrigerant piping to be ACR copper tubing, hard temper, with wrought fittings and silver solder joints. Insulate suction lines with premolded foamed plastic insulation, thickness as recommended by manufacturer for temperature and application.

Refrigeration system to be provided with all required refrigerant piping, insulation, sight glass vibration eliminator, solenoid(s), dryer, suction line filter, expansion valve(s), thermostat(s), heat exchangers, and defrost timers, etc. as necessary for complete installation. Provide pump down control circuit consisting of thermostat and solenoid valve. All components including piping and insulation to be installed using accepted industry standards, manufacturer's instructions and first-class workmanship.

See refrigeration connection schedule.

K. Miscellaneous:

Assembly to be installed on depressed building slab. See detail drawing.

Provide 1/8" diamond tread wainscott along exposed front exterior of assembly mounted from floor to 48" A.F.F.

Provide trim strips, closure panels, etc., as necessary to trim assembly to adjacent building surfaces.

Provide removable top closure panels with "C" channel rails. Lift-out panel sections to have turn-down edges for strength and are not to exceed 4'-0" in length.

Provide plastic strip curtains at door locations, transparent vinyl overlapping strips, aluminum bar hanging rod and bracket, suitable for low temperature application, as manufactured by Curtron, Flexstrip Products, Inc., or equal. Size to suit openings.

Provide sleeves properly located for utility entrance, drain lines, and refrigeration lines, and after lines are installed, fill sleeves with spray foam compound, suitable for use in refrigerated spaces. Trim excess foam away and cover with stainless steel escutcheon.

Cold storage room shall be erected by factory trained, or factory approved installers or shall be supervised by factory personnel. Refrigeration systems shall be furnished by cold storage room manufacturer and installed by factory approved personnel. Shop drawing submittal shall indicate who the installer is, and a letter of approval shall accompany the submittal indicating the manufacturer's acceptance of the installers.

This specification does not constitute a complete description of cold storage assembly, also see plan and detail drawings.

Cold storage room assembly to be as manufactured by Bally, Masterbilt, or W.A. Brown complying with specifications and drawings.

ITEM 50

ITEM 51 UTILITY RACK, MOBILE QUANTITY AS SCHEDULED

Provide aluminum mobile pan rack having the following features:

- A. Versatile Tray Rack, mobile
- B. Holds (11) 18" x 26" or (22) 18" x 14" trays or (10) 12" x 20" pans.



DIVISION 12

FURNISHINGS



SECTION 12 32 00
ARCHITECTURAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Architectural Casework (AC), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Firm with manufacturing and delivery capacity required for the project.
 - 2. Successfully completed at least five projects within the past four years, utilizing systems, materials and techniques as specified.
- B. Installer Qualifications:
 - 1. Manufacturer or manufacturer's authorized representative.
- C. AWI Architectural Woodwork Standards (AWS).
 - 1. Grade: Premium, with exceptions indicated.
 - 2. Exposed cabinet body edges are to be fabricated flush before and after installation of edge banding.
- D. ASTM D1037 Standard Test Methods for Evaluating Properties of Wood Base Fiber and Particle Panel Materials.
- E. ANSI 208.2: MDF for Interior Applications.
- F. Composite Panel Association listed NAUF (No Added Urea Formaldehyde).

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Plans of casework at 1/4 IN = 1 FT scale or larger.
 - 2. Elevations of casework at 1/4 IN = 1 FT scale or larger.
 - 3. Cross reference shop drawings to Contract Documents casework elevations.
- B. Product Data:
 - 1. Typical details of casework construction.
 - 2. Reports indicating favorable outcome to Wall Cabinet Load Testing.
- C. Contract Closeout Information:
 - 1. Warranty.
 - 2. Operation and Maintenance Data.
 - a. See Section 01 78 23.

1.4 WARRANTY

- A. Manufacturer five (5) year warranty against defects in materials and workmanship, such as but not limited to delamination, swelling, or warping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Architectural Casework:
 - 1. Base:
 - a. Calmar Manufacturing (Imperial Woodworking)

2. Optional:
 - a. Case Systems
 - b. Stevens Industries
 - c. TMI Systems Design
- B. Plastic Laminate:
 1. Base:
 - a. Formica
 - b. Nevamar
 - c. Wilsonart
- C. Contact Adhesive:
 1. Base:
 - a. Wilsonart
 - b. Formica
 - c. Nevamar
- D. Wood Glue:
 1. Base:
 - a. Franklin (TiteBond)
 - b. Wilsonart (Lokweld)
- E. Low Pressure Decorative Laminate (LPDL) Panels:
 1. Base:
 - a. Casework Manufacturer
 2. Optional:
 - a. Uniboard
- F. Medium Density Fiberboard:
 1. Base:
 - a. Roseburg Forest Products.
 2. Optional:
 - a. Georgia Pacific.
 - b. Uniboard.
- G. PVC Edge Banding:
 1. Base:
 - a. Doellken-Woodtape.
 2. Optional:
 - a. Rehau.
 - b. Charter Industries.
 - c. Canplast.
- H. Countertops:
 - a. See 12 36 63.
- I. Sealant:
 1. Base:
 - a. See Section 07 92 16.
- J. Cabinet Hardware:
 1. Base:
 - a. Accuride.
 - b. EpcO.
 - c. Hafele.
 - d. Blum.
 - e. KnapE & Vogt.
 - f. Grant.
 - g. National Lock.

- h. Ilco Unican Corporation.
 - i. Stanley Hardware.
 - j. Stylmark.
 - k. HEWI.
 - l. TMI Systems Design.
 - m. Rockford Process Control.
 - n. U.S. Futaba.
 - o. Weber Knapp Company.
 - p. CCL Security Products.
 - q. Schlage Lock.
 - r. Olympus Lock.
 - s. Sugatsune America.
 - t. Colson Caster Corporation.
 - u. AllenField.
- K. Miscellaneous items:
- 1. Products and Manufacturers as listed.
- L. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
- 1. FSC certified wood components.
 - 2. No Added Urea Formaldehyde (NAUF) in materials or fabrication.
- B. Medium Density Fiberboard (MDF):
- 1. ANSI A208.2 Grade 155 MR50.
 - 2. Moisture resistant:
 - a. Water Absorption: 6 PCT average, 24 HR soak.
 - b. Thickness Swell: 3 PCT
 - 3. 48 PCF density
 - 4. Base: Medex by Roseburg
 - 5. Core material for plastic laminate casework.
 - 6. Core material for counters, backsplash, and sidesplashes with sinks.
- C. Plastic Laminate Facings:
- 1. Standard: NEMA LD3.
 - 2. NEMA LD3, Impact rated at 43IN when adhered to MDF.
 - 3. Thickness and Grade:
 - a. Formed surfaces: Post form Grade-HGP, 0.048 IN thick.
 - b. Other exposed surfaces: Grade-VGS, 0.028 IN thick.
 - 4. Backer Sheets for laminated items.
 - a. Semi-exposed cabinet liner: Grade-CLS, 0.020 IN thick; color to match LPDL.
 - b. Concealed backer sheet: Grade-CLS, 0.020 IN thick; any color.
 - 5. See Sheet I-001 Interior Finish Schedule for selections.
- D. Low Pressure Decorative Laminate (LPDL):
- 1. Resin impregnated 80 gram paper overlay, heated and fused onto substrate.
 - 2. Material: Polyester or melamine; phenolic resin may be used on concealed surfaces.
 - 3. NEMA LD3, Grade-VGL requirements.
 - 4. NEMA LD3, Impact rated at 15 IN when adhered to MDF.
 - 5. Finish: Satin.
 - 6. Color:
 - a. As selected by Architect from manufacturer's standard color line.
- E. PVC-Free Edge Banding:
- 1. Machine applied with waterproof hot melt adhesive.
 - 2. Edge of case body and exposed components:
 - a. Thickness: 1mm.

- b. Color: To match case exterior.
 - 3. Edge of shelves inside plastic laminate clad units:
 - a. Thickness: 1mm.
 - b. Color: To match shelf.
 - 4. Edges of doors and drawer fronts, exposed finished shelves and removable panels:
 - a. Thickness: 3mm.
 - b. Color: To match exterior face of panel.
 - 5. Edges of plastic laminate countertops and tops of backsplashes and side splashes:
 - a. Thickness: 3mm.
 - b. Color: To match plastic laminate.
- F. Tackboards (TB):
 - 1. Vinyl fabric faced complying with F.S.CCC-W-408, Type II, Class 2, laminated to 1/4 IN cork sheet.
 - 2. Color: Architect to select from manufacturers standard fabric line.
 - 3. Laminate under pressure to minimum 1/4 IN thick plywood or hardboard backing.
 - 4. Wrap fabric around edges.
 - 5. Provide as noted.
- G. Contact Adhesives:
 - 1. Description:
 - a. Viscosity: 760 cps.
 - b. Density: 7.7 Lbs/gallon.
 - c. Solids content: 36 PCT +/- 1 PCT.
 - d. VAHP content: None.
- H. Wood Glue:
 - 1. Description:
 - a. Bond Strength per ASTM D905: 4,000 PSI at room temperature.
 - b. ANSI/HPVA Type I water resistant.
 - c. Application temperature: Above 47 DEGF.
 - d. FDA approved for indirect food contact.
- I. Sealant:
 - 1. Description:
 - a. Silicone sealant in colors matching components.
 - b. See Section 07 92 16.
 - 2. Colors:
 - a. Colors to match Plastic Laminate, Stone, Wood, Solid Surfacing and other materials specified for casework bodies, countertops and splashes.
 - b. Architect to select from no less than 400 standard color choices.
 - c. Number of different colors for project shall not be limited.
 - 3. Base Product:
 - a. Solid Colors: Color-Sil by Color Rite; 100 PCT Silicone, no suspended partials.
 - b. Architect to select final colors and locations during submittals phase.

2.3 CABINET HARDWARE

- A. Five Knuckle Hinges:
 - 1. Institutional (hospital tip), 5 knuckle, wrap around type with barrel only projecting beyond face of cabinet.
 - 2. Use on cabinets unless noted otherwise.
 - 3. Minimum Height: 2-3/4 IN.
 - 4. Minimum 8 screws per hinge.
 - 5. ANSI/BHMA-A156.9 Grade-1.
 - 6. Hinge Quantities per leaf:
 - a. For doors up to 48 IN high: 2 hinges.
 - b. For doors over 48 IN high: 3 hinges.
 - 7. Finish: 26D Dull Chrome.

8. Base Product: 370/450 series hinge by Rockford Process Control (RPC).
- B. Drawer Slides:
1. Full extension.
 2. Stainless steel ball bearings
 3. Positive closing.
 4. Pull out stops - drawer removable without use of tools.
 5. Capacity:
 - a. Standard Drawers (other than types listed below): 100 LBS.
 - b. File Drawers: 150 LBS.
 - c. Lateral Files:
 - 1) Less than 42 IN wide: 200 LBS.
 - 2) 42 to 48 IN wide: 400 LBS.
 6. Base Product:
 - a. Model 3732 or 3832 by Accuride
 7. Optional Product:
 - a. Metabox System by Blum, is acceptable where capacities (listed above) can be met.
- C. Straight Wire Pulls:
1. 4 IN centers.
 2. Finish: Satin stainless steel.
- D. Catches:
1. Magnetic or roller type, adjustable.
 2. Minimum 4 LB pull.
 3. Provide two catches on doors more than 48 IN high.
- E. Elbow Catch:
1. Provide at pairs of doors with locks.
- F. Door Stops:
1. Braided steel cable with clear PVC coating, mounting eyelets, and screws.
 - a. Base Product: Hafele 366.74.900.
 2. Finish: zinc plated.
 3. Length: 6 IN nominal.
 4. Provide at locations where door opens adjacent to walls, cabinets and equipment.
 5. Mount to prevent contacting wall or equipment with door or hardware.
- G. Door Bumpers:
1. Provide on backside of doors and drawer faces.
- H. File Hanging Rails:
1. Description: Full length metal suspension rails designed to support pendaflex hanging files.
 2. Material: Powder coated steel to match drawer interior or mill finish aluminum.
 3. Provide one pair of such rails at file drawers.

2.4 LOCKS

- A. Keyed Locks:
1. Provide as noted at all doors and drawers.
 2. Small pin tumbler with heavy duty deadbolt.
 - a. Disc tumbler type locks will not be accepted.
 - b. Cam locks will not be accepted.
 3. Keyway: D4292, 5-pin.
 4. ANSI/BHMA Standard: E07121.
 - a. Cycle Tested per ANSI/BHMA A156.11 Grade 1.
 5. Base Products:
 - a. Door Locks: 100DR by Olympus Lock.
 - b. Drawer Locks: 200DW by Olympus Lock.
 6. Finish: Satin Chrome US26D (BHMA 626).

7. Include spacers, adapters, fasteners and strikes.
8. Barrel Length: As appropriate for conditions.
9. Provide 2 keys for each lock.
10. Master key and grand master key as directed.
11. Provide 20 extra locks of each type; door locks and drawer locks to Owner at closeout.

B. Cipher Locks:

1. Base Product: C9602-26D-41 by Kaba Ilco.

2.5 SUPPORTS AND BRACKETS

A. Adjustable Shelf Supports:

1. Friction fit pins into cabinet end panels and vertical dividers.
2. Space 1/4 IN holes on 1 1/4 IN centers.
3. Locate support holes to avoid conflict with installation of hinges.
4. Retain shelves on support with spring clip shelf lock or screw attachment.
5. Material:
 - a. Injection molded clear polycarbonate.
6. Capacity: 200 LB minimum, per support device.

B. Concealed Wall Shelf Supports:

1. Provide for shelves mounted to walls (not within cabinets).
2. Bracket:
 - a. Nominal 1/2 IN dia. steel pin with 4 IN projection minimum.
 - b. Adjustable height and inclination.
3. Coordinate locations of blocking (see Section 06 10 53).
4. Route drywall and mount bracket directly to blocking or masonry.
5. Drill hole in shelf to receive mounting pin.

C. Metal Bracket for Cantilevered Countertop:

1. Material: 1/8 IN thick steel.
2. Pre-drilled for attachment to wall and countertop.
3. Include fasteners suitable for conditions.
4. Coordinate locations of blocking (see Section 09 22 16).
5. Capacity: 1000 LBS per bracket.
6. Base Product: 2424 AMH by Wizard Products.
7. Finish: Powder coat.
 - a. Color: To be selected by Architect.

2.6 MISCELLANEOUS CABINET HARDWARE

A. Continuous Hinge:

1. Base Product: 0351.04.039 by Hafele.
2. Finish: Chrome finish.

B. Pocket door slide system:

1. Base Product: RP-60 by Hafele.
2. Finish: Satin chrome.

C. Grommets:

1. Base Product: XG-3 by Doug Mockett & Company, Inc.
2. Finish: Black or putty as selected by Architect.
3. Size: Provide 3-1/2 IN diameter flip top grommet cap with 7/8 IN x 1-3/8 IN cord slot.
4. Provide as directed by Owner after installation of equipment at each location such as, but not limited to, undercounter electrical or systems outlet, cord drops, and keyboard drawers.

2.7 FABRICATION

A. General:

1. See Drawings for casework quantities, configurations, finishes, countertops and casework accessories.

2. Verify dimensions at site.
 3. Verify locations of items furnished in other Sections.
 4. If necessary to vary from arrangement indicated because of structural, mechanical, electrical or other considerations, make such variations only after approval of Architect.
- B. Definitions:
1. Exposed surfaces: Surfaces visible when doors and drawers are closed.
 - a. Door and drawer fronts, and their edges.
 - b. Exposed ends.
 - c. Bottom of wall case.
 - d. Countertop and backsplash and their exposed edges.
 - e. Face of cabinet body not covered by doors or drawer fronts.
 - f. Interior of open cabinets, including shelving.
 2. Concealed surfaces: Surfaces not visible after installation.
 - a. Solid top panels.
 - b. Security panels.
 - c. Locking rails.
 3. Semi-exposed surfaces: Surfaces only visible when doors and drawers are opened.
 - a. Interior of cabinets with opaque doors.
 - b. Back sides of doors.
 - c. Top of wall cabinets and tall cases.
 - d. Drawer boxes.
- C. Plastic Laminate Faced Casework:
1. Factory built casework finished on exterior with high pressure laminate.
 2. Core Material:
 - a. Medium Density Fiberboard (MDF).
 - b. MR moisture resistant panels where work surfaces include a sink.
 - c. MR panels shall have 50 PCT reduction in thickness swell by ANSI A208.1.
 3. Provide units complete with hardware, subbases and trim, in sizes and configurations indicated.
 4. Style:
 - a. Reveal overlay, with doors and drawer fronts overlapping case front with minimum reveal.
 - b. Edge doors and drawer fronts with 3mm PVC banding, machine applied using waterproof hot melt adhesive. Machine profile exposed edges with 1/8 IN radius.
 5. Finishes:
 - a. Exposed surfaces: Plastic Laminate.
 - b. Grain Direction, where laminate finish is directional: Vertical grain at frames, cases, door faces, drawer faces and other vertical surfaces.
 - c. Semi-exposed surfaces: LPDL.
 - d. Concealed surfaces: LPDL.
 - e. Edges of Doors and Drawer Fronts: 3mm PVC edge banding.
 - f. Edges of Case Body panels: 1mm PVC edge banding.
 - g. Edges of Shelves: 1mm PVC edge banding (four sides).
- D. Casework Components:
1. Case Body:
 - a. Sides: 3/4 IN thick.
 - 1) Locate shelf support holes to avoid conflict with installation of door and drawer hardware.
 - b. Top and Bottom Panels: 3/4 IN thick.
 - c. Backs: 1/2 IN thick.
 - 1) Exception: Where back face is exposed to view: Upgrade to 3/4 IN.
 - d. Security Panels: 1/2 IN thick.
 - e. Drawer Lock Rails: 3/4 IN thick.
 - f. Base: 3/4 IN thick, with intermediate reinforcing at 24 IN on center maximum.

2. Shelves:
 - a. Less than 30 IN long: 3/4 IN thick.
 - b. Between 30 and 40 IN long: 1 IN thick.
 3. Doors:
 - a. 3/4 IN thick.
 - b. Doors not to exceed 25 IN in width.
 4. Drawers:
 - a. Drawer Fronts: 3/4 IN thick.
 - b. Sub-fronts, Sides and Backs: 1/2 IN thick.
 - c. Bottoms: 1/2 IN thick.
 - 1) Include intermediate reinforcing rails where drawer width exceeds 18 IN.
 5. Small Compartment Dividers: 1/4 IN clear acrylic panel.
 6. Filler Panels and Scribe Pieces: 3/4 IN thick.
 7. Soffits:
 - a. Material and finish to match cabinets.
 - b. 3/4 IN thick.
 - c. Abut soffit to acoustical tile ceiling without reveal or gap.
 - d. Cope tegular ceiling tile to overhang face of soffit.
 - e. Where distance between top of cabinet and ceiling is greater than 24 IN: Soffits to be sloped 30 DEG, unless noted otherwise.
- E. Case Configuration:
1. Plastic Laminate Faced Units:
 - a. Provide reveal, approximately 1/8 IN, at top of doors and drawer fronts, and between doors and drawer fronts in same unit; reveal approximately 7/16 IN at sides.
 2. Provide reveal 1/8 IN x 1/8 IN (black) in upper edge of exposed sides of wall case when plastic laminate soffits provided.
 3. Toe space:
 - a. 4 IN high by approximately 3 IN deep; provide on front of each base unit unless noted on architectural drawings.
 4. Countertop:
 - a. Plastic laminate units:
 - 1) Overhang 3/4 IN beyond doors, drawer fronts and exposed ends.
 5. Hardware mounting:
 - a. Drawers:
 - 1) Center the pull in drawer front, horizontally.
 - 2) No more than 4 IN from top.
 - b. Drawers with 2 pulls:
 - 1) Set pulls at 1/4 points.
 - 2) No more than 4 IN from top.
 - c. Framed glass doors:
 - 1) Center the pull in corner of frame.
 - d. Swinging doors:
 - 1) Set door pull in swing side corner, vertically, at top of base units; at bottom of wall units.
 6. Adjustable shelves:
 - a. Use drilled hole supports only.
 - 1) Depth: 1/2 IN less than inside cabinet depth.
 - 2) Width: 1/8 IN, maximum, less than inside cabinet width.
 7. Provide doors at locations requiring access to electrical devices, as indicated on drawings.
- F. Joinery
1. Construct cabinet body of 3/4 IN thick core joined with 10mm diameter industrial grade hardwood dowels, securely glued and clamped under pressure during assembly.
 2. Case body:
 - a. Sides, dividers, bottom, and top panels:
 - 1) Minimum of 6 dowels at each joint for 24 IN deep cabinets.

- 2) Minimum of 4 dowels for 12 IN deep cabinets.
- 3) Glue joints.
- b. Back:
 - 1) For dadoed backs, dado into sides, bottom and top. Locate dado 3/4 IN in from back face of cabinet.
 - 2) For on-set backs, rabbet at finished ends, screw at the top and bottom, staple at the sides.
 - 3) Glue joints.
- c. Compartment dividers and lock rails:
 - 1) Dowel and glue.
- d. Base:
 - 1) Integral or separate.
 - 2) Construct to receive base material to match adjacent walls, unless shown otherwise.
 - 3) Blind fasten to bottom of case body when separate.
- 3. Drawers:
 - a. Sub-front, sides and back: Doweled and glued corner joints.
 - b. Bottom: Dado into 4 sides and glued or screwed to the bottom with the use of bottom supporting drawer slide hardware.
 - c. Front: Secured from sub-front side with no less than four screws.
 - d. Use no blocking or fasteners in exposed or semi-exposed locations.
- G. Mechanical Fasteners:
 - 1. Countertop joints:
 - a. Provide joint connectors every 6 IN OC.
 - 2. Pre-drill and countersink screw holes before installation.
 - 3. Do not use mechanical fasteners or blocking in exposed locations. When fasteners are required on exposed surfaces color, materials and finish to be approved by Architect.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Ensure that adequate Wall Backing has been installed.
 - 1. Metal Wall Backing: See Section 09 22 16.
 - 2. Coordinate and direct installation of backing where required.
- C. Correct unsatisfactory conditions.
- D. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Use manufacturer's printed instructions or drawings in cases where items or details are not indicated.
- B. Hardware:
 - 1. Install hinges, stops, guides and other door and drawer hardware to avoid adjustable shelf holes in case body.
- C. Construct units with sinks or lavatories to withstand an applied vertical load of not less than 250 LBS on the front edge of countertop.
- D. Provide cutouts for mechanical and electrical items.
- E. Seal sink cutouts.
- F. Install up to 10 extra door locks and 10 extra drawer locks in casework not previously shown or scheduled to have locks.

1. Install extra locks where directed by Owner.
2. Closeout: Turn over extra, uninstalled locks to Owner.

3.3 SEALING OF JOINTS

- A. Seal casework, countertops and splashes to walls, to seal joints.
 1. Sealant color to match countertop color.
- B. Seal perimeter of counter mounted sink fixtures.
 1. Sealant color to match countertop or sink color.
- C. Seal window sills to walls and window frames to seal joints.
 1. Sealant color to match color of sill material specified.

3.4 ADJUSTMENTS AND CLEANING

- A. Test and adjust items of equipment for satisfactory operation.
- B. Adjust hinges for proper door alignment.
- C. Adjust drawer guides for proper drawer front alignment and operation.
- D. Adjust countertops to a level position and align to adjacent unit.
- E. Repair damage to casework or countertops to appear in original new condition.
- F. Repair damage to premises as a result of installation.
- G. Remove debris left by this installation.
- H. Clean casework and countertops after above items have been completed.

END OF SECTION

SECTION 12 36 63
SOLID SURFACE FABRICATIONS (SSF)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Solid Surface Fabrications, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Applicable standards:
 - 1. International Association of Plumbing and Mechanical Officials (IAPMO)
 - a. IAPMO Z124 Plastic Plumbing Fixtures.
 - 2. ASTM International:
 - 3. National Electrical Manufacturers Association (NEMA).
 - a. NSF International.
 - 1) NSF/ANSI Standard 51 for food zone - all food types.
 - 4. Manufacturer's certification of fabricator and installer.
- B. Installer Qualifications:
 - 1. Successfully installed at least five projects within the past four years, utilizing systems, materials and techniques as specified or required by product manufacturer.
- C. Manufacturer Certification of Fabricator and Installer:
 - 1. Certified by manufacturer.
 - 2. Submit prior to Shop Drawings.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Show location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components.
 - 2. Show full size details, edge details, thermoforming requirements, attachments, etc.
 - 3. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement.
 - 4. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in surface.
 - 5. Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Product Data:
 - 1. Manufacturer's product data sheets, details and installation instructions for Solid Surface Fabrications, components and accessories.
- C. Samples:
 - 1. For each SSF color selected:
 - a. Minimum 6 IN x 6 IN sample in specified gloss.
 - b. Cut sample and seam together for representation of inconspicuous seam.
 - c. Indicate full range of color and pattern variation.
 - 2. Sealant colors for selection.
 - 3. Approved samples will be retained as a standard for work.
- D. Project Information:
 - 1. Manufacturer's current certification of Fabricator and Installer prior to submittal of Shop Drawings.

- E. Contract Closeout Information:
 - 1. Warranty.
 - 2. Maintenance data.
 - a. See Section 01 78 23.

1.4 WARRANTY

- A. Manufacturer’s ten (10) year warranty including colorfastness and material defects.
 - 1. Warranty shall provide material and labor to repair or replace defective materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Solid Surface Fabrications (SSF):
 - 1. Base:
 - a. Corian by DuPont.
 - 2. Optional:
 - a. Avonite by Aristech Acrylics LLC.
 - b. Hi-Macs by LG Decorative Surfaces.
 - c. Wilsonart Solid Surface.
- B. Sealant:
 - 1. Base:
 - a. Color Rite.
 - 2. Optional:
 - a. As approved by SSF manufacturer.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Solid Surface Materials:
 - 1. Cast, non-porous, homogeneous, acrylic polymer composition with additional fire retardant fillers and pigments.
 - a. Prime product may not be coated, laminated or of composite construction.
 - 2. Defects with depth < 0.010 IN shall be considered superficial.
 - a. Repair superficial damage by sanding and/or polishing.
 - b. Components with more severe defects shall be rejected.
 - 3. Physical properties:

Minimum Physical Properties		
Property	Method	Value
Tensile Strength	ASTM D638	5500 PSI
Flexural Strength	ASTM D790	10 KSI
Hardness	Rockwell M Scale ASTM D785	Greater than 85
	Barcol Impressor ASTM D2583	55
Thermal Expansion	ASTM D696	1.8 x 10-5 IN/IN/DegF
Gloss (60 –degree Gardner)	IAPMO Z124	Matte = 5; Highly Polished = 75
Light Resistance	NEMA LD 3-2000 Method 3.3	No Effect (Xenon Arc)
Wear and Cleanability	IAPMO Z124	Pass
Stain Resistance	IAPMO Z124	Pass
Fungal Resistance	ASTM G21	Does not support growth
High Temperature Resistance	NEMA LD 3-2000 Method 3.6	No change

Boiling Water Resistance	NEMA LD 3-2000 Method 3.5	No visible change
Ball Impact Resistance; 1/2 LBS Ball	NEMA LD 3-2000 Method 3.5	36 IN drop 1/4 IN sheet
		144 IN drop 1/2 IN sheet
Water Absorption	ASTM D570	0.8 PCT for 1/4 IN sheet
		0.6 PCT for 1/2 IN sheet
Flammability	ASTM E84 and NFPA 255	Class I / Class A
Flame Spread Index		Less than 25
Smoked Developed Index		Less than 450

- B. Backing materials (build down):
1. Finished or exposed edges: SSF material.
 - a. Profiles as indicated.
 2. Concealed spaces and non exposed edges:
 - a. Moisture resistant, medium density fiberboard (MDF) panels or moisture resistant plywood.
 - 1) Use at countertops with sinks
 - 2) No added formaldehyde (NAF)
 - 3) Particleboard is not acceptable.
 - 4) Base Product: Medex by Roseburg.
 - b. Physical Properties, Based on 3/4 IN Thickness, ASTM D1037, Part A:
 - 1) Density: 48 LBS/FT³.
 - 2) Modulus of Rupture: 4,000 PSI.
 - 3) Screw Holding: Required to pull 1 IN #10 sheet metal screw:
 - a) Face: 225 LBS.
 - b) Edge: 200 LBS.
 - c. Panel Thickness:
 - 1) As required for application, use a single thickness to achieve build down to cross sectional thickness.
 3. Backer Sheets for knee spaces:
 - a. Plastic laminate in coordinating color
 - b. Grade 20 (VGP)
 - c. Apply to bottom side of backing material
 4. Backing materials adhesive:
 - a. Construction grade adhesive recommended by SSF manufacturer for backing materials with VOC content no greater than 70 g/L.
- C. Joint Adhesive:
1. Manufacturer's standard one- or two-part adhesive as required for inconspicuous, non-porous joint with VOC content no greater than 80 g/L.
- D. Sealant:
1. Mildew resistant silicone sealant in colors matching components.
 2. Specifically formulated for applications indicated, including wet areas.
 3. Shore A Hardness: 25.
 4. Compatible with SSF specified.
 5. Compatible with gypsum wallboard, paint, laminates and other materials being sealed.
 6. Sealant VOC content shall be no greater than 250g/L.
 7. Colors:
 - a. Colors to match specified SSF colors from no less than 400 standard color choices.
 - b. Number of different colors required for project shall not be limited.
 8. Base Products:
 - a. At solid colored SSF: Color-Sil by Color Rite; 100 PCT silicone.
 - b. Where speckle colored SSF is specified: Poly-Sil by Color Rite; 100 PCT silicone with suspended accent color particles.
 - c. Architect to select final colors and locations during submittals phase.

- E. Conductive Foil Tape:
 - 1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.
- F. Insulating Felt Tape:
 - 1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.3 SHOP FABRICATION

- A. Shop Assembly
 - 1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's instructions.
 - 2. Form joints between components using color matched Joint Adhesive in an inconspicuous manner.
 - a. Reinforce with 4 IN wide strip of SSF material.
 - 3. Provide factory cutouts for plumbing fittings and bath accessories as indicated.
 - a. Radius inside corners of cutouts as large as but not less than 1/4 IN.
 - b. Reinforce with SSF corner blocks to avoid stress cracking.
 - c. Sand edges and corners smooth and free of chips or nicks.
 - d. Utilize heat conductive aluminum tape around drop-in stoves and other heat sources to protect SSF from thermal stress.
 - 4. Rout and finish component edges with clean, sharp returns.
 - a. Rout cutouts, radii and contours to template.
 - b. Smooth edges.
 - c. Repair or reject defective and inaccurate work.
 - 5. Fabricate coved splashes where indicated.
 - 6. Reinforce inside corners, narrow pieces, cantilevered overhangs, and stress points against breakage by laminating an additional thickness of SSF on concealed face.
 - 7. Laminate additional thicknesses of SSF and tool edge profiles indicated.
 - 8. Uniformly finish completed pieces according to SSF schedule.

2.4 FABRICATIONS

- A. SSF Countertops:
 - 1. Configurations as indicated on the IC-series Drawings.
 - 2. Composite thickness of countertop assemblies: 1-1/4 IN unless otherwise indicated.
 - a. Nominal Thickness of SSF material: Minimum 1/2 IN unless otherwise indicated.
 - 3. Radius exposed outside corners: Minimum 1-1/2 IN.
 - 4. Join multiple pieces, where required, with Joint Adhesive to create inconspicuous seam.
 - 5. Backer:
 - a. Configure backing material as required for application:
 - b. Ladder frame at SSF countertops supported by base cabinets:
 - 1) Form ladders from approved backing material ripped into 3- 4 IN wide strips.
 - 2) Locate main runner strips (rails) along front and back edges of countertops.
 - a) Provide clearance for shrinkage and normal expansion and contraction.
 - 3) Space front-to-back supports (stiles) to align with line where base cabinet units adjoin. Locate stiles over other wall brackets and supports.
 - 4) Where base cabinets and supports exceed in 24 IN width: Include additional intermediate stiles so that maximum spacing does not exceed 24 IN.
 - 5) Provide additional intermediate stiles at seams in SSF countertop material.
 - 6) Join the stiles to rails using screwed or glued wooden biscuit seams, serrated dowels or rabbeted seams.
 - 7) Overhangs: Configure backer material per SSF manufacturer's guidelines according to distance overhang projects past its support.
 - c. Countertops which span between supports 30 IN and wider:
 - 1) Fabricate backer from solid backing material (not stile and rail construction).

- 2) Extend one piece, solid backer material, across entire span. Extend load bearing edges not less than 4 IN over edge of supporting cabinets (or similar support).
 - d. Portions of Countertops schedule to support countertop equipment:
 - 1) Provide full backing for the entire countertop cross section for the full width of the equipment.
 - 2) Extend 4 IN (min) beyond equipment width and as required for mounting.
 - 6. Backsplashes and Sidesplashes:
 - a. Provide where indicated.
 - b. Thickness: Minimum 1/2 IN (unless otherwise indicated).
 - c. Height: As indicated.
 - d. Fabricate from same material and color as top.
 - e. Backsplash Style: Integrally coved.
 - f. Sidesplash Style: Applied.
 - 7. Front overhang of Tops: 1-1/2 IN, unless otherwise indicated.
 - 8. Edge Treatments: As indicated on the drawings.
 - 9. Polish exposed faces.
 - 10. SSF color / pattern / finish: Per SSF Schedule.
- B. Integral SSF Sinks:
- 1. Material: Cast, homogenous material composed of polyester and acrylic resins, fire retardant filler materials, and coloring agents.
 - 2. Shapes complying with IAPMO Z124 standards for plastic sinks and lavatories.
 - 3. Mounting: Seamed under mount.
 - 4. Mounting hardware: Manufacturer's standard bowl clips, panel inserts and fasteners for attachment of undermount sinks/lavatories.
 - 5. Provide bowl size and depth as indicated on IC-series elevations.
 - 6. Base Product: Model # 810.
 - 7. Color: Cameo White.
- C. Sinks (specified elsewhere):
- 1. Porcelain, enameled steel and/or stainless steel bowls: Specified in Section 22 42 00.
- D. Faucets and Trim: Specified in Section 22 42 00.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with fabricator present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Verify measurements, dimensions and drawing details before proceeding.
 - 2. Coordinate location of furring, nailers, blocking, grounds and similar supports for attached work.
 - 3. Examine conditions under which work is to be installed.
 - 4. Correct unsatisfactory conditions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. General:
 - 1. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
 - 2. Provide product in the largest pieces available.
 - 3. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - a. Exposed joints/seams will not be allowed.

4. Reinforce field joints with SSF strips extending a minimum of 1 to 2 IN on either side of the seam with the strip being the same thickness as the top.
 5. Cut and finish component edges with clean, sharp returns.
 6. Rout radii and contours to template.
 7. Anchor securely to base cabinets or other supports.
 8. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
 9. Carefully dress joints smooth, remove surface scratches and clean entire surface.
 10. Install countertops with no more than 1/8 IN sag, bow or other variation from a straight line.
 11. Units with sinks or lavatories shall withstand an applied vertical load of not less than 250 LBS on front edge of countertop.
- B. Countertops:
1. Install plumb, level, true and straight.
 - a. Shim as necessary using concealed shims.
 2. Adhere tops to base cabinets with dabs of a clear silicone sealant at 10 to 12 IN apart.
 3. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
 - a. Supply additional wood supports, spaced no more than 18 IN apart or as otherwise required for adequate strength.
 4. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
 - a. Ensure full contact with support brackets and backing for entire support length with mechanical fastening into backing material.
 - b. Provide fasteners of appropriate length. Do not allow screws to penetrate into SSF material.
 - c. Supply additional supports or solid backing as required for adequate strength.
 5. Where tops are abutted by walls at both ends:
 - a. Include 1/8 IN expansion gaps at both ends for every of 10 FT countertop.
 - b. Seal gaps with elastomeric sealant.
- C. Backsplashes and Sidesplashes:
1. Integrally Coved Splashes:
 - a. Join coved items to countertops using color matched Joint Adhesive.
 - b. Adhere to walls and other substrates with clear silicone sealant.
 - c. Seal to walls and adjacent cabinets with color matched, elastomeric sealant.
 2. Applied Splashes:
 - a. Join adhered items to substrate using color matched, elastomeric sealant.
 - b. Adhere to walls and other substrates with clear silicone sealant.
 - c. Seal to walls and adjacent cabinets with color matched, elastomeric sealant.
- D. Integral SSF Sinks:
1. Install SSF sink or lavatory bowls in locations shown on the drawings.
 2. Secure bowls to tops using Joint Adhesive and mounting hardware to maintain warranty.
 3. Drain connections: Specified in Section 22 42 00.
- E. Sinks:
1. Install sinks per Section 22 42 00.
 2. Seal to Countertop with elastomeric sealant and mounting hardware provided.
 3. Drain and overflow connections: Specified in Section 22 42 00.
- F. Faucets and Trim:
1. Install faucets and trim per Section 22 42 00.
 2. Plumbing connections: Specified in Section 22 42 00.
 3. Seal to Countertop with elastomeric sealant.

3.3 CLEANING AND PROTECTION

- A. Keep components clean during installation.

- B. Protect finished surfaces from damage.
- C. Remove adhesives, sealants and other stains.
- D. Replace damaged work which cannot be repaired.

END OF SECTION



DIVISION 20

GENERAL MECHANICAL



SECTION 20 05 00
SPECIAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Special Mechanical Requirements, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Drawings Use and Interpretation:
 - 1. Drawings are diagrammatic and indicate general arrangement of systems and equipment, except when specifically dimensioned or detailed.
 - 2. For exact locations of building elements, refer to dimensioned architectural/structural drawings.
 - 3. Field measurements take precedence over dimensioned drawings.
 - 4. Piping and ductwork plans are intended to indicate size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement.
 - 5. Field verify locations and arrangement of existing systems and equipment.
- D. Installation of Systems and Equipment:
 - 1. Installation is subject to clarification as indicated in reviewed Shop Drawings and Field Coordination Drawings.
 - a. Generally, lay out piping requiring gravity drainage first; then lay out large pipe mains, ductwork and electrical conduit.
 - b. This procedure is intended to promote orderly installation, but not to establish trade precedence.
 - c. Dimensions indicated are limiting dimensions.
 - d. Do not use equipment exceeding dimensions indicated on detail drawings or arrangements that reduce required clearances or exceed specified maximum dimensions.
 - e. In mechanical equipment room aisles, maintain clear head room between floor and underside of ducts, pipes, and equipment to allow for future replacing of equipment and major components (e.g., coils, fans, heat exchangers, pumps).
- E. Description of Systems:
 - 1. Provide materials resulting, upon completion, in functioning systems in compliance with performance requirements specified, and modifications resulting from reviewed Shop and Field Coordination Drawings.

1.2 QUALITY ASSURANCE

- A. Perform work in accordance with following codes:
 - 1. State and local building, plumbing and mechanical codes.
 - 2. American Gas Association.
 - 3. National Electrical Code.
 - 4. National Fire Protection Association.
 - 5. Authorities Having Jurisdiction (AHJ).
- B. Use only prime quality, new materials, apparatus and equipment.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Structural steel support drawings and calculations signed and sealed by Specialty Structural Engineer.

1.4 PROTECTION

- A. Provide covering and shielding for equipment provided to protect from damage.
- B. Repair, restore and replace damaged items.
- C. Protect nameplates on motors, pumps and similar equipment.
- D. Protect plumbing fixtures and brass or chromium plated trim, valves and piping from damage.
- E. Keep dirt and debris out of pipes and ducts by capping or plugging open ends.
 - 1. Keep plug or cap in place until final connections are made.

1.5 JOB CONDITIONS

- A. Avoid interference and interruption of existing utilities and services.
 - 1. Schedule work which will cause interference or interruption in advance with Owner, Construction Manager, Architect, authorities having jurisdiction, and affected contractors.
- B. Keep roads clear of materials and debris.
- C. Examine Contract Documents to determine how other work will affect execution of mechanical work.
- D. Examine site and become familiar with existing local conditions affecting work.
- E. Determine and verify locations of existing utilities on or near site.
- F. Make arrangements for and pay for necessary permits, licenses, and inspections.
- G. Air Quality Permits: Contractor shall be responsible for obtaining EPA air quality permits. Coordinate permitting process with Owner.
- H. Record drawings:
 - 1. Keep a complete set of mechanical drawings in job site office for indicating actual installation of mechanical systems and equipment.
 - 2. Use this set of drawings for no other purpose.
 - 3. Where material, equipment, or system components are installed differently from that indicated, indicate such differences clearly and neatly.
 - 4. At project completion, submit record set of drawings in accordance with Division 01.
- I. Operation and Maintenance Data:
 - 1. See Division 01.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Motors:
 - 1. Base:
 - a. Reliance Electric.
 - 2. Optional:
 - a. Baldor.
 - b. Century Electronics; E-Plus.
 - c. General Electric; Energy Saver.
 - d. Westinghouse Motor.
- B. Shaft grounding ring for motors:
 - 1. Base:
 - a. Aegis.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 ACCESS DOORS, PANELS, AND FRAMES

- A. Access Doors, Panels and Frames:
 - 1. See Section 08 31 16.
 - 2. Where not indicated on Drawings, provide access panels and/or doors at walls, and inaccessible ceilings permit access to equipment, devices and piping requiring service, adjustment, or inspection.
 - 3. Size:
 - a. As required to allow access, inspection, service, and removal of items served.
 - b. Minimum 18 IN x 18 IN.

2.3 COVERS FOR EXPOSED VERTICAL PIPING

- A. Covers for Exposed Vertical Piping:
 - 1. 18 GA stainless steel (type 302) with No.4 finish.
 - 2. Extend from 2 IN above ceiling to equipment or island partition.
 - 3. Size covers to contain number of pipes served.
 - 4. Minimize number of covers by enclosing maximum number of pipes in each drop.
 - 5. Anchor to equipment or partition.
 - 6. Fasten seams and joints with stainless steel pop rivets.

2.4 EQUIPMENT GUARDS

- A. Equipment guards:
 - 1. Use suitable structural frames with minimum 12 GA, 3/4 IN galvanized mesh, or expanded metal mesh.
 - 2. Attach to equipment by removable clips and bolts with wing nuts, or other approved connectors.
 - 3. At belts, provide opening for measuring RPMs.
 - 4. Provide at belts, couplings, moving machinery and equipment in accordance with OSHA.
 - 5. Design for easy access to belts and other items requiring replacement.

2.5 MOTORS AND CONTROLS

- A. Motors:
 - 1. Provide motors indicated in Mechanical Specification Divisions.
 - 2. Ball or roller bearing type, premium efficiency type.
 - 3. Starting and running characteristics consistent with torque and speed requirements of driven machine.
 - 4. Motor efficiency:
 - a. NEMA Standard MG-1, part 31.
 - b. Indicate full load efficiency on each nameplate.
 - 5. Rated in accordance with NEMA performance standards to carry full nameplate load continuously at maximum temperature rise of 40 DEGC above ambient with service factor of 1.15.
 - 6. Motor powers as scheduled.
 - 7. Do not allow power requirements of driven machine to exceed nominal nameplate rating of motor furnished.
 - 8. Do not include service factor when selecting motor power.
 - 9. Motors 1/2 HP and over: 460/3/60.
 - 10. Motors less than 1/2 HP: 115/1/60.
 - 11. Provide for items which require electric drive.
- B. Motors for use with variable frequency drives (VFDs):
 - 1. Provide with following to prevent bearing current damage:
 - a. Shaft grounding ring:
 - 1) Discharges shaft currents to ground through use of frictionless conductive microfibers surrounding motor shaft.
 - 2) Maintenance required: none.
 - 3) Design to last for service life of motor.

- 4) RPM limitation: none.
 - 5) Manufacturer: Aegis SGR.
- C. Motor controls and wiring for controls:
1. Provide complete installation of controls and wiring for controls for Mechanical Specification Divisions packaged/pre-wired equipment.
 - a. Include line voltage controls, low voltage controls, control switches, starters, disconnects, conduit, and wiring.
 - b. Locate disconnects on outside of equipment enclosures or guards.
 2. Starters, disconnects, conduit, and wiring furnished under Mechanical Specification Divisions shall comply with applicable Electrical Specification Divisions.
 3. Where equipment is specified with packaged/pre-wired controls, but is furnished instead with loosely shipped components that require field wiring, coordinate complete installation and assume costs.

2.6 RAIN HOODS AND COUNTER FLASHINGS

- A. Rain hoods and counter flashings not exposed to view:
1. Stainless steel: Minimum 20 GA.
 2. Sheet copper: Minimum 24 OZ/SF.
- B. Rain hoods and counter flashings exposed to view:
1. Material specified in Section 07 62 00.

2.7 PENETRATIONS

- A. Maintain fire and smoke ratings where mechanical items penetrate fire and fire/smoke rated building elements.

2.8 STRUCTURAL STEEL FOR SUPPORTS

- A. Assume engineering responsibility for design of steel supports.
- B. Engineer Qualifications: Comply with Section 01 71 21, Specialty Engineering Requirements
- C. Design units and connections to satisfy requirements of applicable Building Codes.
- D. Design units and connections capable of withstanding the following design loads as shown on structural drawings within limits and under conditions indicated:
1. Include effect from adjacent attached construction.
 2. Wind pressure, and/or earthquake lateral forces.
 3. Live Loads.
 4. Dead load of unit plus superimposed loads.
- E. Structural Steel for Supports:
1. Comply with ASTM A36.
 2. Galvanize members installed in fan plenums or areas of high humidity or condensation, and outside.
 3. Furnish other members with shop coat of rust inhibiting primer.
 4. Shop fabricate for field assembly using bolts.
 5. Minimize field welding.
 6. Retouch primer after field welding.

PART 3 - EXECUTION

3.1 GENERAL

- A. When changes in location of work are required, obtain approval of Architect before making change.
1. Make changes at no extra cost.
- B. Provide necessary offsets and crossovers in piping and ductwork, whether indicated or not.

- C. Install piping and ductwork parallel to walls and vertically plumb.
- D. Do not change indicated sizes without approval of Architect.
- E. Electrical equipment:
 - 1. Maintain space above electrical equipment rooms and closets clear of ductwork and piping.
 - 2. Maintain space above panelboards, switchboards, motor control centers, or motor control panels clear of ductwork and piping.
- F. In elevator machine rooms, install no piping except floor drains and fire protection piping that specifically serves the room.
- G. Roof penetrations:
 - 1. Make penetrations through roofs prior to installation of roofing.
 - 2. For penetrations required after installation of roofing:
 - a. In built up roofing (BUR), provide curbs, cants and counter flashings.
 - b. In elastic sheet roofing (ESR), arrange and pay for flashing work by authorized roofer; provide counter flashings.
 - 3. Repair and replace roof construction which is damaged by this work in manner which will not nullify roof warranty.

3.2 LOCATING SERVICEABLE DEVICES

- A. Install devices, that may require adjustment or service maintenance, in accessible locations or provide flush-mounted access doors.
 - 1. Such devices include but are not limited to equipment, valves, filters, motors, drives, compressors, unions, traps, strainers, thermometers, gauges, switches, measurement devices, coils, detectors, dampers, sensors, monitors, backflow prevention devices, drains, floor sinks, cleanouts, test stations, signal devices, sprinkler heads, air vents, expansion joints, and system drains.
 - 2. Arrange piping, conduit, ducts, and related work to facilitate maintenance.
 - 3. Relocate items which interfere with access.

3.3 CUTTING AND PATCHING

- A. Requesting openings in advance.
 - 1. Coordinate locations with work of other sections.
- B. Avoid cutting, where possible, by setting sleeves or frames.
- C. Before cutting of structural elements, obtain written approval of Structural Engineer.
 - 1. Use only approved methods.
 - 2. Neatly cut holes as approved by structural engineer to admit work.
 - 3. Do not weaken walls or floors; locate holes in concrete to avoid structural members.
- D. Perform cutting, fitting, repairing, patching and finishing of work to permit installation of mechanical work.
- E. Locate openings and sleeves to permit neat installation of piping, ductwork and equipment.
- F. Do not remove or damage fireproofing materials.
 - 1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
 - 2. Repair or replace fireproofing removed or damaged.
- G. Remove and replace existing ceilings for mechanical work in existing areas.
- H. See Section 01 73 29.

3.4 EXCAVATING AND BACKFILLING

- A. See Section 31 23 33.

3.5 INSTALLATION OF EQUIPMENT

- A. Install equipment in accordance with manufacturer's recommendations and as specified.

- B. Provide necessary anchoring devices and supports.
 - 1. Use structural supports suitable for equipment, or as indicated.
 - 2. Check loadings and dimensions of equipment with shop drawings.
 - 3. Do not cut building structural members.
 - 4. Provide equipment supports even though not detailed on architectural and structural drawings.
- C. Equipment Bracing:
 - 1. See Section 20 05 48.
- D. Coordinate fit of equipment support with layouts indicated.
 - 1. Where substitute equipment is used, revise indicated supports to fit.
- E. Arrange for necessary openings to allow entry of equipment.
 - 1. Where equipment cannot be installed as structure is being erected, provide and arrange for building in of boxes, sleeves or other devices to allow later installation.
- F. Install rain hoods and metal counter flashings as indicated, and to make penetrations of mechanical work through walls and roofs water and weathertight.
 - 1. Furnish clamps, waterproofing material and labor.
 - 2. Where metal flashings are applied over concrete, paint concrete with 1/8 IN of mastic cement first.
 - 3. Set flashing in mastic cement, watertight.
- G. Provide concrete foundations (isolation pads) or housekeeping pads for mechanical equipment as follows unless indicated otherwise:
 - 1. Install 4 IN high concrete housekeeping pads. Outside dimension of pad shall be at least 4 IN larger in all directions than base of equipment or 9 IN from center of anchor, which ever is greater.
 - 2. Use 3,000 PSI concrete.
 - 3. Reinforce with No.4 bars, 12 IN OC each way, with short No.4 dowels into floor at 24 IN OC each way .
 - 4. Chamfer top edges 3/4 IN.
 - 5. Make faces smooth.
 - 6. Set anchor bolts for equipment.

3.6 INSTALLATION OF EQUIPMENT FURNISHED BY OWNER OR OTHER DIVISIONS

- A. Receive, uncrate and set in place mechanical equipment furnished by Owner or other Divisions.
- B. Remove, relocate and reinstall existing mechanical equipment to be reused.
- C. Provide rough-in and final connections to equipment requiring mechanical services.
 - 1. See schedules.
 - 2. Obtain rough-in data from inspection of same for existing equipment.
 - 3. Obtain rough-in data from final shop drawings for equipment furnished by Owner or other divisions.
- D. Install loosely shipped fittings, valves, and other items furnished as integral part of equipment.

3.7 PAINTING

- A. See Section 09 91 13 and Section 09 91 23.

3.8 WORK IN EXISTING BUILDING

- A. Where relocation of existing equipment and piping systems is necessary in areas providing uninterruptible services, schedule work for minimal down time during slack periods.
- B. Assign an adequate crew to accomplish job in shortest time.
- C. Fabricate and install interconnecting portions of these systems prior to shut down for final connections including valve assemblies in piping systems and dampers in ductwork.

- D. Locate existing piping and make connections as required.
 - 1. Do not cut into existing services without first verifying with Owner that service has been correctly identified.
 - 2. Perform work interrupting service at time to cause least interference to normal operation of building.
 - 3. Inform building engineering staff in advance of interruptions and provide estimate of duration.
 - 4. Begin work only after engineering staff is fully informed and has agreed to schedule of service interruptions.
- E. Maintain existing services and equipment unless indicated to be removed.
- F. Salvage items in accordance with Section 02 41 00.

3.9 FIELD QUALITY CONTROL

- A. Perform indicated tests to demonstrate workmanship, operation, and performance.
 - 1. Conduct tests in presence of Architect and, if required, inspectors of agencies having jurisdiction.
 - 2. Arrange date of tests in advance with Architect, manufacturer and installer.
 - 3. Give inspectors minimum of 24 HRS notice.
 - 4. Furnish or arrange for use of electrical energy, steam, water or gas required for tests.
 - 5. Furnish materials required for test.
- B. Repair or replace equipment and systems found inoperative or defective and retest.
 - 1. If equipment or system fails retest, replace it with products conforming to Contract Documents.
 - 2. Continue remedial measures and retests until satisfactory results are obtained.
- C. Test equipment and systems for each item, unless otherwise recommended by manufacturer.
 - 1. Tests specified in Section 20 08 00, Testing and Balancing need not be duplicated under other sections.

3.10 ADJUST AND CLEAN

- A. Inspect equipment and put in satisfactory working order.
- B. Clean exposed and concealed items: See Section 01 74 23 Cleaning .
 - 1. Clean air surfaces of coils, fans (including fan wheels and motors), air handler plenums and air filter frames.
 - 2. Clean floor drains, cleanouts, and plumbing fixtures.
 - 3. Clean specialties such as traps and strainers and equipment surfaces such as pumps, motors, boilers, chillers, etc.
 - 4. Clean finned elements of fin tube radiation with compressed air.
 - 5. Clean piping of tags, debris and other construction materials before insulating or painting.
 - 6. Clean debris including dirt and sand out of ductwork.

3.11 PUTTING SYSTEMS IN OPERATION - START UP

- A. Prior to substantial completion and building occupancy, at time agreed to by Owner and Architect, put systems into satisfactory operation.
 - 1. At first heating or cooling season following substantial completion, put systems not yet operated under their seasonal loads into satisfactory operation.
- B. Operate systems in satisfactory working order for period of 10 working days.
 - 1. After the 10 days, clean debris including dirt and sand out of ductwork.

END OF SECTION

SECTION 20 05 19
PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Piping Specialties, as indicated, in accordance with provisions of Contract Documents.
- B. Systems Included:
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Comply with applicable UL, ANSI and ASTM Standards.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Layout of piping showing expansion joints and manufacturer recommended locations for pipe anchor and guide locations.
 - 2. Include axial, lateral, and vertical stresses at anchors as calculated by expansion joint manufacturer. Stresses shall be compliant with ASME B31.1 requirements.
- B. Product Data:
 - 1. Expansion joints.
 - 2. Pressure gauges.
 - 3. Thermometers.
 - 4. Wye strainers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Expansion joints, bellows type:
 - 1. Base:
 - a. Hyspan Precision Products, Inc. (Barco).
 - 2. Optional:
 - a. Senior Flexonics Pathway.
 - b. American Boa Inc.
 - c. Hyspan Precision Products, Inc. (Barco).
- B. Pressure gauges:
 - 1. Base:
 - a. Weiss Instruments.
 - 2. Optional:
 - a. Trerice, HO.
 - b. Marsh Instrument.
 - c. US Gauge.
 - d. Weiss Instruments.
 - e. Weksler Instruments.
 - f. Weston and Ernst.
 - g. Winters.
- C. Thermometers and Pressure Gauges:
 - 1. Base:
 - a. Weiss Instruments.

2. Optional:
 - a. Marsh Instrument.
 - b. Marshalltown Instrument.
 - c. Palmer Instruments.
 - d. Taylor Environmental Instruments.
 - e. Trerice, HO.
 - f. Weiss Instruments.
 - g. Weksler Instruments.
 - h. Weston and Ernst.
 - i. Ashcroft.
 - j. Winters.
- D. Wye strainers:
 1. Base:
 - a. Armstrong International
 2. Optional:
 - a. Armstrong International.
 - b. Spirax Sarco.
 - c. Keckley, OC.
 - d. Metraflex.
 - e. Mueller Steam Specialty.
 - f. Spence Engineering.
 - g. Victaulic of America.
- E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 EXPANSION JOINTS

- A. Expansion joints, bellows type:
 1. Suitable for 150 PSI working pressure and 380 DEGF maximum temperature.
 2. In 2-1/2 IN and smaller lines:
 - a. Expansion-compensator type with external shrouds.
 - b. Bellows: Stainless steel.
 - c. Shrouds and end fittings: Carbon steel or bronze (compatible with system piping material).
 3. In 3 IN and larger lines:
 - a. Controlled-flexing type with neck and control rings.
 - b. Bellows: Stainless steel.
 - c. Flanges: Steel.
 - d. Control rings: Nickel iron.

2.3 PRESSURE GAUGES

- A. Pressure gauges:
 1. Steam systems and water systems operating above 150 DEGF :
 - a. Case and twist ring: 4-1/2 IN diameter, anodized aluminum.
 - b. Socket: brass.
 - c. Bourdon tube: Phosphor bronze.
 - d. Movement: Bushed Brass Rotary.
 - e. Dial: White aluminum, black markings.
 - f. Pointer: Black or red anodized aluminum, slotted adjustable.
 - g. Window: Glass.
 - a. Siphon and gauge cock (low pressure steam): brass.
 - b. Siphon and needle valve (medium and high pressure steam): brass..
 - c. Accuracy: 1.0 PCT full scale, ASME B40.1 Grade 1A.
 - d. Range: Operating pressure to occur in middle half (25 % to 75 PCT) of the full scale range of the fluid being measured.
 - e. Connections: 1/4 IN or 1/2 IN NPT.
 2. Compressed air systems and water systems operating below 150 DEGF

- a. Case and Ring: 4 IN diameter, liquid filled, type 304 stainless steel case with polished stainless steel bayonet ring.
 - b. Fill liquid: Glycerin.
 - c. Socket: Brass with push-in restrictor.
 - d. Bourdon tube: Phosphor Bronze.
 - e. Movement: Brass rotary type with bushings.
 - f. Dial: White aluminum with black markings.
 - g. Pointer: Black or red anodized aluminum, adjustable.
 - h. Window: Clear acrylic.
 - i. Snubber and gauge cock: Chrome plated brass.
 - j. Accuracy: 1.0 PCT full scale, ASME B40.1 Grade 1A.
 - k. Range:
 - 1) Refer to pressure range schedule except as follows:
 - a) Pump suction gauges for open piping systems where elevation difference between pump center line and liquid level of open system is less than 50 FT: Compound type, indicating at least 30 IN Hg to 30 PSIG.
 - b) Fuel oil pump suction: Compound type, indicating to 210kPa 30 IN Hg to 30 PSIG.
 - l. Connections: 1/4 IN or 1/2 IN NPT.
3. Pressure gauge range schedule:

	Range PSIG	Fig. Interval PSIG	Inter. Gradu- ations PSIG	Bldg. Height Stories
Fire	0-400	50	5	
Domestic hot water	0-200	20	2	
Domestic cold water	0-200	20	2	

2.4 SYSTEM DRAINS

- A. Valved drains (nonpotable water):
 - 1. Piping 2 IN and smaller:
 - a. 1/2 IN V-13, or V-14 with male hose-thread outlet and brass cap.
 - 2. Piping 2-1/2 IN and larger:
 - a. 1-1/2 IN V-13 or V-14 ball valve with 1-1/2 IN fire hose adapter and cap.
- B. Valved drains (potable water):
 - a. 1/2 IN V-13 with plugged outlet.
- C. On nonpotable systems, label system drains as nonpotable.
- D. Valve standards: See section 20 05 23.

2.5 THERMOMETER WELLS (SOCKETS) AND TEST GAUGE CONNECTIONS

- A. Temperature sensing wells (sockets) and test gauge connections:
 - 1. Brass or stainless steel.
 - 2. Provide extension necks for insulated piping.

2.6 THERMOMETERS

- A. BiMetal Thermometers:
 - 1. Case: Type 304 Stainless Steel.
 - 2. Window: Shatterproof glass or acrylic.
 - 3. Stem assembly: Stainless steel all welded construction and 1/2 IN NPT connection.
 - 4. Element fluid: Silicone.
 - 5. Dial: Heavy gauge aluminum, white finish, black or red graduation lines and numerals.
 - 6. Accuracy: 1 PCT of scale range.

- B. Liquid filled thermometers:

1. Case: Industrial type molded polyester or die cast aluminum.
2. Window: Shatterproof glass or acrylic.
3. Liquid: Blue reading, non-mercury.
4. Scale: 9 IN scale minimum, black lines and numbers.
5. Accuracy: 1 PCT of scale range.
6. Angle adjustment: variable with angle adjusting screw.

C. Digital Thermometers:

1. Case: High-impact ABS.
2. Display: m 1/2 IN LCD digits.
3. Sensor: Glass passivated thermistor.
4. Ambient Operating conditions:-30 DEGF to 140 DEGF.
5. Accuracy 1 PCT of reading or 1 DEGF.
6. Resolution: .1 DEGF between-20 DEGF and 200 DEGF.
7. Recalibration: Through case potentiometer adjustment.
8. Lux rating: 10 Lux (one foot candle).
9. Update span: 10 seconds.
10. Range: -50 DEGF to 300 DEGF. Switchable from Metric to English scale.
11. Ambient temperature error: Zero.
12. Maximum ambient humidity: 100 PCT.
13. Power: Solar.

D. Thermometers range schedule:

	Range degF	Division degF
Domestic hot water	32-180	2
Domestic cold water	32-100	1
Heating hot water	50-300	2
Condensate pump disc	50-300	2
Compressed air	50-300	2
LP steam	50-300	2
Boiler feed water	50-300	5
Blow down	50-400	5
Fuel oil	50-400	5
Chilled water at coils	32-130	1
Chilled water at pumps and chiller	32-100	1
Condenser water	32-100	1

2.7 WYE STRAINERS FOR STEAM AND HYDRONIC SYSTEMS

A. Wye strainers.

1. Screwed or flanged.
2. Body:
 - a. 2 IN and smaller:
 - 1) Cast bronze, ASTM B62, screwed ends.
 - b. 2-1/2 IN and larger:
 - 1) Cast iron, flanged ends.
 - 2) Coating: Rust inhibiting.
3. Working pressure, non shock: 150 PSIG.
4. Screens:
 - a. Water: Bronze, monel or stainless steel.
 - 1) 2 IN and less: 3/64 IN perforations.
 - 2) 2-1/2 IN and larger: 1/8 IN perforations.
 - b. Steam: Stainless steel or brass.
 - 1) 3/64 IN perforations.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install piping specialties according to manufacturer instructions and as specified.

3.2 EXPANSION JOINTS

- A. Expansion joints in hot water and steam piping, bellows type:
 - 1. Suitable for 150 PSIG working pressure and 380 DEGF maximum temperature.
 - 2. Provide pipe guides at 4 and 14 pipe diameters from each expansion joint.
 - 3. Install pipe guides in accordance with Expansion Joint Manufacturers Association Standard.
 - 4. Size in accordance with manufacturer's recommendation, with 30 PCT excess traverse available at maximum expansion.
 - 5. Axial traverse indicated includes 30 PCT excess.

3.3 PRESSURE GAUGES

- A. Install filter type pressure snubbers at pumps and chillers.
- B. Install siphons on steam gauges.
- C. Install brass tee handle cock and 1/4 IN hard tempered tubing from gauge to pipe connection.
- D. Install additional brass tee handle cock at gauge for panel mounted gauge.
- E. Calibrate and zero gauges at job site.

3.4 SYSTEM DRAINS

- A. At low points of piping systems, provide valved drains to allow complete drainage of each system.
- B. Neither terminate nor run drains over electrical equipment.

3.5 THERMOMETER WELLS AND TEST GAUGE CONNECTIONS

- A. Provide test thermometer well adjacent to each point where a temperature sensing device is required by control specifications and where piping schematics indicate thermometers.
- B. Placement and sizing:
 - 1. For 4 IN piping and larger, place tee in piping to create perpendicular flow-to-stem measurement.
 - a. Size stem length based on pipe size as indicated below:
 - 1) 4 and 5 IN pipe: 3-1/2 IN stem.
 - 2) 6 and 8 IN pipe: 6 IN stem.
 - 3) 10 and 12 IN pipe: 9 IN stem.
 - 4) 14 IN pipe and larger: 12 IN stem.
 - 2. For piping smaller than 4 IN, place oversize piping well and tee in 90-degree piping turn to create parallel flow-to-stem measurement.
 - a. Stem length: 12 IN.
 - b. Piping well length: 14 IN.
 - c. Size piping well and tee based on pipe size as indicated below:
 - 1) 1/2 and 3/4 IN pipe: 1-1/4 IN well and tee.
 - 2) 1 IN pipe: 1-1/2 IN well and tee.
 - 3) 1-1/4 and 1-1/2 IN pipe: 2 IN well and tee.
 - 4) 2 IN pipe: 2-1/2 IN well and tee.
 - 5) 2-1/2 and 3 IN pipe: 4 IN well and tee.

3.6 THERMOMETERS

- A. Where temperature control requires a temperature transmitter, a thermometer is not required in same location unless specifically required in equipment specifications.

- B. Where 2 or more pumps are headered, provide one thermometer in suction header and one in discharge header.

3.7 WYE STRAINERS

- A. Provide wye strainers as indicated in piping-system sections.
- B. Connections to suit piping system.
- C. Provide blow-down valves:
 - 1. Strainers 6 IN and larger: 1-1/2 IN blow-down valve.
 - a. Pipe blow down to drain.
 - 2. Strainers 2 to 5 IN: 1 IN blow-down valve with 3/4 IN hose end connection and brass cap.
 - 3. Strainers 1-1/2 IN and smaller: 1/2 IN blow-down valve with 3/4 IN hose end connection and brass cap.

END OF SECTION

SECTION 20 05 23
MANUAL VALVES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Manual Valves, as indicated, in accordance with provisions of Contract Documents.
- B. Definitions:
 - 1. Class: ANSI Class.
 - 2. SWP: Steam Working Pressure.
 - 3. WOG: Water/Oil/Gas non-shock working pressure.
 - 4. WWP: Cold water non-shock working pressure.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. This specification lists a variety of valves that may be applicable to the project. Not all valves listed are applicable to the project, refer to appropriate specs sections for project applicability.
- B. Fire protection valves: UL listed, NFPA and FM approved.
- C. Valves used in flammable liquid or flammable gas systems: UL listed for applicable service.
- D. Valves for Potable Water: Shall comply with provisions called for by the Safe Drinking Water Act as amended by S3874 (the "Lead Free Law) or any subsequent amendments or addendums thereto.
- E. Valve bodies, shells and seats: Designed, manufactured, and tested in accordance with the following:
 - 1. Pressure testing of steel valves: MSS SP-61.
 - 2. Butterfly valves: MSS SP-67.
 - 3. Cast iron gate valves, flanged and threaded ends: MSS SP-70.
 - 4. Cast iron swing check valves, flanged and threaded ends: MSS SP-71.
 - 5. Cast iron plug valves, flanged and threaded ends: MSS SP-78.
 - 6. Bronze gate, globe, angle and check valves: MSS SP-80.
 - 7. Valve pressure testing methods: MSS SP-82.
 - 8. Cast iron globe and angle valves, flanged and threaded ends: MSS SP-85.
 - 9. Diaphragm type valves: MSS SP-88.
 - 10. Resilient seated eccentric cast iron plug valves: MSS SP-108.
 - 11. Ball valves--threaded, socket-welding, solder joint, grooved, and flared ends: MSS SP-110.
- F. Standard Specification for Composition of Bronze or Ounce Metal Castings: ASTM-B62.
- G. Standard Specification for Steam or Valve Bronze Castings: ASTM-B61.
- H. Iron body valves:
 - 1. Pressure containing parts: ASTM-A126, Grade-B.
 - a. Standard Specification for Gray Iron Castings for valves, flanges and pipe fittings: ASTM-A126, Grade B.
 - 2. Face to face and end to end dimensions: ANSI/ASME-B16.10.
 - 3. Use domestic manufactured valves as defined by Buy American Act.
- I. Valve stems: ASTM-B371, Alloy C69400; ASTM-B371, Alloy C65100H04 (rolled silicon brass); or other material equally resistant to dezincification.
- J. Indicate following information on valves:
 - 1. Stamped or cast into body:

- a. Manufacturer's name or trademark.
 - b. Pressure rating as Class, SWP, WOG, or WWP.
 - c. "UL-FM" for UL-FM valves.
2. Permanently attached to body:
- a. Valve's country of origin.

1.3 SUBMITTALS

A. Product Data:

- 1. Valves.
 - a. In addition to submittal requirements of Section 01 33 00, submittal shall include the following:
 - 1) For submittals with model numbers not listed in this section, include published cross reference sheet. Indicate association between submitted model number and the listed model number on the cross reference sheet.
 - 2) For each valve submitted indicate in which specification section(s) and in which system(s) the valve will be used.
 - b. When valve assembly includes components other than the base valve body and handle (e.g., operator, valve box), include data on entire valve assembly.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Angle valves:

- 1. Base:
 - a. Nibco.
 - b. Stockham .
- 2. Optional:
 - a. Crane Valves.
 - b. Hammond Valve.
 - c. Jenkins Valves.
 - d. Lunken.
 - e. Milwaukee Valve.
 - f. Powell.
 - g. Walworth.

B. Ball valves:

- 1. Base:
 - a. Milwaukee Valve.
 - b. Nibco.
- 2. Optional:
 - a. Apollo.
 - b. Crane Valves.
 - c. Hammond Valve.
 - d. Jamesbury.
 - e. Jenkins Valves.
 - f. Stockham.

C. Butterfly valves:

- 1. Base:
 - a. DeZurik.
 - b. Milwaukee Valve.
 - c. Stockham.
 - d. Victaulic of America.
- 2. Optional:
 - a. CenterLine Inds.
 - b. Crane Valves.

- c. Jamesbury.
 - d. Hammond Valve.
 - e. Keystone Valve.
 - f. Lunken.
 - g. Mueller Steam Specialty.
 - h. Nibco.
 - i. Powell.
 - j. Walworth.
- D. High Performance Butterfly Valves:
- 1. Base:
 - a. Dezurik.
 - 2. Optional:
 - a. Bray Controls.
 - b. Neles (Jamesbury).
- E. Check valves:
- 1. Base:
 - a. Apco Valve & Primer.
 - b. Nibco.
 - c. Stockham Valves & Fittings.
 - 2. Optional:
 - a. Crane Valves.
 - b. Hammond Valve.
 - c. Kennedy Valve.
 - d. Milwaukee Valve.
 - e. Mueller Steam Specialty.
 - f. Powell.
 - g. Victaulic of America.
 - h. Viking.
 - i. Walworth.
 - j. Waterous.
- F. Gate Valves:
- 1. Base:
 - a. Mueller Steam Specialty.
 - b. Nibco.
 - c. Stockham.
 - 2. Optional:
 - a. Crane Valves.
 - b. Hammond Valve.
 - c. Jenkins Valves.
 - d. Kennedy Valve.
 - e. Milwaukee Valve.
 - f. Mueller Steam Specialty.
 - g. Powell.
 - h. Walworth.
- G. Globe valves:
- 1. Base:
 - a. Stockham.
 - 2. Optional:
 - a. Crane Valves.
 - b. Hammond Valve.
 - c. Jenkins Valves.
 - d. Lunken.
 - e. Milwaukee Valve.
 - f. Nibco.

- g. Powell.
 - h. Walworth.
- H. Plug valves:
- 1. Base:
 - a. DeZurik.
 - b. Resun Valves.
 - 2. Optional:
 - a. Milliken.
 - b. Mueller Steam Specialty.
 - c. Rockwell International.
 - d. Victaulic of America.
- I. Valve boxes and stop boxes:
- 1. Base:
 - a. Tyler Pipe.
 - b. Western.
 - 2. Optional:
 - a. Neenah Foundry.
 - b. Vulcan.
 - c. Local foundry.
- J. Balancing valves (globe style):
- 1. Base:
 - a. Tour and Andersson.
 - 2. Optional:
 - a. Armstrong.
 - b. Wheatley.
 - c. Mepco.
- K. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Ball valves:
- 1. Port size: Standard.
 - 2. Ball and stem material: 316 Stainless Steel unless noted otherwise in specific valve description.
 - 3. Blow-out proof stems.
 - 4. Reinforced Teflon (PTFE) (PTFE) seats.
 - 5. Teflon (PTFE) (PTFE) seals.
 - 6. Adjustable packing.
 - 7. 3-piece valves:
 - a. May be standard port.
 - b. Repairable in line.
- B. Butterfly valves:
- 1. Ninety degree operation.
 - 2. Bubble-tight shut off, suitable for bi-directional dead-end service at rated pressure without use of downstream flange.
 - 3. 2 IN extended neck.
 - 4. Lugs, where specified, shall be drilled and tapped.
 - 5. Operators:
 - a. 2-1/2 to 4 IN: Position lock handle.
 - b. 5 IN and larger: gear operator with 4-arm or wheel handle.
 - 6. Bronze:
 - a. Viton seals.
 - b. Pressure rating: Refer to valve listings under Part 2.3.
- C. High performance butterfly valves:

1. Ninety degree operation.
 2. Bi-directional, drip-tight shut off at full pressure rating.
 3. 2 IN extended neck.
 4. Lugs shall be drilled and tapped.
 5. Operator: gear type with 4-arm or wheel handle.
 6. Body: carbon steel.
 7. Disc: stainless steel.
 8. Seat: RTFE.
 9. Stem: stainless steel; blow-out proof.
 10. Taper pins: compression type; stainless steel.
 11. ANSI Class: 150.
 12. Applicable fire test standard: API-607.
- D. Chain operators:
1. Provide operators for valves located in mechanical spaces 8 FT or higher above floor.
 2. Chain lever or chain sprocket operator with sufficient chain to reach within 5 FT of floor.
 3. Remote operator accessories by same manufacturer as valve.
 4. Do not provide for Fire Protection valves.
- E. End styles, general:
1. Compatible with piping systems served.
 2. Flanged valves:
 - a. Class 125 cast iron: Flat flanges.
 - b. Class 250 cast iron: Raised flanges.
 - c. Ductile iron: Raised flanges.
 3. Valves with solder ends for use in brazed piping systems shall be constructed for brazing.
- F. Extended necks and stems:
1. For valves specified with extended necks or stems, provide design that isolates moving valve parts from insulation.
 2. For valves specified with extended necks or stems and memory stops, provide design that allows access to memory stop without disturbing insulation.
- G. Packing shall not contain asbestos.
- H. Plug valves:
1. Eccentric plugs:
 - a. Non-lubricated valves with resilient seats shall be suitable for 250 DEGF service.
 - b. Rubber seated eccentric plugs: Bolted stem seals shall permit replacement of packing without removing valve from line or removing parts other than operator.

2.3 VALVES

- A. General:
1. Example model numbers may indicate a general series, or may be abbreviated. They may not reflect all features described. Provide valves with described features.
 2. Specified requirements are minimums. Valves that meet or exceed specifications may be submitted.
 3. Where valves are installed in piping systems using ring seal crimped pipe joining systems acceptable manufactures who manufacture valves designed for connection to ring seal crimped systems are acceptable. Refer to specification sections 22 10 16 Plumbing Piping and 23 21 13 Hydronic Piping Systems for acceptable applications of Ring Seal Crimped piping systems..
- B. V-1: Gate valve, Class 125, bronze body, screwed bonnet, non-rising stem, solid wedge disc, solder. Example: Stockham B-112.
- C. V-2: Gate valve, Class 150, bronze body, union bonnet, rising stem, solid wedge disc, threaded. Example: Stockham B-120.

- D. V-3: Gate valve, Class 125, cast iron body, bronze trim, bolted bonnet, rising stem, OS&Y, solid wedge disc, flanged. Example: Stockham G-623.
- E. V-4: Gate valve, same as V-2 except Class 200. Example: Stockham B-135.
- F. V-5: Gate valve, same as V-3 except Class 250. Example: Stockham F-667.
- G. V-6: Globe valve, Class 150, bronze body, union bonnet, renewable Teflon (PTFE) disc, solder. Example: Stockham B-24T.
- H. V-7: Globe valve, same as V-6 except threaded. Example: Stockham B-22T.
- I. V-8: Globe valve, Class 125, cast iron body, bronze trim, bolted bonnet, OS&Y, renewable seat and bronze disc, flanged. Example: Stockham G-512.
- J. V-9: Globe valve, Class 200, bronze body, union bonnet, renewable plug type seat and disc, threaded. Example: Stockham B-62.
- K. V-10: Globe valve, same as V-8 except Class 250. Example: Stockham F-532.
- L. V-11: Ball valve, 150 PSI SWP, 400 PSI WOG bronze body, adjustable memory stop, 3-piece construction, extended stem, solder. Example: Milwaukee UPBA-350S.
- M. V-12: Ball valve, same as V-11 except threaded. Example: Milwaukee UPBA-300S.
- N. V-13: Ball valve, 150 PSI SWP, 400 PSI WOG bronze body, 2-piece construction, extended stem, solder. Example: Milwaukee BA-450S.
- O. V-14: Ball valve, same as V-13 except threaded. Example: Milwaukee BA-400S.
- P. V-15: Ball valve, 150 PSI SWP, 600 PSI WOG, 29 IN Hg vacuum service, full port, bronze body, 3-piece construction, chrome plated brass ball, Teflon seats, cleaned and capped for oxygen service, lockable or non-lockable as specified, color coded handle to match gas service, braze. Example: Milwaukee BA-350.
- Q. V-16: Ball valve, 150 PSI SWP, 600 PSI WOG, 250 PSI UL listed for flammable liquids and LP gas, bronze body, 2-piece construction, full or standard port, bronze ball, non-lubricated, threaded. Example: Nibco T-580-70-UL & T-585-70-UL.
- R. V-17: Angle valve, Class 125, bronze body, screwed bonnet, bronze disc, threaded. Example: Stockham B-216.
- S. V-18: Angle valve, Class 125, cast iron body, bolted bonnet, bronze trim, renewable seat and disc, flanged. Example: Nibco F-818-B.
- T. V-19: Angle valve, Class 200, bronze body, union bonnet, bronze disc, threaded. Example: Stockham B-237.
- U. V-20: Angle valve, Class 250, cast iron body, bronze trim, flanged. Example: Stockham F-541.
- V. V-21: Angle valve, automatic stop-check, Class 250, cast iron body, bolted bonnet, renewable disc and seat, flanged. Example: Stockham F-541.
- W. V-22: Check valve, in-line pattern, spring-operated double doors, Class 250, cast iron body, renewable bronze doors and Viton-A seal, Inconel springs, stainless steel trim, flat faced wafer. Example: Stockham WG-976.
- X. V-23: Check valve, Y-pattern, horizontal swing, Class 150, bronze body, threaded cap, renewable Teflon (PTFE) disc and seat, threaded. Example: Nibco T-433-Y.
- Y. V-24: Check valve, Y-pattern, horizontal swing, Class 125, bronze body, threaded cap, renewable bronze disc and seat, solder. Example: Nibco S-413-Y-LF.
- Z. V-25: Check valve, same as V-23 except Class 125. Example: Nibco T-413-Y-LF.

- AA. V-26: Check valve, in-line pattern, spring-operated disc, Class 125, bronze body, renewable Teflon (PTFE) disc and seat, 316 stainless-steel spring, threaded. Example: Nibco T-480-Y.
- BB. V-27: Check valve, T-pattern, horizontal lift, Class 150, bronze body, union bonnet, renewable Teflon (PTFE) disc and seat, threaded. Example: Stockham B-322-T.
- CC. V-28: Check valve, T-pattern, horizontal swing, Class 125, cast iron body, bolted bonnet, bronze trim, renewable bronze or cast iron disc and seat, flanged. Example: Stockham G-931.
- DD. V-29: Check valve, in-line pattern, spring-operated double doors, Class 125 (cast iron body) or Class 150 (steel body), Buna-N or EPDM seal, aluminum bronze or stainless steel doors, 316 stainless steel spring; grooved, threaded, flanged, wafer, or lugged at locations other than equipment; grooved, flanged or lugged if between equipment and its isolation valve. Example: APCO L9000.
- EE. V-30: Check valve, silent, in-line pattern, spring-operated disc, Class 125, cast iron body, renewable bronze disc and seat, stainless steel spring, flat faced wafer. Example: Nibco W-910-B.
- FF. V-31: Check valve, same as V-23 except Class 200. Example: Nibco T-473-Y.
- GG. V-32: Check valve, same as V-28 except Class 250. Example: Stockham F-947.
- HH. V-33: Butterfly valve, 200 PSI WWP; 27 IN Hg vacuum; cast or ductile iron body; EPT (EPDM) sleeve; stainless steel stem; aluminum-bronze or stainless steel disc; lugged. Example: Stockham L#-7#2.
- II. V-34: Butterfly valve, same as V-33 except wafer. Example: Stockham L#-5#2.
- JJ. V-35: Butterfly valve, 200 PSI WWP for 12 IN and smaller, 175 PSI WWP for 14 IN and larger; 27 IN Hg vacuum for all sizes; cast or ductile iron body; EPT (EPDM) seat; stainless steel stem; replaceable forged brass, aluminum-bronze, stainless steel, or EPDM coated ductile iron disc; grooved. Example: Victaulic 300/709.
- KK. V-36: Eccentric plug valve, 175 PSI WOG, cast-iron body, bronze or nickel-plated cast-iron plug, Isobutene-Isoprene stem and plug seals, high-temperature plug face, capped drip tap on seat end of valve, memory stop, lever handle, threaded. Example: DeZurik 499S.
- LL. V-37: Eccentric plug valve, 175 PSI WWP for 12 IN and smaller, 150 PSI WWP for 14 IN and larger, cast-iron body, Viton filled TFE U-ring seal, Isobutene-Isoprene plug face, memory stop; lever handle for sizes 2-1/2 to 4 IN; gear operator with handwheel actuator for sizes 6 IN and larger; flanged. Example: DeZurik 118F.
- MM. V-38: Eccentric plug valve, same as V-36 except flanged, or grooved. Example: DeZurik 499.
- NN. V-39: Ball valve, same as V-13 and V-14 except include adjustable memory stop. Example: Milwaukee BA-100S and BA-150S.
- OO. V-40: Butterfly valve, 200 PSI WWP, bronze body, adjustable memory stop with visual disc position range of 90 DEG, stainless steel disc and stem, Viton seal, threaded. Example: Milwaukee BB2-100.
- PP. V-41: Plug valve, lubricated, 200 PSI WOG, semi-steel, bottom or bolted-top entry, UL listed for application, lubricant compatible with application, short pattern flanged. Example: Resun R-1431.
- QQ. V-42: Not used.
- RR. V-47, Gate valve with valve box:
1. Gate valve, AWWA-C500, 200 PSI WWP for 12 IN and smaller, 150 PSI for 14 IN and larger, iron body, bronze mounted, bronze or cast-iron double disc, non-rising stem, parallel seat, mechanical joint. Example: Stockham G-743.

2. Valve box: coated cast-iron, 5-1/4 IN shaft, screw type, 3-piece, drop-in lid with cast-in marking indicating service. Example: Tyler 6860.
- SS. V-48, Butterfly valve with valve box:
1. Butterfly valve, AWWA-C504, Class 150, iron body, stainless steel seat, aluminum-bronze or cast iron disc, natural rubber or Buna-N seat, mechanical joint or flanged. Example: DeZurik BAW.
 2. Valve box: coated cast-iron, 5-1/4 IN shaft, screw type, 3-piece, drop-in lid with cast-in marking indicating service. Example: Tyler 6860.
- TT. V-49: Gate valve, UL-FM, 175 PSI WWP, bronze body, union or screwed bonnet, solid wedge disc, OS&Y, threaded. Example: Nibco T-104-O.
- UU. V-50: Gate valve, UL-FM, 175 PSI WWP, cast iron body, bolted bonnet, resilient or solid wedge, OS&Y, flanged. Example: Stockham G-634.
- VV. V-51: Butterfly valve, UL-FM, 175 PSI WWP, ductile iron body, O-Ring seals, aluminum-bronze or ductile-iron disc, stainless steel stem, Buna-N seal, manual geared operator with visual position indicator, lugged. Example: Stockham LD-72UF.
- WW. V-52: Gate valve, UL-FM, AWWA C-509, 175 PSI WWP, cast iron body, resilient wedge, non-rise stem, indicator post flange, MJ or flanged. Example: Stockham G-600/601/602.
- XX. V-53: Check valve, T-pattern, horizontal swing, UL-FM, 175 PSI WWP, cast iron body, bolted bonnet, bronze trim, renewable bronze or cast-iron disc and seat, flanged. Example: Stockham G-939.
- YY. V-54: Check valve, in-line, spring-operated single or double door(s), UL-FM, 200 PSI WWP, cast iron body, renewable bronze door and rubber or EPDM seat, stainless steel spring, wafer or grooved. Example: Stockham WG-990.
- ZZ. V-55: Butterfly valve, UL listed, 175 PSI WWP, bronze body, stainless steel stem and disc, Viton seal, threaded. Example: Milwaukee BB2-100.
- AAA. V-56: Butterfly valve, same as V-40 except include extended neck, solder. Example: Milwaukee BB2-350.
- BBB. V-57: Butterfly valve, same as V-40 except include extended neck, threaded. Example: Milwaukee BB2-100.
- CCC. V-58: Not used.
- DDD. V-59: Butterfly valve, same as V-55 with tamper switch. Example: Milwaukee BB2-100.
- EEE. V-60: Plug valve, lubricated, 125 PSI WOG semi-steel, bottom or bolted-top entry, UL listed for application, lubricant compatible with application, threaded. Example: Resun R-1430.
- FFF. V-61: Butterfly valve, UL-FM, 175 PSI WWP, coated cast or ductile iron body, aluminum bronze or ductile iron disk with EPDM coating, manual geared operator with visual position indicator, grooved. Example: Victaulic 708.
- GGG. V-62: Butterfly valve, 300 PSI WOG, 27 IN vacuum, brass body, aluminum bronze disk, extended neck, grooved. Example: Victaulic 608N.
- HHH. V-63: High performance butterfly valve, Class 150, carbon steel body, RTFE seat, stainless steel shaft, stainless steel disc, TFE packing, wafer. Example: Dezurik BHP.
- III. V-64: Globe-style balancing valve, Y-pattern design, rated for 300 PSI WWP and 250 DEGF, cast copper alloy construction, dual pressure/temperature read-out ports, calibrated handwheel with minimum (4) 360 degree adjustment turns and hidden tamper-proof memory stop, threaded or sweat connections and suitable for positive shut-off. Example: Tour and Andersson STAD/STAS.

- JJJ. V-65: Globe style balancing valve, Y-pattern design, rated for 250 PSI WWP and 250 DEGF, cast iron body fitted with copper alloy components, dual pressure/temperature read-out ports, calibrated handwheel with minimum (5) 360 degree adjustment turns and hidden tamper-proof memory stop, Class 125 flanged or grooved connections, and suitable for positive shut-off. Example: Tour and Andersson STAF/STAG.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to individual sections for specific valve installation requirements.
- B. Keep valves clear of pull spaces.
- C. Install valves in accessible locations for operation, removal, inspection, and repair of valves and equipment.
- D. Install gate and globe valves with stem in vertical upright to horizontal position.
- E. Install butterfly valves with stem in horizontal position.
- F. Install diaphragm valves to be self draining.
- G. Support valves individually to relieve pipe stress and allow equipment removal.
- H. Follow manufacturer's recommendation for disassembly of valves for end joining method employed.
- I. Provide globe valve in bypass around control valves. Coordinate with Controls Contractor.
- J. Provide shut off valve on each side of control valve. Coordinate with Controls Contractor.

END OF SECTION

SECTION 20 05 29
PENETRATIONS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Penetrations and Supports, as indicated, in accordance with provisions of Contract Documents.
- B. Systems Included:
 - 1. Penetrations.
 - 2. Pipe hangers and supports.
 - 3. Pipe and equipment anchors.
- C. Definitions:
 - 1. UCSS: Universal Channel Strut System.
- D. Completely coordinate with work of other trades.
- E. Concrete Anchoring:
 - 1. Cracked concrete is the baseline condition for the design of cast-in-place and post-installed anchors in alignment with both ACI 318 and International Building Code.

1.2 QUALITY ASSURANCE

- A. Pipe hanger standards:
 - 1. Manufacturers Standardization Society (MSS) SP-58 Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.
 - 2. ASME/ANSI B31.1 Code for Pressure Piping
 - 3. ACI 318: Building Code Requirements for Reinforced Concrete

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. For pipe larger than 16 IN, show layout of hanger locations and method of support from structure.
 - 2. Layout for all required structural penetrations shown on structural framing plan or structural wall elevation. When working with existing construction include size and location of all existing penetrations on the drawing.
 - 3. Pipe Anchors:
 - a. Detailed drawings, signed and sealed by a Specialty Structural Engineer.
- B. Product Data:
 - 1. Pipe hangers:
 - a. Identify each hanger according to systems, pipe sizes, and orientations on which it will be used.
 - 2. Concrete Anchors:
 - a. Document Manufacturer approval or listing for cracked concrete application
 - 1) Drop-In Anchors are NOT cracked concrete rated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Pipe hangers:
 - 1. Base:
 - a. PHD Manufacturing.
 - 2. Optional:

- a. Anvil International.
 - b. Cooper B-Line.
 - c. Tolco Inc.
 - d. Erico International.
- B. Concrete inserts, pre-pour:
- 1. Base:
 - a. Hilti.
 - 2. Optional:
 - a. Simpson.
 - b. Powers Fasteners.
 - c. Tolco.
 - d. B-line.
- C. Concrete inserts, post-pour:
- 1. Base:
 - a. Hilti.
 - 2. Optional:
 - a. Simpson.
 - b. Powers Fasteners.
- D. Factory-fabricated supports for insulated pipe:
- 1. Base:
 - a. Pipe Shields.
 - 2. Optional:
 - a. B-Line Systems.
 - b. Power Piping.
- E. Pipe and equipment anchors:
- 1. Base:
 - a. Shop fabricated.
 - 2. Optional:
 - a. Field fabricated.
- F. Factory-fabricated pipe supports at plumbing fixtures:
- 1. Base:
 - a. Sioux Chief Manufacturing.
 - 2. Optional:
 - a. B-Line Systems.
 - b. Holdrite.
 - c. Sumner.
- G. Universal channel strut system:
- 1. Base:
 - a. Unistrut (Tyco Electrical and Metal Products).
 - 2. Optional:
 - a. Erico International.
 - b. Cooper B-Line.
 - c. Tolco, Inc.
- H. Insulation Saddles:
- 1. Base:
 - a. PHD Manufacturing.
 - 2. Optional:
 - a. Buckaroos, Inc.
- I. Elastomeric Pipe Insulation Saddles:
- 1. Base:
 - a. Armacell engineered foams.

- J. Wooden saddles:
 - 1. Base:
 - a. Buckaroos, Inc.
 - 2. Optional:
- K. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 PENETRATIONS

- A. Penetrations - General:
 - 1. For concrete walls, floors, roofs, foundations, footings and grade beams, provide openings sufficiently sized to allow free movement of piping with insulation continuous through sleeve.
 - 2. Create openings by placing sleeves prior to pouring of concrete in accordance with requirements indicated on structural drawings.
 - 3. Core drilling or cutting will not be permitted without prior written approval by structural engineer.
 - 4. Opening diameters:
 - a. Minimum 3 IN.
 - b. Bare pipe: Minimum 1 IN larger than outside diameter of pipe.
 - c. Insulated pipe: Minimum 1-1/2 IN larger than outside diameter of insulation.
 - d. Diameter suitable for construction tolerances and to receive sealant.
 - 5. Openings for future work: Same as this work.
 - 6. Coordinate detailing of roof, foundation wall, and slab-on-grade penetrations with roofing, waterproofing, and vapor retarder installers. Protect continuity of roofing, waterproofing, and vapor retarder systems.
- B. Pipe entrance wall sleeve and anchoring:
 - 1. Provide steel, heavy wall welded or seamless pipe sleeve full circle continuously welded water stop plate.
 - 2. Provide sleeve full length of wall thickness and protect with a primer coat.
 - 3. Structurally secure pipe to withstand water hammer force.
 - a. Extend exterior piping material into building a minimum of 12 IN.
 - b. Provide a mechanical joint on interior end of pipe and mechanical tie in back to adjoining structural, exterior, wall.
 - 4. Provide "Link-Seal" on pipe at exterior side of sleeve.
- C. Water dams:
 - 1. Construct water dams to meet either of the following criteria:
 - a. Steel pipe with flange water dam:
 - 1) Construct water dam by welding together Schedule 40 steel pipe and steel flange to be water tight.
 - 2) Cut flange from flat steel of same thickness as pipe wall. Flange ring width shall be 1 IN minimum.
 - 3) Inside diameter of dam shall be approximately 1 IN larger than outside diameter of piping or its insulation, which ever is larger.
 - 4) Install top of water dam to be 4 IN above the finished floor.
 - 5) Permanently anchor dam flange to the floor, and seal the flange-to-floor joint water tight.
 - b. Steel water dam:
 - 1) Construct dam by inserting end of Schedule 40 steel pipe or sheet steel fully into a groove approximately 1/2 IN deep.
 - 2) Seal the joint between dam and floor water tight.
- D. Sealants:
 - 1. Seal annular space around piping.
 - 2. Maintain fire and smoke ratings at pipe penetrations of fire and fire/smoke rated building elements.
 - 3. For non-rated floors and walls see Section 07 92 16.

4. For exterior and foundation walls: Use synthetic rubber seals, "Link-Seal" water proof material or system.
 - a. Optional sealing of pipe with oakum stop and caulk on exterior side is acceptable.
5. Seal water dams to floor in accordance with Section 07 92 13.

2.3 PIPE HANGERS

A. Pipe hangers - General:

1. MSS SP-58 for materials, design, manufacture, selection, application, and installation requirements.
2. ACI 319 for attachment requirements to concrete.
3. Hangers and channels, angles, and supporting steel: Galvanized unless indicated otherwise.
4. Pipes running parallel may be supported on trapezes.
5. Hanger rods of continuous thread type: Galvanize after threads are cut.
6. Galvanize structural steel, angles, rods, channels, and hardware located in boiler, mechanical, and fan rooms and on roofs.
7. Where grooved couplings are used, place hanger within 2 FT each side of fittings or refer to manufacturer's pipe support and anchorage guide.
8. Screw threads on hangers and fittings: Conform to Class 2A and 2B of ANSI/ASME-B1.1.

B. Structural considerations:

1. Steel or concrete roof/floor system including slabs or roof deck shall be in place and complete before installation of mechanical piping system.
2. Space hangers so maximum individual hanger load will not exceed values listed in paragraph "Pipe hanger loading".
3. Do not attach hangers to steel roof deck.
4. Do not attach hangers larger than 1/2 IN diameter to bottom of concrete filled floor or roof deck.
5. Individual hanger loads exceeding 1000 LBS attached to the same deck span shall not be spaced closer than 5 FT on center.
6. The sum of all hangers supported by a slab span in a 5 FT by 5 FT area shall not exceed 1000 LBS.
7. Attach hangers to beams whenever possible.

C. Pipe hanger spacing:

1. Locate hangers at each change of direction.
2. Space hangers at or within following maximum limits:

Pipe Diameter	Standard Steel		Copper	
	Fluid	Vapor	Fluid	Vapor
1/2 - 1 IN	7 FT	8 FT	5 FT	6 FT
1-1/4 - 2 IN	7 FT	9 FT	7 FT	9 FT
2-1/2 - 3 IN	11 FT	14 FT	9 FT	13 FT
3-1/2 - 4 IN	13 FT	16 FT	11 FT	15 FT
5 - 6 IN	16 FT	19 FT	13 FT	18 FT
8 - 14 IN	16 FT	24 FT	16 FT	23 FT
16 IN	12 FT	24 FT	--	--

3. For pipe larger than 16 IN diameter, see mechanical drawing for location of hanger supports.
 - a. If not shown on plans, provide shop drawings for approval showing location of hangers and method of support from structure.
4. Fire protection piping: See Section 21 10 00.
5. For cast iron pressure piping, space maximum 12 FT OC.
 - a. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.
6. For cast iron soil piping, space maximum 10 FT OC.

- a. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.
 - 7. For piping materials not covered in this spec, space hangers according to manufacturer's recommendations.
- D. Pipe hanger rod loading:
- 1. Total hanger rod load (including piping, insulation, and fluid) not exceeding following limits:

Nominal Rod Diameter	Maximum Load
3/8 IN	560 LB
1/2 IN	890 LB
5/8 IN	1460 LB
3/4 IN	2030 LB

- 2. Do not exceed manufacturer's recommended maximum safe load if smaller than above.
- E. Pipe hangers for uninsulated pipe:
- 1. Independent hangers: MSS SP-58 type 1, 3, 4, 5, 7, 9, 10, 11, 12, 24, 41, 43, 44, 45, or 46.
 - a. Types 7 and 10: Not allowed on pipe sizes greater than 6 IN.
 - 2. Hangers used with trapezes:
 - a. MSS SP-58 type 24 or 26.
 - b. Hanger designed as part of UCSS.
 - 3. Hangers supporting bare copper pipe:
 - a. Copper plated or electro-galvanized hangers. Provide factory-applied felt or plastic padding to eliminate contact between support and copper pipe.
 - 4. Hangers supporting bare glass pipe:
 - a. For horizontal piping, use electro-galvanized supports with factory-applied felt or plastic padding to eliminate contact between metal and glass.
 - b. For vertical piping, use electro-galvanized supports with factory-applied 1/4 IN thick solid neoprene or Buna-N pads to eliminate contact between metal and glass.
- F. Pipe hangers for insulated pipe:
- 1. Hangers shall support piping from outside diameter of insulation.
 - 2. Independent hangers: MSS SP-58 type 1, 3, 7, 9, 10, 41, 43, 44, 45, or 46.
 - a. Types 7 and 10: Not allowed on pipe sizes greater than 6 IN.
 - 3. Hangers used with trapezes:
 - a. Pipe sizes 2 IN and smaller: MSS SP-58 type 26.
 - b. Pipe sizes 2-1/2 IN and larger:
 - 1) MSS SP-58 type 24 or 26.
 - 2) Hanger designed as part of UCSS.
 - 4. Pipe sizes 2 IN and smaller: Use hanger with insulation protection shield: MSS SP-58 type 40.
 - 5. Pipe sizes 2-1/2 IN and larger: Use hanger with factory-fabricated support:
 - a. 100 PSI, waterproofed calcium silicate fully encased in sheet metal shield.
 - 1) Pipe supported on rod hangers: Pipe Shields Models A1000, A2000, A3000, A4000 and A9000.
 - 2) Pipe supported on flat surfaces: Pipe Shields Models A1000, A2000, A5000, A6000 and A7000.
 - 3) Pipe supported on pipe rolls: Pipe Shields Models A3000, A4000, A5000, A6000 and A8000.
 - b. Extend insulation inserts 1 IN beyond shields on refrigerant and chilled water lines.
 - c. For steam piping 8 IN and larger, provide supports with slide bases.
 - 6. For piping systems insulated with Elastomeric pipe insulation, composite Elastomeric and high density insert may be used:
 - a. Jacket: 30 mils stainless steel.
 - b. Basis: Armacell Armafix NPH pipe hanger inserts.

- c. Coordinate with section 20 07 00 Pipe, Duct and Equipment Insulation for applicability.
 - 7. Steam pipe sizes 8 IN and larger: Use MSS SP-58 hanger type 41, 43, 44, 45, or 46 with support indicated for pipe sizes 2-1/2 IN and larger.
- G. Pipe hangers in other situations: See MSS-SP-58.
- H. Trapezes:
- 1. Suspend trapezes from concrete inserts, approved structural clips or beam clamps.
 - 2. Construct trapezes of galvanized angle iron, UCSS channels, or other structural shapes with flat surfaces for point of support.
 - 3. See pipe hanger paragraphs for hanger types allowed with trapezes.
- I. Vertical pipe supports and guides:
- 1. Support vertical pipe runs in pipe chases from the top and every other floor down.
 - 2. Provide pipe guides for lateral movement on alternating floors of pipe supports.
- J. Concrete inserts:
- 1. Pre-pour concrete inserts:
 - a. Continuous-slot or individual concrete inserts for use with hangers for piping and equipment exposed in labs and classrooms, and as required.
 - b. Provide inserts in time for installation in concrete.
 - c. Continuous-slot inserts:
 - 1) B-Line Figure B22I, B32I, B42I or B52I.
 - d. Individual inserts:
 - 1) Grinnell Figure 282, or 281.
 - 2) Do not exceed manufacturer's recommended load on insert.
 - 2. Post-pour concrete inserts:
 - a. Approved for cracked concrete applications. Drop-In Anchors SHALL NOT be used.
 - b. At concrete slabs on steel deck, install anchor in top of deck flute.
 - c. Minimum embedment depth and base material thickness per anchor size shall be according to the following schedule:

Anchor Size IN	Minimum Base Material Thickness IN	Minimum Embedment Depth IN
1/4	3	1
3/8	3-1/8	1-9/16
1/2	4	2
5/8	5-1/8	2-9/16
3/4	6-3/8	3-3/16

- K. Beam clamps:
- 1. Pipe size 3 IN and smaller:
 - a. MSS SP-58 types 19 or 23.
 - 2. Pipe sizes larger than 3 IN but smaller than 8 IN:
 - a. Malleable-iron beam clamp: MSS SP-58 type 30.
 - b. Iron beam clamp: B-Line B3055 or equal.
 - 3. Pipe sizes 8 IN and larger:
 - a. Forged steel beam clamps: MSS SP-58 type 28 or type 29.
 - b. Steel Beam clamps: B-Line B3291 through B3298 or equal.
- L. Attachments to wood structure:
- 1. Provide angle clips and lag screws or side beam connectors: PHD figure 920 or 905.
 - 2. Strap type hangers not acceptable.

2.4 PIPE RACKS

- A. Assume engineering responsibility for design of steel rack.
- B. Engineer Qualifications: Comply with section 01 71 21 Specialty Engineering Requirements

- C. Design racks and connections to satisfy requirements of applicable Building Codes.
 - 1. Installation shall reflect the design intent of the drawings with respect to:
 - a. General pipe arrangement.
 - b. Pipe spacing.
 - c. Pipe clearances for access.
 - d. Rack structural arrangement.
 - e. Expansion anchor forces, when indicated.
- D. Hangers attached to pipe racks: Same as for systems hung from building structural systems.

2.5 PIPE AND EQUIPMENT ANCHORS

- A. Pipe Anchors:
 - 1. Approved for cracked concrete applications.
 - 2. Provide as indicated and required to permit complete installation of system.
 - 3. Do not anchor piping to plaster or gypsum wallboard partition walls.
 - 4. Provide anchoring devices at locations indicated.
 - 5. General arrangement subject to review and approval of the Structural Engineer of Record.
 - 6. Assume engineering responsibility for design of pipe anchors and connection of anchor to structure.
 - 7. Engineer Qualifications: Comply with section 01 71 21 Specialty Engineering Requirements
 - 8. Design anchors to satisfy requirements of applicable Building Codes.
 - 9. Design for stresses determined by expansion joint manufacturer. Adjust stresses at structure connection point for distance between anchor and structure connection point.
 - a. See section 20 05 19.
 - 10. Coordinate with seismic design.
 - a. See Section 20 05 48.
- B. Anchors:
 - 1. Angle iron and rods with turnbuckles, unless detailed otherwise.
- C. Anchors for ductwork, equipment and piping hanger rods:
 - 1. Post-pour concrete inserts:
 - a. Approved for cracked concrete applications. Drop-In anchors SHALL NOT be used.
 - b. Hard-metal, self-drilling tapped for threaded rods and designed not to depend on lead or wood for holding power.

2.6 PIPE SUPPORTS AT PLUMBING FIXTURES

- A. Pipe supports at plumbing fixtures:
 - 1. Fire-treated dimensional lumber.
 - 2. Factory-fabricated metal brackets.
 - a. Plastic grommets/inserts factory fabricated for specific pipe diameters and materials.
 - 3. Factory-fabricated PVC pipe supports and pipe fasteners.
 - a. Fastening method: Stainless-steel bands and screws.
 - b. PVC: Fire retardant.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install components as indicated and in accordance with manufacturer's instructions and recommendations.

3.2 PENETRATIONS

- A. Coordinate locations of openings in structural systems with Architect.
- B. Maintain fire and smoke ratings at pipe penetrations of fire and fire/smoke rated building elements.

- C. Set sleeves plumb or level, in proper position, tightly fitted into work.
- D. Provide water dams around pipes penetrating the floor in wet areas such as the following:
 - 1. Mechanical room.
 - 2. Boiler rooms.
 - 3. Kitchens and Food Service areas.
 - 4. Laundry Rooms.

3.3 PIPE HANGERS

- A. Glass piping:
 - 1. Horizontal glass piping:
 - a. Install supports on horizontal lines to allow sideways movement of piping.
 - b. Provide supports at each change of direction.
 - c. Maximum support spacing: 8 FT.
 - 1) Provide minimum of one support per pipe section within 24 IN of joint.
 - 2) Provide support at branch connections.
 - d. Place support no closer than 6 FT from connection to vertical stack.
 - 2. Vertical glass piping:
 - a. 2 IN and smaller: Support at every other floor.
 - b. 3 IN and larger: Support at every floor.
 - c. On stacks, install clamp below bottom coupling of stack, and below coupling on every third floor.
 - 1) Install clamps to restrict lateral as well as downward movement.

3.4 PIPE SUPPORTS AT PLUMBING FIXTURES

- A. Pipe supports at plumbing fixtures:
 - 1. General: Fasten piping to supports within 8 IN of final fixture connection point (valve).
 - 2. Fire-treated wood:
 - a. Fasten wood to studs with screws.
 - b. Fasten piping to wood support:
 - 1) Pass piping through drilled holes no more than 1/8 IN larger than outside diameter of pipe.
 - 2) Or fasten with pipe straps: Use screws to fasten straps to wood.
 - 3. Factory-fabricated brackets:
 - a. Fasten brackets to studs with screws.
 - b. Galvanized brackets:
 - 1) Fasten piping to brackets with plastic grommets/inserts.
 - c. Copper-clad brackets:
 - 1) Use only with copper piping.
 - 2) Isolate copper-clad brackets from metal studs with insulating tape, felt, or rubber pads.
 - 3) Fasten piping to brackets by soldering or by using plastic grommets/inserts.
 - 4. Factory-fabricated PVC supports:
 - a. Fasten brackets to waste piping, fixture carriers, or studs.

END OF SECTION

SECTION 20 05 50
MECHANICAL SOUND AND VIBRATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Mechanical Sound and Vibration Control, as indicated, in accordance with provisions of Contract Documents.
- B. Systems Included:
 - 1. Vibration isolators.
 - 2. Bases.
 - 3. Piping connections.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Comply with ASHRAE, ASTM and AASHO standards.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit drawings for each piece of isolated equipment.
 - 2. Include drawings of spring isolators with equipment submittal. Include the following information:
 - a. Spring diameter.
 - b. Deflection.
 - c. Compressed spring height.
 - d. Solid spring height.
 - e. Point location of each isolator.
 - f. Calculated load at each point.
 - g. Field static deflection.
 - h. Calculated horizontal loading and bolt requirements.
 - i. Indicate base clearance of 1 IN.
 - j. Installation instructions and drawings.
- B. Product Data:
 - 1. Vibration isolators, bases, and piping connections for equipment: Include with equipment submittal.
 - 2. Vibration isolators, bases, and piping connections for applications other than equipment.
 - a. Indicate specific applications with submittal.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Mechanical Sound and Vibration Control:
 - 1. Base:
 - a. Mason Industries.
 - 2. Optional:
 - a. Vibration Mountings and Controls.
 - b. Vibration Eliminator.
 - c. Korfund Dynamics.
 - d. Amber/Booth.
 - e. California Dynamics.
 - f. Vibro-Acoustics.

- g. Kinetics Noise Control.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Provide piping and equipment isolation systems as specified.
- B. Select vibration isolators in accordance with weight distribution to produce reasonably uniform deflection.
- C. Provide vibration isolation equipment including isolators, bases, and piping connections from a single manufacturer of vibration isolation equipment.
- D. Coat vibration isolation systems exposed to moisture and an outdoor environment as follows:
 - 1. Hot dip galvanize steel parts.
 - 2. Coat springs with neoprene.
 - 3. Cadmium plate hardware.

2.3 VIBRATION ISOLATORS

- A. Neoprene Isolators:
 - 1. Type 1 isolator:
 - a. Similar to ASHRAE Type 1 isolator.
 - b. Neoprene wafer pads.
 - c. Durometer or hardness shall suite application.
 - d. Square waffle pattern on 1/2 IN centers.
 - e. Waffle pad thickness: 3/4 IN.
 - f. Provide steel backing plate where recommended by manufacturer.
 - g. For non-bolted applications, provide adhesive on both sides of isolator.
 - 2. Type 2 isolator:
 - a. Similar to ASHRAE Type 2 isolator.
 - b. Molded neoprene, double-deflection.
 - c. Provide color coded neoprene-stock elements for easy identification of rated load capacity.
 - d. Completely imbed steel top plate and base plate in neoprene elements.
 - e. Where neither isolator nor equipment manufacturer recommends bolting, provide friction pads both top and bottom.
 - f. Where either isolator or equipment manufacturer recommends bolting, provide bolt holes in base plate and tapped holes in top plate.
 - 3. Type 2 isolator for suspended supports:
 - a. Molded neoprene, double-deflection.
 - b. Similar to ASHRAE Type 2 isolation hanger.
 - c. Provide color coded neoprene-stock elements for easy identification of rated load capacity.
 - 1) Provide integral extension bushing on element where it contacts hanger frame to prevent metal to metal contact between frame and hanger rod.
 - d. Provide hanger for direct attachment to flat iron duct straps.
- B. Spring Isolators:
 - 1. Type 3 isolator:
 - a. Similar to ASHRAE Type 3 spring isolator.
 - b. Free standing and laterally stable without housings, snubbers or guides.
 - c. Provide 1/4 IN thick neoprene acoustical friction pads between baseplate and structure.
 - d. Provide leveling bolts for rigid attachment to equipment.
 - e. Spring diameter: Not less than 0.8 of compressed height of spring at rated load.
 - f. Spring shall have minimum additional travel to solid equal to 50 PCT of rated deflection.
 - 2. Type 3 isolator for suspended supports:
 - a. Similar to ASHRAE Type 3 spring hanger.

- b. Provide Steel spring and neoprene cup element in series inside bottom of hanger frame.
 - 1) Provide steel washer in cup to properly distribute load on neoprene and prevent its extrusion.
 - c. Provide integral extension bushing on neoprene element where it contacts hanger frame to prevent metal to metal contact between frame and hanger rod.
 - d. Minimum additional spring travel to solid: 50 PCT of rated deflection.
 - e. Spring diameter and hanger frame's lower hole size shall be large enough to permit hanger rod to swing through a 30 degree arc before contacting hole and short circuiting spring.
3. Type 3N isolator for suspended supports:
 - a. Similar to ASHRAE Type 3 spring hanger.
 - b. Provide Steel spring and molded neoprene element in series inside bottom of hanger frame.
 - 1) Provide steel washer in cup to properly distribute load on neoprene and prevent its extrusion.
 - c. Provide color coded neoprene-stock elements for easy identification of rated load capacity inside top of hanger frame.
 - d. Provide integral extension bushing on neoprene elements where they contact hanger frame to prevent metal to metal contact between frame and hanger rod.
 - e. Minimum additional spring travel to solid: 50 PCT of rated deflection.
 - f. Spring diameter and hanger frame's lower hole size shall be large enough to permit hanger rod to swing through a 30 degree arc before contacting hole and short circuiting spring.
 4. Type 3P isolator for suspended supports:
 - a. Similar to ASHRAE Type 3 spring hanger.
 - b. Same as Type 3N except spring is precompressed to rated deflection so piping/equipment is maintained at a fixed elevation during installation.
 - c. Provide a release mechanism to free spring after installation is complete and hanger is subjected to its full load.
 5. Type 4 isolator:
 - a. Similar to ASHRAE Type 4 restrained spring isolator.
 - b. Free-standing, laterally stable spring isolator.
 - c. Provide resilient vertical limit restraints to prevent spring extension during weight changes.
 - 1) During normal operation, restraints shall not contact spring assembly. (Minimum clearance: 1/2 IN.
 - d. Provide acoustical neoprene separator between spring(s) and base plate to prevent short circuiting through baseplate anchor bolts.
 - e. Installed height shall equal operating height.
 6. Type 5 thrust restraint:
 - a. Similar to ASHRAE Type 5 thrust restraint.
 - b. Same as Type 3 isolator for suspended supports except with angle-iron and rod attachments configured for mounting across flexible duct connection.

2.4 BASES

A. Bases:

1. Type B, structural steel base:
 - a. Rectangular in shape except for equipment which may require "T" or "L" shaped bases.
 - b. Bases for split case pumps:
 - 1) Provide supports for suction and discharge base ells.
 - 2) Size base large enough to support base-ell supports.
 - c. Perimeter members: Beams with a minimum depth equal to 0.10 of longest dimension of base.
 - d. Beam depth need not exceed 14 IN provided that deflection and misalignment is kept within acceptable limits as determined by manufacturer.

- e. Provide height saving brackets in mounting locations to provide a base clearance of 1 IN.
- 2. Type C, concrete-filled, structural steel base:
 - a. Rectangular structural beam or channel concrete forms for floating foundations.
 - b. Minimum base depth: 0.083 of longest dimension of base, but not less than 6 IN.
 - c. Base depth need not exceed 12 IN unless specially recommended by base manufacturer for mass or rigidity.
 - d. Bases for split case pumps:
 - 1) Provide supports for suction and discharge base ells.
 - 2) Size base large enough to support base-ell supports.
 - e. Provide minimum concrete reinforcement consisting of 1/2 IN bars or angles welded in place on 6 IN centers running both ways in a layer 1-1/2 IN above bottom, or additional steel as is required by structural conditions.
 - f. Provide steel members to hold anchor-bolt sleeves when anchor bolts fall in concrete locations.
 - g. Provide height saving brackets in mounting locations to maintain a 1 IN clearance below base.
- 3. Type D, curb mounted base:
 - a. Factory assembled isolation base that fits over roof curb and under isolated equipment.
 - b. Provide extruded aluminum top member to overlap bottom member to provide water run off independent of seal.
 - c. Provide Type 3 isolators integral with base.
 - 1) Minimum deflection: 1.5 IN.
 - d. Design shall allow springs to be inspected, serviced, and changed out while disturbing neither the roofing nor the unit.
 - e. Provide resilient snubbers in corners with minimum clearance of 1/4 IN for wind resistance.
 - f. Provide a weather seal of continuous closed cell sponge material both above and below base and a waterproof flexible duct-like EPDM connection joining outside perimeter of aluminum members.
 - g. Foam or other contact seals are not acceptable at spring cavity closure.
- 4. Type E, roof pedestal or curb: See Section 07 72 13.
- 5. Type IP, field assembled concrete base:
 - a. Isolation bases:
 - 1) Field assembled concrete pads provided by Contractor.
 - 2) See Division 03 and structural drawings.

2.5 PIPING CONNECTIONS

A. Pipe Connections:

- 1. Flexible pipe connectors (FPC):
 - a. Flexible neoprene/EPDM:
 - 1) Straight connectors: Twin sphere type.
 - 2) Elbow connectors: Single sphere type.
 - b. Multiple plies of friction nylon tire cord with EPDM cover and liner.
 - c. Do not use steel wire or rings as pressure reinforcement.
 - d. Connectors:
 - 1) 2 IN NPS and smaller: Threaded or flanged ends.
 - 2) 2-1/2 IN NPS and larger: Floating galvanized steel flanges.
 - e. Minimum pressure ratings:
 - 1) Twin spheres: 250 PSI at 170 DEGF and 165 PSI at 250 DEGF.
 - 2) Elbows and reducing twin spheres: 220 PSI at 170 DEGF and 145 PSI at 250 DEGF.
- 2. Flexible pipe hoses (FPH):
 - a. Braided, stainless-steel type.
 - b. Stainless steel braid: Type 321.
 - c. Fittings: Carbon steel.

- d. Connections:
 - 1) 2-1/2 IN NPS and smaller: Male nipples or copper sweat to match specified piping joints.
 - 2) 3 IN NPS and larger: Flanged.
- e. Minimum transverse motion: $\pm 3/8$ IN with no permanent misalignment.

PART 3 - EXECUTION

3.1 VIBRATION CONTROL

- A. Install vibration control equipment in accordance with manufacturers installation instructions and as specified.
- B. Select vibration control equipment as specified, and size in accordance with weight distribution, pull, and torque imposed by equipment being isolated.
 - 1. Base selection on equipment with Architect approved submittals.
 - 2. Minimum static deflections may be revised subject to prior approval.
- C. Provide revised vibration control equipment to match revised or substituted equipment.

3.2 VIBRATION ISOLATORS, BASES, AND PIPING CONNECTIONS

- A. Provide vibration isolators, bases, and piping connections as indicated in the following tables.
 - 1. Superscript numbers in parentheses refer to notes at the end of the tables.

MOUNTED ON STRUCTURAL FLOOR								
Equipment	Horsepower & Other	21 TO 30 FT FLOOR SPAN			31 TO 40 FT FLOOR SPAN			Pipe
		Isolator Type	Minimum Deflection	Base Type	Isolator Type	Minimum Deflection	Base Type	Connection Type (1,4)
Piping (9) First 3 supports from equipment connection Remaining supports within 50 FT of equipment connection	All	3	Note 11	none	3	Note 11	none	n/a
	All	3	0.75 IN	none	3	0.75 IN	none	n/a
Pumps								
Close Coupled	Up to 7.5 HP	3	0.75 IN	B	3	0.75 IN	C	FPC
	10 HP & Up	3	1.50 IN	B	3	1.50 IN	C	FPC
Flex Coupled	Up to 40 HP	3	1.50 IN	B	3	1.50 IN	C	FPC
	50 to 125 HP	3	1.50 IN	C	3	2.50 IN	C	FPC
Large Inline	Over 125 HP	3	3.5 IN	C	-	-	-	-
	5 to 25 HP	3	1.50 IN	none	3	1.50 IN	none	FPC
End Suction & Split Case	30 HP & Up	3	1.50 IN	none	3	2.50 IN	none	FPC
	Up to 40 HP	3	1.50 IN	C	3	1.50 IN	C	FPC
Packaged Systems (8)	50 to 125 HP	3	1.50 IN	C	3	2.50 IN	C	FPC
	150 HP & Up	3	2.50 IN	C	3	3.50 IN	C	FPC
	All	3	1.50 IN	C	3	2.50 IN	C	FPC

SUSPENDED FROM STRUCTURE								
Equipment	Horsepower & Other	21 TO 30 FT FLOOR SPAN			31 TO 40 FT FLOOR SPAN			Pipe
		Isolator Type	Minimum Deflection	Base Type	Isolator Type	Minimum Deflection	Base Type	Connection Type (1,4)
Piping (9) First 3 supports from equipment connection Remaining supports within 50 FT of equipment connection	All	3P	Note 11	none	3P	Note 11	none	n/a
Suspended Individually	Up to 3 IN	3N	0.75 IN	none	3N	0.75 IN	none	n/a
	4 IN & Up	3P	0.75 IN	none	3P	0.75 IN	none	n/a
Suspended on Trapeze	All	3P	1.50 IN	none	3P	1.50 IN	none	n/a
	All	3N	2.50 IN	none	3N	2.50 IN	none	n/a
Piping in Mechanical Rooms and Sensitive Areas (10,12,15)								
	Up to 3 IN	3N	0.75 IN	none	3N	0.75 IN	none	n/a
	4 to 6 IN	3P	1.50 IN	none	3P	1.50 IN	none	n/a
	8 IN & Up	3P	1.50 IN	none	3P	1.50 IN	none	n/a
	8 IN & Up	3N	2.50 IN	none	3N	2.50 IN	none	n/a
Piping at Building Expansion and Seismic Joints								
Nonflammable Gases (non-medical)	All	n/a	n/a	none	n/a	n/a	none	FPH or Loop FPC or Loop
Potable Water	All	n/a	n/a	none	n/a	n/a	none	Loop
Other Systems	All	n/a	n/a	none	n/a	n/a	none	loop
Piping at Plenum Penetrations	All	n/a	n/a	none	n/a	n/a	none	Note 14
Pumps								
Inline	Up to 2 HP	3 or 3N	0.75 IN	none	3 or 3N	0.75 IN	none	FPC
	3 to 5 HP	3 or 3P	1.50 IN	none	3 or 3P	1.50 IN	none	FPC
	7.5 HP & Up	3 or 3P	1.50 IN	none	3 or 3P	1.50 IN	none	FPC
	7.5 HP & Up	3 or 3N	2.50 IN	none	3 or 3N	2.50 IN	none	FPC

MOUNTED ON ROOF								
Equipment	Horsepower & Other	21 TO 30 FT FLOOR SPAN			31 TO 40 FT FLOOR SPAN			Pipe
		Isolator Type	Minimum Deflection	Base Type	Isolator Type	Minimum Deflection	Base Type	Connection Type (1,4)
Air Conditioning Units								
External	Less than 50 Tons	3 locked out	1.50 IN (13)	D & E	3 locked out	1.50 IN (13)	D & E	Note 14
Internal			---	B		---	B	n/a
External	50 Tons & Up	3 locked out	2.50 IN (13)	D & E	3 locked out	2.50 IN (13)	D & E	Note 14
Internal			---	B		---	B	n/a
Blowers/Fans								
Externally Isolated	Up to 5 HP	3	0.75 IN	E	3	0.75 IN	E	n/a
	7.5 HP & Up	3	1.50 IN	E	3	1.50 IN	E	n/a
Internally Isolated	Up to 10 HP	3	0.75 IN	E	3	1.50 IN	E	n/a
Condensers and Condensing Units								
Less than 25 Tons		4	1.50 IN	E	4	1.50 IN	E	Note 14

25 Tons & Up		4	2.00 IN	E	4	2.00 IN	E	Note 14
--------------	--	---	---------	---	---	---------	---	---------

B. Notes to Tables:

1. Install piping connectors on equipment side of equipment isolation valves.
2. Size indicates diameter of wheel.
3. Provide Type 5 isolators on units operating at 2 IN or more static pressure.
 - a. Mount one pair of isolators (on opposite sides) on each of fan's flexible connections.
 - b. Adjust isolators to prevent flexible connections from extending to a tension condition.
 - c. Attach isolators to duct at flanged joint through angle iron on back side of joint.
 - d. See Section 23 31 13.
4. A swing joint with three flexible mechanical groove couplings may be substituted for an FPC.
5. Spring diameter: 2.50 IN.
6. Spring diameter: 4 IN.
7. Spring diameter: 6 IN.
8. On packaged systems, provide only external isolation.
9. Provide isolators on piping connected to vibrating equipment (i.e., equipment for which piping connections are specified).
10. Provide isolators for drainage and vent piping only if connected to vibrating equipment.
11. Same type as specified for equipment, except minimum deflection is 0.75 IN, and maximum deflection is 2.00 IN.
12. Mechanical rooms and sensitive areas:
 - a. Mechanical rooms:
 - 1) Provide isolators for piping within mechanical rooms.
 - 2) Where isolators are indicated for piping connected to vibrating equipment, provide isolators which have the largest indicated minimum deflections.
13. Integral with base D.
14. Piping connection types:
 - a. Water: FPC.
 - b. Steam and refrigerant: FPH.

END OF SECTION

SECTION 20 05 53
MECHANICAL IDENTIFICATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Mechanical Identification Systems, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Piping system identification:
 - 1. ASME/ANSI-A13.1 Scheme for the Identification of Piping Systems.
- B. Medical gas piping color identification:
 - 1. Compressed Gas Association Pamphlet C-9 Standard Color Marking of Compressed Gas Cylinders Intended for Medical Use.
 - 2. NFPA-99 Standard for Health Care Facilities.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Pipe markers.
 - 2. Valve tags.
 - 3. HVAC duct markers.
 - 4. Equipment name plates.
 - 5. Access panel markers.
 - 6. Underground marking tape.
- B. Contract Closeout Information:
 - 1. Valve Chart.
 - a. Submit completed Spare Parts and Maintenance Material Transmittal form.
 - b. See Section 01 78 43.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Mechanical Identification Systems:
 - 1. Pipe, valve and equipment markers:
 - a. Base:
 - 1) Seton Name Plate.
 - b. Optional:
 - 1) Brady, WH.
 - 2) EMED.
 - 3) Kolbi Industries.
 - 4) 3M.
 - 5) Craftmark Identification Systems.
 - 6) Marking Services, Inc.
 - 7) Carlton Industries.
 - 8) Brimar.
 - 2. Underground marking tape:
 - a. Base:
 - 1) Reef Industries.
 - b. Optional:

- 1) Seton Name Plate.
- 2) EMED.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 PIPE MARKERS

- A. Conform to ASME/ANSI-A13.1.
- B. Pressure sensitive vinyl self-adhesive material.
- C. Mechanically fastened type: Snap on or strap on.
 1. For dirty greasy, oily pipe where pressure sensitive markers may not perform satisfactorily.
- D. Provide with arrows indicating direction of flow.
- E. Letter sizes: In accordance with table in Part 3.

2.3 VALVE TAGS

- A. Brass or anodized aluminum type.
- B. Brass:
 1. Minimum 19 gauge, polished, 1-1/2 IN diameter with following lettering:
 - a. Service: 1/4 IN stamped black filled letters.
 - b. Valve numbers: 1/2 IN stamped black filled letters.
- C. Aluminum:
 1. 2 IN diameter, 0.032 IN thick, with following lettering:
 - a. Service: 1/4 IN engraved letters.
 - b. Valve numbers: 1/2 IN engraved letters.
- D. Valve tag fasteners:
 1. 4 ply 0.018 IN copper or monel wire meter seals, brass "S" hooks or No.16 brass jack chain.

2.4 HVAC DUCT MARKERS

- A. HVAC Duct Markers:
 1. 1-1/2 IN black stenciled letters denoting system number (e.g., AHU-1, RF-3, EF-5), type (supply, return, exhaust) and flow direction.

2.5 EQUIPMENT NAME PLATES

- A. Equipment name plates:
 1. 1/16 IN rigid plastic, Setonply, Emedolite or bakelite with four edges beveled; or engraved aluminum with black enamel background and natural aluminum border and letters.
 - a. Two 3/8 IN mounting holes.
 - b. Lettering size: Minimum 1/2 IN high.

2.6 ACCESS PANEL MARKERS

- A. Metal Tack Style:
 1. Use on acoustical tile ceilings.
 2. Seton style BCM or ECM.
- B. Engraved Plastic Style:
 1. 3/4 IN square with center hole for small screw.
 2. Seton style CM75.

2.7 UNDERGROUND MARKING TAPE

- A. Underground Marking Tape:
 1. 4 MIL inert plastic film for underground use.
 2. Resistant to alkalis, acids and other destructive agents found in soil.
 3. Minimum tensile strength: 20 LBS per 3 IN width.

4. Minimum elongation: 500 PCT.
 5. Provide continuous printed message repeated every 16 to 36 IN warning of pipe buried below (e.g.: "CAUTION GAS LINE BURIED BELOW").
 6. Color code:
 - a. Yellow: Natural gas and fuel oil systems.
 - b. Blue: Water systems, domestic and fire.
 - c. Green: Sanitary sewer system.
 7. Reef Industries, Standard Terra Tape.
- B. Underground Detectable Marking Tape:
1. Lamination bond of 1 layer of aluminum foil between 2 layers of inert plastic film.
 - a. Aluminum foil: Minimum 0.35 mils thick.
 - b. Inert plastic film: Minimum 4.3 mils thick.
 2. Resistant to alkalis, acids and other destructive agents found in soil.
 3. Minimum tensile strength: 63 LBS per 3 IN width.
 4. Minimum elongation: 500 PCT.
 5. Provide continuous printed message repeated every 16 to 36 IN warning of pipe buried below (e.g.: "CAUTION GAS LINE BURIED BELOW").
 6. Tape to be inductively locatable and conductively traceable using a standard pipe and cable device for minimum of 8 years after burial.
 7. Color code:
 - a. Yellow: Natural gas and fuel oil systems.
 - b. Blue: Water systems, domestic and fire.
 - c. Green: Sanitary sewer system.
 8. Reef Industries, Detectable Terra Tape.

2.8 CHART AND DIAGRAM FRAMES

- A. Extruded aluminum with plexiglass or glass windows.

PART 3 - EXECUTION

3.1 VALVE IDENTIFICATION

- A. Identify valves, with service designation and valve number designation on valve tags.
 1. Tagging of valves at unit heaters, fan coil units, air terminal unit reheat coils and plumbing fixture stops are not required.
 2. Install tags on valves using valve tag fasteners in manner for easy reading.
- B. Label medical gas valves in accordance with NFPA-99.
- C. Furnish 4 charts including valve identification number, location (room number, department) and purpose.
 1. Mount 1 chart in frame and secure on wall in location directed by Owner.
 2. Include remaining 3 sets in Operation and Maintenance Manuals.

3.2 PIPE IDENTIFICATION

- A. Fire-protection and Sprinkler Piping.
 1. Painting not required in non-finished areas.
- B. Identify piping systems with indicated lettering:

Drawing Symbol	Pipe Identification Lettering
A	Medical Air (55 PSI)
BB	Boiler Blowdown
BFW	Boiler Feed Water
C	Medical Carbon Dioxide (55 PSI)

CA	Compressed Air
CD	Condensate Drain
CLPR	Clean Low Pressure Return (under 30 PSI)
CLPS	Clean Low Pressure Steam (under 30 PSI)
CPD	Condensate Pump Discharge
CR	Condenser Water Return
CS	Condenser Water Supply
CW	Domestic Cold Water
CWR	Chilled Water Return
CWS	Chilled Water Supply
DA	Dental Compressed Air (55 PSI)
DI	Deionized Water
DV	Dental Vacuum
DW	Distilled Water
EV	Medical Anesthesia Evacuation
F	Fire Protection
FOR	Fuel Oil Return
FOS	Fuel Oil Supply
G	Natural Gas
GWR	Glycol Water Return
GWS	Glycol Water Supply
HPR	High Pressure Return (over 70 PSI)
HPS	High Pressure Steam (over 70 PSI)
HW()	Domestic Hot Water Supply (temperature)
HWC()	Domestic Hot Water Circulating (temperature)
HWR	Heating Hot Water Return
HWS	Heating Hot Water Supply
IA	Medical Instrument Air (160 PSI)
LA	Laboratory Air (55 PSI)
LO	Laboratory Oxygen (55 PSI)
LPR	Low Pressure Steam Return (under 30 PSI)
LPS	Low Pressure Steam (under 30 PSI)
LV	Laboratory Vacuum
MPR	Medium Pressure Return (30-70 PSI)
MPS	Medium Pressure Steam (30-70 PSI)
N	Medical Nitrogen (160 PSI)
NO	Medical Nitrous Oxide (55 PSI)
NPW	Nonpotable Water
O	Medical Oxygen (55 PSI)
P	Discharge Plumbing-Sump Pump/Sewage Ejector
PCWR	Process Cooling Water Return
PCWS	Process Cooling Water Supply
PR	Condensate Pump Return
S	Sprinklers
SCW	Soft Cold Water
V	Medical-Surgical Vacuum
WAGD	Medical Waste Anesthetic Gas Disposal

- C. Locate identification lettering as follows:
1. Next to each valve and fitting, except on plumbing fixtures and equipment.
 2. At each branch or riser take off.
 3. At each passage through walls, floors and ceilings, both sides.
 4. At each pipe passage to underground.
 5. On horizontal pipe runs every 20 FT, at least once in each room and each story traversed by piping system.
 6. Identify piping contents, flow direction, supply and return.

7. So it is readable from access panels and not obscured by other work.
8. At least once in or above every room.

D. Size lettering, marker color fields, and arrows as follows:

mm	mm	mm
	200	12
	200	20
	300	32
	600	65
	800	90

IN	IN	IN
3/4 to 1-1/4	8	1/2
1-1/2 to 2	8	3/4
2-1/2 to 6	12	1-1/4
8 to 10	24	2-1/2
Over 10	32	3-1/2

E. Pipe Markers:

1. Install markers with tape color bands over each end of marker, extending around pipe and overlapping a minimum of 30 DEG.

F. Where supplementary color identification of medical gas piping is used, paint or label in accordance with gases and colors indicated in CGA Pamphlet C-9.

G. Where piping is heat traced, provide warning labels on insulation adjacent to each piping system identifier.

1. Heat tracing cable: See Section 20 05 33.
2. Temperature maintenance cable: See Section 22 10 16.

3.3 DUCTWORK IDENTIFICATION

A. Locate duct markers as follows:

1. At each branch or riser take-off.
2. Next to equipment.

B. Stencil ductwork or exterior surface of insulation.

3.4 EQUIPMENT IDENTIFICATION

A. Attach equipment nameplates in conspicuous location, directly on item of equipment or apparatus such as starters, pumps, fans, HVAC units and control panels.

1. Secure nameplates with self-tapping screws, or nuts and bolts.

B. For unsuitable surfaces, such as high temperature or lack of space, use copper or brass rings or chains to attach tags.

C. Identify devices located above ceilings with additional identification.

1. Use access panel markers (metal tack style) for acoustical tile ceilings, or engraved plastic style, 3/4 IN square, for mounting on panel door; or equipment nameplates.
2. Coordinate with Owner on identification method and color codes.
3. Provide markers on all removable ceilings and ceiling access panels to indicate locations of valves, dampers, smoke detectors, etc., and other mechanical items that may need servicing or adjustment. Glue marking tacks in place to prevent their falling out.
4. Where fire protection devices are located inside ductwork, provide an additional tag on the duct access door identifying device inside.
 - a. Identification letter size: 1-1/2 IN high minimum.

5. Color code access panel markers as follows:
 - a. Red: Fire dampers, smoke detectors, sprinkler shutoff valves and duct type smoke detectors.
 - 1) Notation:
 - D - Damper
 - V - Valve
 - S - Smoke Detector
 - H - Heat Detector
 - b. Yellow: Steam, radiation, reheat and chilled water valves:
 - 1) Notation:
 - V - Valve
 - c. Gold: Automatic and balancing dampers:
 - 1) Notation:
 - V - Valve
 - D - Damper

3.5 INSTALLATION OF UNDERGROUND MARKING TAPE

- A. See Section 20 10 10.

3.6 CONTROL DIAGRAMS AND INSTRUCTIONS

- A. Provide HVAC control and systems instructions and diagrams in wall mounted frames.
 1. Mount framed diagrams in conspicuous, easily accessible places in equipment rooms housing appropriate HVAC system.
- B. Diagrams and instructions may be reduced in size provided they are easily readable and lettering is not smaller than "elite" type of standard typewriter.

END OF SECTION

SECTION 20 05 93
TESTING AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Testing and Balancing, as indicated, in accordance with provisions of Contract Documents.
- B. Test, balance and adjust following mechanical systems:
 - 1. Air distribution systems.
 - 2. Air handling units and air moving equipment.
 - 3. Temperature Controls:
 - a. Assist Temperature Controls installer with calibration of air and waterside control components such as airflow stations, flow meters, etc as outlined in Section 25 50 00.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Agency qualifications: Independent test and balance agency, member of Associated Air Balance Council (AABC), or National Environmental Balancing Bureau (NEBB).
 - 1. Work supervised by a certified Testing and Balancing Engineer.
 - 2. Indicate at least 5 successfully completed projects of similar size and scope.
- B. Testing and balancing standards: AABC or NEBB standards and procedures.

1.3 RESPONSIBILITIES OF TESTING AND BALANCING (TAB) AGENCY

- A. Review contract document ductwork drawings before bid and advise 23 31 13 contractor as to the number and size of additional branch main volume dampers required to facilitate balancing.
- B. In accordance with 23 31 13, review contractor ductwork installation drawings before fabrication and advise where additional volume dampers are required to facilitate balancing.
- C. Schedule work with trades involved.
- D. Check, adjust, and balance system components to obtain optimum conditions for function and operation of system.
- E. Evaluate operation of systems and advise installer of necessary adjustments and corrective measures.
- F. Prepare and submit test reports.

1.4 RESPONSIBILITIES OF MECHANICAL INSTALLER

- A. Coordinate and schedule with testing agency.
- B. Start up system and keep in correct operation during balancing operations.
- C. Provide necessary adjustments and corrections to systems as directed by Testing and Balancing Agency.
- D. Maintain accessibility to test locations and devices requiring adjustment.
- E. Provide additional sets of pulleys and belts as required by Testing and Balancing Agency.
- F. Provide a complete set of approved mechanical-equipment shop drawings to Testing and Balancing Agency.
- G. Provide a complete set of "As-built" drawings to Testing and Balancing Agency.

1.5 JOB CONDITIONS

- A. Balance at time directed by Architect.
 - 1. If balancing is not done during peak cooling season demonstrate satisfactory balancing during next peak cooling season.
- B. Keep dust, dirt and debris to an absolute minimum and reinstall removed ceiling tiles to original positions at end of each work day.

1.6 CORRECTIVE WORK

- A. Provide extended warranty of ninety (90) days, after completion of test and balance work, during which time Architect may, at Architect's discretion, request recheck or resetting of equipment or system which is not performing satisfactorily. Provide technicians to assist as required in making such tests.

1.7 SUBMITTALS

- A. Project Information:
 - 1. Within sixty (60) days of award of contract submit a complete Submission Report including:
 - a. A company resume listing its personnel and project experience in air and hydronic balancing.
 - b. An inventory and calibration data of instruments and devices in possession of balancing agency whether or not they will be used on this project.
 - c. A working agenda that includes procedures for testing and balancing each air and water flow system.
 - d. Test and Balance Report Forms and Field Data Sheets that will appear in final report, with design data already filled in.
 - e. A written, system-by-system description of measurements, test locations and procedures that will be employed during test and balance.
- B. Contract Closeout Information:
 - 1. Final test and balance report:
 - a. Use forms similar to AABC or NEBB latest editions.
 - b. Report(s) signed by TAB Engineer.

PART 2 - PRODUCTS

2.1 JOB SITE INSPECTIONS

- A. During construction inspect installation of piping, sheet metal work, temperature controls, flow meters, pressure taps, strainers and other components of HVAC system as specified in contract documents.
- B. Note any deficiencies and submit them, in writing, to Architect.
 - 1. Include these inspection reports in final TAB report.

2.2 FINAL TEST AND BALANCE REPORT

- A. Using field data, test forms and procedures outlined in Submission Report, perform and record measurements, and complete final TAB report including:
 - 1. Preface:
 - a. General discussion of system including any abnormalities and problems encountered.
 - 2. Instrumentation list:
 - a. List of instruments including type, model, manufacturer, serial number and calibration date.
 - 3. System identification:
 - a. On each Test and Balance Report Form, number and/ or letter air terminal units, zones, supply, return and exhaust openings and traverse points to correspond to numbers and letters on Field Data Sheets.
 - 4. Air handling equipment:

- a. Manufacturer, model number, and serial number.
 - b. Design and manufacturer related data.
 - c. Total actual air flow rate by traverse if practical; if not practical, sum of outlets may be used, or a combination of each of these procedures.
 - 1) For specific systems, such as ones with diversity, see AABC National Standards.
 - d. Suction and discharge static pressure of each fan, as applicable.
 - e. Outside air and return air total air flow rate.
 - f. Actual operating current, voltage, and brake power of each fan motor.
 - g. Final RPM of each fan.
 - h. Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
 - i. Belt size and quantity.
 - j. Static pressure controls final operation set points.
5. Room Pressure relationships.
- a. Maintain pressure relationships in rooms that are either positive (supply greater than return/ exhaust) or negative (supply less than return/exhaust).
 - b. In the final test and balance report, indicate that these pressure relationships were maintained.
- B. Units of measure:
- 1. Flow rates:
 - a. Air: .
 - b. Water: ____ GPM.
 - 2. Temperatures: ____ degF.
 - 3. Pressures:
 - a. Air: ____ IN WC.
 - b. Water: ____ PSIG.
 - 4. Power: ____ HP.

PART 3 - EXECUTION

3.1 GENERAL

- A. Final reports are required to be completed and submitted far enough in advance of local agencies final inspections for occupancy to provide adequate time for Engineer to review, Contractor to correct any deficiencies and reports to be revised for agencies final inspections.
- B. Coordinate and schedule testing and balancing with Contractor and Mechanical Contractor.
 - 1. Report deficiencies in systems to Mechanical Contractor for resolution.
- C. Accurately calibrate and maintain test instruments in good working order.
 - 1. If requested, conduct tests of instruments in presence of Engineer.
- D. If requested, conduct balancing tests in presence of Engineer.
- E. Do not begin balancing until system(s) have been substantially completed and are in good working order to permit preliminary measurements of total air or water volumes and system pressures.
- F. Proceed with final balancing and adjustments when systems are 95 to 100 PCT complete.
- G. Record inspections, tests and adjustments.

3.2 AIR BALANCING METHODS

- A. Balance each air system that is served by air filters, using artificial static loading of system, to demonstrate, test and obtain system design pressure drop data.
 - 1. Provide dirty filter pressure drop conditions on system.
 - 2. Do not use high efficiency filters (75 PCT and above) in testing and balancing.

3. Static pressure losses may be simulated by using wood or sheet steel blanking plates in high efficiency filter racks and housings.
4. Do not install blanking plates within 2 FT of low efficiency filter unit or rack.

3.3 AIR BALANCE TESTING PROCEDURE

- A. Perform tests and balance system in accordance with approved Submission Report.
- B. Take readings of airflow stations if installed or make pitot tube traverse of main supply, return and exhaust air ducts.
 1. Obtain flow rates at fans at both maximum and minimum outside air operation.
- C. Test and adjust each diffuser, grille, and register served by an air terminal unit to within 10 PCT of design requirements.
- D. In cooperation with HVAC Controls installer, set automatically operated dampers to operate as indicated.
 1. Check controls for proper calibration and list controls requiring adjustment.

3.4 OPERATING TEST

- A. After systems are balanced, conduct operating test of not less than 8 HRS duration to demonstrate to satisfaction of Architect that system(s) comply with requirements of plans and specifications, and that equipment and controls are functioning properly.

END OF SECTION

SECTION 20 07 00
PIPE, DUCT AND EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Pipe, Duct and Equipment Insulation, as indicated, in accordance with provisions of Contract Documents.
- B. Insulation Applications:
 - 1. Pipe insulation.
 - 2. Duct insulation.
 - 3. Equipment insulation.
 - 4. Insulation jacketing and prefabricated fitting covers.
 - 5. Insulation fasteners: Adhesives, mastics, and caulking.
 - 6. Grease and Air Ventilation Duct Wrap Fire Protection Systems.
 - 7. Special Considerations at hangers and bracing: See Section 20 05 29 Penetrations and Supports.
- C. Definitions:
 - 1. Concealed: Outside surfaces are isolated from room ambient air conditions by physical barrier.
 - a. Concealed items are typically accessed through suspended ceilings, through access doors, or by cutting and patching.
 - b. Listed below are examples of spaces that typically contain concealed items:
 - 1) Walls.
 - 2) Partitions.
 - 3) Chases.
 - 4) Shafts.
 - 5) Ceiling spaces.
 - 2. Exposed: Outside surfaces are not isolated from room ambient air conditions by physical barrier.
 - a. Exposed items are typically accessed directly from within a room or space.
 - b. Listed below are examples of rooms/spaces that typically contain exposed items:
 - 1) Mechanical rooms.
 - 2) Tunnels.
 - 3) Rooms without ceilings.
 - 3. Exposed to weather: Outside surfaces are not isolated by physical barrier(s) from weather or outside ambient air conditions.
 - 4. Runouts: Piping not more than 12 FT in length.
 - 5. Thermal conductivity (k): Btu/(h-ft-degF).
 - 6. Serviceable: strainers, steam traps, cleanouts.
 - 7. Non-Serviceable: fittings, valves.
- D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Comply with the following fire and smoke hazard ratings:
 - 1. Test products by procedure ASTM E84, NFPA-255 and ANSI/UL-723.
 - 2. Rating requirements:
 - a. Maximum Flame Spread: 25.
 - b. Maximum Smoke Developed: 50.
 - 3. Properly identify products for flame and smoke ratings.
 - a. Shipping cartons may be labeled instead of product.

- B. Comply with requirements of the following:
1. ASTM C547 Standard Specification for Mineral Fiber Preformed Pipe Insulation.
 2. ASTM C533 Standard Specification for Calcium Silicate Pipe and Block Insulation.
 3. ASTM C534 Standard Specification for Preformed Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - a. Products are allowed to deviate from this standard with regard to insulation density.
 4. ASTM C552-00 Standard Specification for Cellular Glass Thermal Insulation.
 5. ASTM C553 Standard Specification for Mineral Fiber Blanket and Felt Insulation.
 6. ASTM C585 Recommended Practice for Inner and Outer Diameters of Rigid Pipe 'Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
 7. ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 8. ASTM C1136 Standard Specification for Flexible Low Permeance Vapor Retarders for Thermal Insulation.
 9. ASTM C795 Thermal Insulation for Use Over Austenitic Stainless Steel.
 10. Federal Specification HH-I-558B Mineral Fiber Boards, Blankets, Pipe Covering.
 11. ASTM E 84, Surface Burning Characteristics: Underwriters Laboratories Applied Fireproofing Listing Nos. 11660-2, 11660-4.
 12. ASTM E 2336: Standard Test Methods Fire Resistive Grease Duct Enclosure Systems.
 13. ASTM E 814, Through-Penetration, 2-Hour Firestop Test.
 14. ASTM E 119 Standard Method of Fire Tests of Building Construction, 2 Hour Wall Panel Test, 2 Hour External Total Engulfment Test, hose stream evaluation.
 15. ASTM C 518 Aging Test, Steady State Heat Flux Measurements and Thermal Transmission Properties.
 16. ASTM E 162, Surface Flammability of Materials.
 17. ASTM E 136, Combustion Characteristics of Building Materials in a Vertical Tube Furnace.
 18. ISO 6944-1985, Method of Determining Fire Resistance of Ventilation Ducts.
 19. National Commercial and Industrial Insulation Standards (2013 seventh edition).
 - a. Published by Midwest Insulation Contractors Association (MICA).
 - b. Endorsed by National Insulation Association (NIA).
 - c. MICA plate numbers listed in this specification reference this document.

1.3 SUBMITTALS

- A. Product Data:
1. Pipe insulation.
 2. Precut insulation inserts.
 3. Ductwork insulation.
 4. Insulation for hot equipment.
 5. Insulation for high-temperature equipment.
 6. Insulation for cold equipment.
 7. Jacketing and prefabricated fitting covers.
 8. Insulation fasteners.
 9. Schedule of services and insulation thicknesses.
 10. Grooved coupling system insulation procedures and methods.
 11. Grease and Air Ventilation Duct Wrap Fire Protection Systems:
 - a. Submit reports substantiating code compliance along with manufacturer's installation instructions.

PART 2 - GENERAL

2.1 ACCEPTABLE MANUFACTURERS

- A. Pipe, Duct and Equipment Insulation:
1. Insulation materials:
 - a. Base: As indicated.
 - b. Optional:

- 1) Owens-Corning Fiberglass.
 - 2) Armacell.
 - 3) Nomaco K-Flex.
 - 4) CertainTeed Insulations.
 - 5) Knauf Insulation.
 - 6) Johns Manville.
 - 7) Pittsburgh Corning.
2. Grease and Air Ventilation Duct Wrap Fire Protection Systems:
 - a. Base:
 - 1) Thermal Ceramics.
 - b. Optional:
 - 1) Unifrax Corporation.
 - 2) 3M.
 3. Jacketing:
 - a. Base: As indicated.
 - b. Optional:
 - 1) Ceel-Co.
 - 2) Childers Products.
 - 3) Johns Manville.
 - 4) Proto PVC Corporation.
 - 5) RPR Metals.
 - 6) Pabco Metals Corporation.
 4. Prefabricated fitting covers:
 - a. Base: As indicated.
 - b. Optional:
 - 1) Ceel-Co.
 - 2) CertainTeed Insulations.
 - 3) Childers Products.
 - 4) Proto PVC Corporation.
 - 5) Johns Manville.
 - 6) RPR Metals.
 - 7) Pabco Metals Corporation.
 5. Adhesives, mastics, caulking, and finishes:
 - a. Base: As indicated.
 - b. Optional:
 - 1) Foster Products, Division of HB Fuller.
 - 2) Armacell.
 - 3) Childers Products.
 - 4) Dow Corning.
 - 5) Johns Manville.
 - 6) Knauf Insulation.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
 1. Do not use material that exceeds specified flame and smoke ratings.
 2. Use permanent treatments to jacketings and facings to impart specified fire ratings.
 3. Use of water soluble treatments is prohibited.

2.3 PIPE INSULATION - NON-FLEXIBLE FIBERGLASS

- A. Preformed commercial-grade fiberglass.
- B. Temperature range: 0 DEGF to 850 DEGF.
- C. Thermal conductivity at mean temperature:
 1. $k \leq 0.23$, 75 DEGF.

- 2. $k \leq 0.29$, 200 DEGF.
- 3. $k \leq 0.54$, 500 DEGF.
- D. Facing: All service jacket.
- E. Integral vapor retarder: Provide where indicated in Part 3.
- F. Seams, longitudinal: 2 IN self-sealing facing tabs.
 - 1. Provide adhesive on both contacting surfaces.
 - 2. Designed to perform without stapling.
- G. Pipe insulation, non-flexible; cellular glass:
- H. Commercial-grade closed-cell inorganic glass insulation.
- I. Temperature range: -450 to 900 DEGF.
- J. Minimum density: 8.0 PCF.
- K. Thermal conductivity at mean temperature:
 - 1. $k \leq 0.20$, -210 DEGF.
 - 2. $k \leq 0.29$, 0 DEGF.
 - 3. $k \leq 0.69$, 500 DEGF.
- L. Fittings: Factory fabricated shapes designed for specific fittings.

2.4 PIPE INSULATION - FLEXIBLE

- A. Commercial-grade closed-cell elastomeric or unicellular polyolefin thermal insulation.
- B. Temperature range: 40 to 200 DEGF.
- C. Thermal conductivity at mean temperature:
 - 1. $k \leq 0.27$, 75 DEGF.
 - 2. $k \leq 0.276$, 90 DEGF.
- D. Seams, longitudinal: Factory-cut and self-sealing.
 - 1. Base product: AP Armaflex SS.

2.5 DUCTWORK INSULATION, NON-FLEXIBLE

- A. Commercial-grade fiberglass thermal insulation formed with a thermosetting resin into semi-rigid or rigid boards.
- B. Temperature range: 0 to 450 DEGF.
- C. Minimum density:
 - 1. Semi-rigid: 3.0 PCF.
 - 2. Rigid: 6.0 PCF.
- D. Thermal conductivity at mean temperature:
 - 1. Semi-rigid:
 - a. $k \leq 0.22$, 75 DEGF.
 - b. $k \leq 0.27$, 150 DEGF.
 - c. $k \leq 0.38$, 300 DEGF.
 - 2. Rigid:
 - a. $k \leq 0.23$, 75 DEGF.
 - b. $k \leq 0.27$, 150 DEGF.
 - c. $k \leq 0.37$, 300 DEGF.
- E. Facing: All-Service-Jacket (ASJ).
- F. Temperature range: -20 to 150 DEGF.
- G. Base Products:

1. Semi-Rigid: Owens-Corning Fiberglas Type 703.
2. Rigid: Owens-Corning Fiberglas Type 705.

2.6 DUCTWORK INSULATION - FLEXIBLE

- A. Interior Use:
1. Commercial-grade fiberglass thermal insulation, formaldehyde free.
 2. Temperature range: 40 to 250 DEGF.
 3. Thermal conductivity at mean temperature: $k \leq 0.27$, 75 DEGF.
 4. Installed R-value: . 5.6 HR-ft²-degF/BTU based on 2 IN nominal thickness.
 5. Density: 3 .75 PCF
 6. Facing: Foil-Reinforced-Kraft (FRK) vapor-retarding.
 7. Seams: 2 IN facing tab.
 8. Base product: Owens-Corning Fiberglass commercial-grade all-service duct wrap.
- B. Exterior Use:
1. Commercial-grade closed-cell elastomeric or unicellular polyolefin thermal insulation.
 2. Temperature range: -40 to 180 DEGF.
 3. Thermal conductivity at mean temperature: $k \leq 0.27$, 90 DEGF.
 4. Water vapor permeability: 08 perm-in.
 5. Base Product: AP Armaflex Sheet and Roll.

2.7 INSULATION FOR HOT EQUIPMENT

- A. Same as Pipe Insulation - Nonflexible.

2.8 GREASE DUCT AND VENTILATION DUCT WRAP FIRE PROTECTION SYSTEMS

- A. High temperature inorganic foil encapsulated flexible fireproofing wrap.
1. Performance:
 - a. Fire rating: 1 or 2 HR, as indicated.
 2. Clearance to combustibles rating: zero clearance.
 3. Thickness: 1-1/2 IN.
 4. Density: 6 PCF
 5. Encapsulated maximum flame spread rating: 25.
 6. Encapsulated maximum smoke developed rating: 50.
- B. Grease Duct Standards compliance:
1. ASTM E2336.
 2. ASTM E814 Firestop Test F-Rating: 2 HRS.
 3. ASTM E814 Firestop Test T-Rating: 2 HRS.
 4. ASTM E119 Full Scale Engulfment test fire rating: 2 HR.
- C. Ventilation Duct Standards compliance:
1. ISO 6944-1985.
 2. ASTM E814 Firestop Test F-Rating: 2 HRS.
 3. ASTM E814 Firestop Test T-Rating: 2 HRS.
 4. ASTM E119 Full Scale Engulfment test fire rating: 2 HR.
- D. Tapes:
1. As directed by and approved by manufacturer installation requirements.
- E. Banding Material:
1. Stainless steel: minimum 1/2 IN wide x .0.015 IN thick.
- F. Insulation Pins and Washers:
1. As directed and approved by manufacturer installation requirements.
- G. Through Penetration Firestop Materials:
1. As directed by and approved by manufacturer installation requirements.
- H. Access Door:

1. Pre-fabricated system supplied by insulation manufacturer with following main components:
 - a. Inner door: compression seal door:
 - 1) Base: Morgan Thermal Ceramics Fast Door
 - 2) Optional: Ductmate Ultimate Door
 - b. Outer door: pre-fabricated insulated access door.
2. Accessory devices, including but no limited to, threaded rod, insulation pins, wing nuts, washers,: per manufacturers instructions to provide a complete rated and tested assembly.
3. Access door sizes:
 - a. Duct vertical dimension less than 12 IN: minimum: 8 IN wide x 6 IN tall.
 - b. Duct vertical dimension greater than 12 IN but less than 16 IN minimum: 12 IN wide x 8 IN tall.
 - c. Duct vertical dimension greater than 16 IN but less than 24 IN: 16 IN x 12 IN.
 - d. Duct vertical dimension equal to or greater than 24 IN: 20 IN x 20 IN.

2.9 JACKETING AND PREFABRICATED FITTING COVERS

- A. General:
 1. Fitting Covers:
 - a. Designed to fit over precut insulation inserts.
 - b. Designed specifically for fitting being covered.
 - c. 2-gore covers are not acceptable.
- B. Jacketing and Fitting Covers:
 1. High impact PVC.
 2. Minimum 0.028 IN thick.
- C. Metal Jacketing and Fitting Covers:
 1. Material: As indicated in Part 3.
 2. On cold systems and equipment, provide factory moisture barrier.
 3. Attaching method:
 - a. 0.020 x 3/8 IN bands on 9 IN centers unless indicated otherwise in Part 3.
 - b. Band material: Same as jacketing and covers.
 4. Minimum 2 IN overlap at joints.
 5. Tubular jacketing: Locking longitudinal seams.
 6. Base manufacturer: Childers.

2.10 INSULATION FASTENERS

- A. Insulation Adhesive:
 1. Flexible pipe insulation: Manufacturers standard adhesive as approved for application.
 2. Foster 30-36.
 3. Foster Spark-Fas 85-70.
- B. Insulation Mastic:
 1. Childers CP-30.
 2. Foster 35-00-GPM.
- C. Insulation Caulking:
 1. Dow No.11.

PART 3 - GENERAL

3.1 APPLICATION

- A. General:
 1. Apply products per manufacturer's recommendations and as specified.
 - a. Include allowance for thermal expansion and contraction.
 2. MICA plate numbers are listed under some insulation applications to clarify scope and acceptable methods of insulation application for particular listing.

3. Do not insulate piping until satisfactory completion of required pressure tests.
4. Do not insulate piping until heat tracing cable has been installed.
5. Do not insulate piping below grade.
 - a. Specific exceptions may exist under Pipe Insulation - Flexible.
6. Apply insulation to clean, dry surfaces and within manufacturers recommended temperature range.
7. Butt edges of insulation firmly together, and seal joints with compatible jackets, facings and adhesives as specified.
8. Apply insulation with a continuous, unbroken vapor retarder including, but not limited to, insulation of following.
 - a. Vapor seals on hangers, supports, and anchors secured directly to cold surfaces.
9. Continue insulation through sleeves and wall and ceiling openings.
10. Insulate fittings, unions, valve bodies, flanges and other pipeline accessories.
11. Insulation at piping supports: Coordinate with Section 20 05 29.
12. Rectangular and flat-oval ductwork exposed to weather:
 - a. Apply insulation and jacketing so top of ductwork crowns to prevent pooling of water.
 - 1) Minimum crown slope: 1/4 IN/FT.
13. Insulation installed in multiple layers: Stagger joints between layers.

3.2 PIPE INSULATION - NONFLEXIBLE FIBERGLASS

A. General:

1. Provide either type of lap seal at joints:
 - a. Self-sealing facing tabs.
 - b. 3 IN wide pressure-sensitive joint-sealing tape matching facing.
 - 1) Manufacturer: Same as insulation.
 - c. Insulation application standard: MICA plate number 1-100.
 - d. Insulation application for heat traced piping standard: MICA plate number 1-900.
2. Fittings:
 - a. On non-serviceable items, use either of the following methods:
 - 1) Built-up systems:
 - a) Elbows: MICA plate numbers 2-100 through 2-800 as applicable.
 - b) Valves and fittings: MICA plate number 2-530 or 2-536 as applicable.
 - c) Flanges: MICA plate number 2-535.
 - d) Tees: MICA plate number 2-120.
 - 2) Prefabricated fitting cover encapsulated:
 - a) Elbows: MICA plate number 2-500.
 - b) Valves and fittings: MICA plate number 2-130.
 - c) Flange or grooved coupling: MICA plate number 2-535.
 - b. Serviceable items: Provide prefabricated fitting covers attached with bands.
 - 1) Exception: On systems exposed to weather, attach with method described as best by manufacturer.
 - c. Exposed fittings, flanges, valves, and pipe terminations: Provide prefabricated fitting covers.
 - d. Built-up system:
 - 1) DN50 2 IN and smaller: Finish with mineral fiber cement to thickness of adjoining pipe insulation.
 - 2) DN65 2-1/2 IN and larger: Insulate with insulation insert, mitered pipe insulation segments or preformed fiberglass fittings.
 - a) Secure with vinyl faced insulation strapping tape or 20 AWG galvanized annealed wire finished with one coat of mineral fiber cement.
 - 3) Finish with Glass Fab embedded in 2 coats of Foster 30-36 adhesive.

B. Provide non-flexible insulation on following piping systems in wall thickness indicated:

1. Plumbing systems:
 - a. Domestic cold water piping:
 - 1) DN40 1-1/2 IN and smaller: 1 IN.

- 2) DN50 2 IN and greater: 1-1/2 IN.
- b. Domestic hot/recirculating water, 100 to 140 DEGF:
 - 1) DN32 1-1/4 IN and smaller: 1 IN.
 - 2) DN40 1-1/2 IN and greater: 1-1/2 IN.
- c. Domestic hot/recirculating water 141 to 180 DEGF:
 - 1) DN32 1-1/4 IN and smaller: 1-1/2 IN.
 - 2) DN40 1-1/2 IN and greater: 2 IN.

3.3 PIPE INSULATION - NONFLEXIBLE CELLULAR GLASS

A. General:

- 1. Provide non-flexible insulation on following piping systems in wall thickness indicated:

3.4 PIPE INSULATION - FLEXIBLE

A. General:

- 1. Install insulation sleeve over piping.
- 2. Do not make longitudinal field cuts.
- 3. Seal joints with manufacturer approved adhesive.
- 4. Do not use flexible pipe insulation on systems with heat tracing cable or temperature maintenance cable.

B. Fittings:

- 1. Insulate fittings and valve bodies with segments cut from pipe insulation.

C. Provide flexible insulation on following piping systems in wall thickness indicated:

- 1. Hydronic systems:
 - a. Cooling coil condensate:
 - 1) All sizes: 1 IN.
- 2. Plumbing systems:
 - a. Domestic cold water piping:
 - 1) DN40 1-1/2 IN and smaller: 1/2 IN.
 - 2) DN50 2 IN and larger: 1 IN.
 - b. Waste piping from water coolers and drinking fountains to first point of mixing with waste from a different type of fixture:
 - 1) All sizes: 1/2 IN.
 - c. Domestic water piping below grade within 5 FT of outside walls:
 - 1) All sizes: 1/2 IN.
 - d. Horizontal rain leaders, including overflow systems and 24 IN up and down from horizontal and up to underside of roof deck:
 - 1) All sizes: 1 IN.
 - 2) Rain leaders are cold systems.
 - e. Horizontal condensate drain leaders (serving condensate drain discharge from cooling coil condensate drains, walk in refrigerator and freezer cooling units) and floor drain:
 - 1) All sizes: 1 IN.
 - 2) Condensate drain leaders are cold systems.

3.5 DUCTWORK INSULATION - NONFLEXIBLE

A. General:

- 1. Secure insulation to ductwork by impaling over welded-pin or adhesive-pin mechanical fasteners.
 - a. Secure insulation on mechanical fasteners with speed clips.
 - b. Space mechanical fasteners to hold insulation securely in place.
 - 1) Maximum spacing: 12 IN centers.
- 2. Where access is not possible for pin attachment, use adhesive or caulk.
 - a. Cover entire surface with brush applied adhesive.
 - b. Apply caulk in continuous bead on 6 IN centers.
- 3. Seal joints and speed clips with 3 IN wide pressure-sensitive joint-sealing tape matching facing.

- a. Staple corners of tape with outward clinching staples.
 - 4. Cold systems only: Coat staples with mastic.
 - 5. Reinforce edges with metal corner angles.
 - 6. Apply insulation to ductwork from unit housing to ends of duct runs including diffuser necks and register ducts.
 - 7. Do not apply insulation over coil and damper access panels.
 - 8. Do not apply insulation over internally lined ductwork: Coordinate with Section 23 31 13.
 - 9. Use FRK facing on concealed ductwork.
 - 10. Use ASJ facing on exposed ductwork.
- B. Provide non-flexible insulation on following ductwork in thickness indicated:
- 1. Outside-air rectangular ductwork:
 - a. All sizes: 2 IN.
 - 2. Supply-air ductwork exposed in occupied spaces, except equipment rooms:
 - 3. Factory packaged air handling units, mixed-air plenum and ductwork, component housings to fan unit inlet including transition sections and prefilter:
 - a. All sizes: 2 IN.
 - 4. Fan discharge transition to and including final filter housing:
 - a. All sizes: 2 IN.
 - 5. Relief-air/exhaust-air plenums behind louvers or below gravity and powered roof ventilators:
 - a. All sizes: 2 IN.

3.6 DUCTWORK INSULATION - FLEXIBLE

- A. General:
- 1. On ductwork 24 IN wide and less, secure insulation to bottom of ductwork with 4 IN wide bands of brush-applied adhesive on 12 IN centers.
 - 2. On ductwork over 24 IN wide, secure insulation to bottom of ductwork by impaling over welded-pin or adhesive-pin mechanical fasteners.
 - a. Secure insulation on mechanical fasteners with speed clips.
 - b. Space mechanical fasteners to hold insulation securely in place.
 - 1) Maximum spacing: 12 IN centers.
 - c. Seal speed clips with 3 IN wide pressure-sensitive joint-sealing tape matching jacket.
 - 1) Staple corners of tape with outward clinching staples.
 - 2) Cold systems only: Seal staples with mastic.
 - 3. Provide either type of lap seal at joints:
 - a. Seal facing tab over adjoining facing with lap adhesive.
 - 1) Secure lap with outward clinching staples on 6 IN centers.
 - b. Use 3 IN wide pressure-sensitive joint-sealing tape that matches facing.
 - 1) Secure both sides of tape with outward clinching staples on 6 IN centers.
 - c. Cold systems only: Seal staples with mastic.
 - 4. Apply insulation to ductwork from unit housing to ends of duct runs, including diffuser necks and register ducts.
 - 5. Do not apply insulation over coil and damper access panels.
 - 6. Do not apply over internally lined ductwork: Coordinate with Section 23 31 13.
- B. Provide flexible insulation on following ductwork in thickness indicated:
- 1. Outside-air round ductwork:
 - a. All sizes: 3 IN; minimum installed R-value of 8.0.
 - 2. Supply-air ductwork, including downstream of terminal units, sound attenuators, reheat coil casings and tube ends, except where specified to be internally lined or specified to be covered by nonflexible insulation:
 - a. All sizes: 2-1/8 IN; minimum installed R-value of 6.0.
 - 3. Return-air ductwork in non air conditioned areas (including utility shafts):
 - a. All sizes: 2-1/8 IN; minimum installed R-value of 6.0.
 - b. Ceiling spaces directly above conditioned spaces are considered conditioned.

- C. Flexible Elastomeric:
 1. For exterior ductwork exposed to weather.
 2. Install in accordance with MICA National Commercial and Industrial Standards Plate No.: 20A.
 3. Adhesive: Applied as required to assist installation.
 4. Mechanical fasteners: As required to assist installation.
 5. Provide one of following as a weather barrier:
 - a. Jacket: metal.
 - b. Aluminum composite facing with UV/weather resistant coating.
 - 1) Example: K-Flex LS sheet.
 - 2) Product must be provided with a twenty-five (25) year limited warranty against breakdown of the membrane due to ultraviolet radiation.
 - c. Factory applied multi-ply laminate UV/weather resistant facing.
 - 1) Example: Armaflex ArmaTuff Plus II.
 - 2) Thickness: 16 MIL laminated covering membrane.
 - a) UV protective, blended polymeric top surface.
 - b) Puncture-resistant blended polymeric base around a scrim reinforced core.
 - 3) Product must be provided with a ten (10) year limited warranty against breakdown of membrane due to ultraviolet radiation.
 6. Insulation of standing seams: insulation manufactures field-cut pipe insulation with weather barrier.
 7. Apply insulation and jacketing so that top of ductwork has crown that effectively prevents pooling of water.
 - a. Minimum crown slope: 1/4 IN/FT.
 8. Provide flexible elastomeric insulation on the following exterior ductwork in thickness indicated:

3.7 INSULATION - HOT EQUIPMENT

- A. General:
 1. Secure insulation to bottom of flat surfaces wider than 24 IN by impaling over adhesive-pin mechanical fasteners.
 - a. Secure insulation on mechanical fasteners with speed clips.
 - b. Space mechanical fasteners to hold insulation securely in place.
 - 1) Maximum spacing: 12 IN centers.
 2. Seal joints and speed clips with 3 IN wide pressure-sensitive joint-sealing tape that matches facing.
 - a. Secure both sides of tape with outward clinching staples on 3 IN centers, 5 MM 1/4 IN from edge.
 3. Insulate flanges and fittings as indicated under Pipe Insulation, Nonflexible.
 4. Reinforce ends and irregular surfaces with Glass Fab embedded in 2 coats of Foster 30-36 adhesive.
- B. Provide hot-equipment insulation on following equipment in thickness indicated:
 1. Domestic hot water instantaneous heaters (unless factory insulated): 2 IN.
 - a. Insulation assembly standard: MICA plate number 4-100.
 2. Domestic water heater storage tanks (unless factory insulated): 2 IN.
 - a. Use unfaced insulation.
 - b. Insulation assembly standard: MICA plate number 4-100.

3.8 INSULATION - COLD EQUIPMENT

- A. Apply insulation with adhesive and coatings approved by manufacturer.
 1. Completely cover joining surfaces (equipment surfaces, and back and butting edges of insulation).
 2. Apply with 1/8 IN overlay pressure on butt joints.
 3. Apply 2 coats of white latex enamel to outside layer.

- B. Provide cold-equipment insulation on following equipment in number of layers and total thickness indicated:
 - 1. Domestic water meter: 1 layer, 3/4 IN.
 - a. Insulation assembly standard: MICA plate number 8-400.
 - 2. Roof drain bodies: 1 layer, 20 MM 3/4 IN.
 - 3. Water softeners: 1 layer, 3/4 IN.
 - a. Insulation assembly standard: MICA plate number 4-200.

3.9 GREASE DUCT AND VENTILATION DUCT WRAP FIRE PROTECTION SYSTEMS

- A. General installation methods:
 - 1. Acceptable application methods:
 - a. Telescoping overlap.
 - b. Butt joint with collar wrap.
 - c. UL listed G-18 butt joint.
 - 2. Utilize stainless steel banding to attach the material to duct; space banding per manufacturers guidelines.
 - 3. Duct spans 24 IN or larger:
 - a. Weld insulation pins, and apply insulation, to the duct along the bottom horizontal and outside vertical runs per manufacturers' instructions.
- B. Access door installation:
 - 1. Install pre-fabricated access doors according to manufacturer instructions to provide required assembly rating. Coordinate installation with installer of kitchen grease hood exhaust duct, refer to Section 23 31 13.
- C. Provide grease and air ventilation duct wrap on following ductwork in thickness indicated:
 - 1. Kitchen grease duct hood exhaust ductwork:
 - a. All sizes: 2 layers, 1-1/2 IN per layer.
 - b. Option: 1 layer may be used in lieu of two layers if product rating is in compliance with ASTM E2336 and applicable codes and standards at one layer of use but in no case shall a product of greater than 3 IN thickness be used.
 - 2. Air systems: 1 layer, 1-1/2 IN.

3.10 JACKETING AND PREFABRICATED FITTING COVERS

- A. General:
 - 1. Stagger jacketing and insulation joints.
- B. Systems exposed to weather:
 - 1. Material:
 - a. 0.016 IN smooth aluminum.
 - 2. Attach as recommended by manufacturer.
 - 3. Joints:
 - a. Orient joint laps to prevent entry of water.
 - b. Seal joints weather tight.
- C. Exposed cryogenic systems:
 - 1. Material: PVC.
 - 2. Attach as recommended by manufacturer.
- D. Hot Equipment:
 - 1. Material:
 - a. 0.016 IN smooth aluminum.
 - 2. Attach as recommended by manufacturer.

END OF SECTION

SECTION 20 08 00

COMMISSIONING OF MECHANICAL SYSTEMS

1.1 COMMISSIONING AUTHORITY

The Commissioning Authority (CxA) has been contracted directly with the Architect for this project. Commissioning involves all parties to the design and construction process, including the Division 23 Mechanical Contractor, and all Subcontractors within Division 23 as required.

1.2 CONTRACTOR RESPONSIBILITY

The Division 23 Mechanical Contractor's responsibilities are defined in Section 01 91 00 of the Specifications. These responsibilities apply to all Subcontractors and vendors within Division 23. Each Contractor and vendor shall review Section 01 91 00, and their proposals shall include for carrying out the work described, as it applies to each Section within the Division 23 specifications, individually and collectively.



DIVISION 21

FIRE SUPPRESSION



SECTION 21 10 00
FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Fire Protection Systems, as indicated, in accordance with provisions of Contract Documents.
- B. Fire Protection Systems Included:
 - 1. Water based:
 - a. Wet-pipe sprinkler system.
 - 2. Products:
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Use only new material of first class construction, designed and guaranteed to perform service required.
- B. Provide fully operational systems.
- C. Provide complete fire protection systems as described in the Contract Documents and according to criteria of authority having jurisdiction (AHJ) and the Owner's insurance carrier.
 - 1. Where system requirements as described in the Contract Documents exceed those of the AHJ, meet requirements of both.
 - 2. Where discrepancies exist among the AHJ, Owner's insurance carrier, and Contract Documents, the most stringent requirements shall take precedence.
- D. Addition, deletion, or relocation of existing sprinklers, and rerouting of existing pipe may be necessary.
- E. Do not downsize piping indicated to serve future areas.
- F. Authorities Having Jurisdiction:
 - 1. Code Enforcement Agencies.
 - 2. Fire Marshall's Office.
 - 3. State Insurance Office.
 - 4. Water Supply Authority.
- G. Owners Insurance Carrier: _____.
- H. Referenced Criteria (applicable as referenced by AHJ and Owner's insurance carrier):
 - 1. Latest edition of referenced criteria applies unless an earlier edition is specifically indicated by the AHJ and Owner's insurance carrier.
 - 2. National Fire Protection Association (NFPA).
 - 3. Underwriter's Laboratories (UL).
 - 4. Factory Mutual Engineering Commission (FM).
- I. Installer Qualifications:
 - 1. Fire Protection Installer shall be licensed, and shall provide evidence of the successful completion of at least five projects of equal or greater size and complexity.
 - 2. Use workmen skilled in this trade.
 - 3. Provide documentation that welders, and welding operators are certified in accordance with American Welding Society Standard AWS D10.9.
 - 4. Installation of the following items/systems shall be done by authorized representatives of respective manufacturers:
 - a. Fire pump.

- b. Dry-chemical fire suppression system.
 - c. Fire system valves.
- J. Piping and Fittings: Section 20 11 00.
- K. Outside Utilities: Section 20 10 10.

1.3 SUBMITTALS

- A. Product Data:
- 1. Backflow protection devices.
 - 2. Wet-pipe sprinkler system.
- B. Project Information:
- 1. Submit detailed data and complete layout of fire protection systems approved by authorities having jurisdiction (including Owner's insurance carrier) and prepared in accordance with the requirements for Working Plans described in applicable NFPA standards.
 - a. Include calculations prepared in accordance with the requirements for Hydraulic Calculations described in applicable NFPA standards.
 - 2. Architect reviews for project information and general conformance with contract documents.
- C. Contract Closeout Information:
- 1. Letter, with Owner acceptance signature, stating spare parts and extra materials per NFPA requirements have been delivered.
 - 2. Operation and Maintenance Data.
 - 3. Owner instruction report.
 - 4. Test reports:
 - a. Factory pump tests as indicated in this section's Part I "Quality Assurance" paragraph.
 - b. Certification that tests as indicated in FIELD QUALITY CONTROL (Part 3) have been successfully completed and approved by authorities having jurisdiction.

1.4 JOB CONDITIONS

- A. Arrange and pay for permits, fees and inspections required.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Alarm and Signal Devices:
- 1. Base:
 - a. Viking.
 - 2. Optional:
 - a. Federal Signal.
 - b. Fire-Lite Alarms/Notifier.
 - c. Potter Electric Signal.
 - d. Potter Roemer.
 - e. Simplex Access Controls.
 - f. United Electric Controls.
- B. Alarm-test Device:
- 1. Base:
 - a. Viking.
 - 2. Optional:
 - a. Grinnell.
 - b. Victaulic of America.
 - c. AGF Manufacturing Inc.
- C. Backflow Protection Devices:
- 1. Base:

- a. Cla-Val.
 - 2. Optional:
 - a. Febco.
 - b. Hersey Measurement.
 - c. Watts Control Valves.
 - d. Wilkins Regulator.
 - e. Ames Co./Fluid Controls Systems.
- D. Fire Department Connections, Fire Department Valves, Fire Hose Cabinets, and Hydrants:
- 1. Base:
 - a. Elkhart Brass.
 - 2. Optional:
 - a. Croker West.
 - b. Grinnell.
 - c. JL Industries.
 - d. Larsen's Manufacturing.
 - e. Potter Roemer.
 - f. Seco.
 - g. Waterous.
- E. Fire Protection Systems, Water Based:
- 1. Base:
 - a. Viking.
 - 2. Optional:
 - a. Central Sprinkler.
 - b. Firematic Sprinkler Devices.
 - c. Globe Fire Sprinkler.
 - d. Potter Roemer.
 - e. Star Sprinkler.
- F. Sprinklers:
- 1. Base:
 - a. Viking.
 - 2. Optional:
 - a. Firematic Sprinkler Devices.
 - b. Globe Fire Sprinkler.
 - c. Reliable Automatic Sprinkler.
 - d. Star Sprinkler.
- G. Submit other pipe materials, joining methods, and equipment not specified, but accepted by applicable NFPA standards and approved by Authority Having Jurisdiction, in accordance with Section 00 26 00.

2.2 DESIGN REQUIREMENTS

- A. Design fire sprinkler systems.
- B. Design fire sprinkler and suppression systems.
 - 1. Obtain water supply fire flow test prior to designing systems.
 - a. Flow hydrant location: _____.
 - b. Gauge hydrant location: _____.
 - 2. Compare flow test results to those listed below, and use lowest pressure of the two to design systems.
 - a. Static pressure: _____ PSIG
 - b. Residual pressure: _____ PSIG.
 - c. Flow: _____ GPM.
 - d. Pitot pressure: _____ PSIG.
 - e. Nozzle size: ___ IN.
 - f. Butt Coefficient: _____.

2.3 PIPE, FITTINGS, AND SUPPORTS

- A. Pipe and Fittings - General:
 - 1. Meet or exceed applicable NFPA standards and Section 20 11 00.
 - 2. Working pressure: Not less than 175 PSI.
 - 3. The following are not permitted:
 - a. Lightwall and Schedule 5 pipe.
 - b. Plain end, pressure fit type fittings.
 - c. Hole cut mechanical tee fittings.
 - 4. Fittings: galvanized where galvanized piping is used.
 - 5. Corrosion Resistance Ratio (CRR) of all pipe used: equal to or greater than one.
- B. Above ground pipe normally containing water:
 - 1. Examples: Wet-pipe and standpipe-and-hose fire protection systems.
 - 2. Sprinkler piping 4 IN and greater:
 - a. Black steel, Schedule-10:
 - 1) Welded joints.
 - 2) Mechanical coupling joints:
 - a) Rolled groove type (cut grooving not allowed).
 - b) Mechanical locking (push-on) type.
 - 3. Sprinkler piping less than 4 IN:
 - a. Black steel, Schedule-40:
 - 1) Threaded joints.
 - 2) Welded joints.
 - 3) Mechanical joints:
 - a) Cut or rolled groove type.
 - b) Mechanical locking (push-on) type.
 - 4. Seamless copper tubing.
 - a. High temperature soldered joints.
- C. Above Ground Pipe normally containing air:
 - 1. Examples: Deluge, dry-pipe, and dry-pipe/pre-action fire protection systems; piping for alarm and sensing devices.
 - 2. Galvanized steel, Schedule-40:
 - a. Threaded joints.
 - b. Welded joints.
 - c. Mechanical joints:
 - 1) Cut or rolled groove type.
 - 2) Mechanical locking (push-on) type.
 - 3. Seamless copper tubing:
 - a. High temperature soldered joints.
 - 4. Brass pipe, Schedule-40 (only for valve trim):
 - a. Threaded.
- D. Pipe, below ground:
 - 1. Same as outside utility fire protection piping.
 - a. See Section 20 10 10.
- E. Fittings:
 - 1. Threaded:
 - a. Black cast iron, Class 150.
 - b. Black malleable iron.
 - c. Galvanized malleable iron.
 - 2. Flanged:
 - a. Black cast iron, short body, Class 125.
 - b. Galvanized malleable iron.
 - c. Gaskets: Full face of 1/8 IN minimum red sheet rubber.
 - d. Flange bolts: ANSI-B18.2.

- 1) Hexagon head machine bolts with heavy semi-finished hexagon head nuts, cadmium plated.
- 3. Welded:
 - a. Black steel, standard weights.
- 4. Mechanical: ASTM-A47.
 - a. Malleable iron, 500 PSI working pressure.
 - b. Coupling gasket material: Butyl rubber.
 - c. UL listed.
 - d. Approved by FM, NFPA-13, and NFPA-14.
- 5. High temperature soldered:
 - a. Wrought copper.
 - b. Cast bronze.
- F. Pipe Supports:
 - 1. All-purpose type, UL listed and FM approved.
 - 2. Manufacture: Comply with Section 20 05 29.
 - 3. Supports, hanger rods, inserts and clamps acceptable to NFPA.

2.4 ALARM AND SIGNAL DEVICES

- A. UL listed and FM approved.
- B. Coordinate electrical requirements with electrical installer.
- C. Alarm Devices:
 - 1. Alarm pressure switch:
 - a. Shall signal Fire Alarm System Control Panel upon sensing change of pressure in fire system valve.
 - 1) Switch shall automatically reset when pressure returns to normal.
 - b. Service: Normal.
 - 2. Local alarm devices:
 - a. General:
 - 1) Provide local alarm on systems of sufficient size as indicated in NFPA-13.
 - 2) Use alarm bell and visible light alarm on electrically operated supplemental fire detection (valve release) systems.
 - 3) Use water motor gong on hydraulically or pneumatically operated supplemental fire detection (valve release) systems.
 - 4) Devices shall be weatherproof.
 - b. Alarm bell, electric:
 - 1) Shall provide audible alarm signal upon activation of fire protection system.
 - 2) 10 IN weatherproof bell.
 - 3) Provide backer plate to prevent birds and insects from entering inside of bell housing.
 - c. Visible light alarm:
 - 1) Semi-flush, 24 volt DC.
 - 2) Tamper-resistant white lexan lens, with "FIRE" imprinted in red.
 - 3) Light shall be mountable on either ceiling or wall.
 - d. Water motor gong:
 - 1) Shall provide local audible alarm indication upon sensing water flow through fire system valve.
 - 2) 175 PSI iron body mechanical alarm device with 8 IN diameter gong, 5 IN water motor.
 - 3) Drive shaft length compatible with wall thickness encountered.
 - 4) Red hood finish with nameplate.
 - 5) Provide wye strainer upstream of motor.
 - 6) Provide backer plate to prevent birds and insects from entering inside of bell housing.
- D. Signal Devices:

1. Valve tamper switch:
 - a. Shall signal Fire Alarm System Control Panel upon valve movement.
2. Waterflow detector:
 - a. Shall signal Fire Alarm System Control Panel when water flows in system.
 - b. Vane type flow switch with retard mechanism or manual adjustment to prevent false alarm.
 - c. 175 PSI rated.
 - d. Suitable for working pressure of 150 PSI with sensitivity adjusting screw.
3. Pressure supervising switch:
 - a. Shall signal Fire Alarm System Control Panel upon drop in air pressure.
 - 1) Adjustable low-pressure setting.

2.5 BACKFLOW PROTECTION DEVICES

- A. Provide on water supply at location indicated on drawings to prevent contamination of potable water system.
- B. Corrosion resistant materials.
- C. Totally rebuildable.
- D. Flanged ends.
- E. Rating: Water at 175 PSI working pressure and between 33 to 110 DEGF.
- F. Provide OS&Y inlet and outlet isolation valves.
- G. Provide four test cocks.
 1. Provide No. 1 test cock on inlet valve.
- H. Approved by authority having jurisdiction.
- I. UL listed and FM approved.
- J. Double Check Detector:
 1. Two independently operating check valves.
 2. Bypass line with two independently operating check valves, water meter, three test cocks, and outlet shutoff valve. Bypass shall allow 8-10 GPM of flow before main-line assembly opens.

2.6 FIRE ALARM SYSTEM CONTROL PANEL

- A. Fire alarm system control panel: Provided under Electrical Specification Divisions.

2.7 FIRE PROTECTION SYSTEMS, WATER-BASED

- A. Supplemental Fire Detection Valve Release System:
 1. Detection system shall be part of UL listed and FM approved fire protection system.
 2. Provide hydraulically, pneumatically, or electrically actuated supplemental fire detection system as indicated in system description.
 - a. Hydraulically actuated system:
 - 1) Do not use where system may be subject to freezing.
 - b. Pneumatically actuated system:
 - 1) When subject to freezing, provide desiccant dried air (with dew point lower than coldest expected ambient temperature).
 - 2) Connect dry air to system where air will not pass over or through standing water as it pressurizes piping system.
 - 3) When pressurizing system with air, do not exceed flow capacity of dryer: Prefill with dry nitrogen if faster fill is desired.
 - c. Electrically actuated system:
 - 1) May be used with any fire protection system.
 3. Support supplemental detection system piping/wiring separately from sprinkler piping.
 4. Devices for hydraulically or pneumatically actuated supplemental detection systems:

- a. Sprinkler with temperature setting lower than normal system sprinklers.
 - b. Thermostatic device that causes fire valve to operate when space temperature rises faster than 15 DEGF per minute.
 - c. Combination of sprinkler and thermostatic devices.
- B. Wet Pipe Fire Protection Sprinkler System:
- 1. Description: Automatic system shall employ closed sprinklers attached to a piping system filled with pressurized water.
 - a. Normal operation:
 - 1) Actuation of sprinkler allows water to flow through actuated sprinkler.
 - 2) Waterflow in zone sends signal to Fire Alarm System Control Panel.
 - b. Failure of sprinkler allows water to flow through sprinkler.
 - 1) Waterflow in zone sends signal to Fire Alarm System Control Panel.

2.8 FIRE DEPARTMENT CONNECTIONS

- A. Components and assemblies UL listed and FM approved.
- B. Minimum 175 PSI non-shock cold-water working pressure.
- C. Inlet threads for connections to fit local fire department standards.
- D. Outlet threads for hydrants to fit local fire department standards.
- E. Fire Department Siamese Connections.
 - 1. Outside type.
 - 2. Inlet:
 - a. Quantity:
 - 1) Two.
 - b. Size:
 - 1) 2-1/2 IN.
 - c. Fittings:
 - 1) Brass snoots, brass pin-lug swivels, brass pin-lug plugs, chains, and gaskets.
 - 3. Outlet:
 - a. Quantity:
 - 1) One.
 - b. Size:
 - 1) 4 IN.
 - 4. Finish:
 - a. Satin brass.
 - 5. Raised lettering:
 - a. "AUTOSPKR STANDPIPE".
 - 6. Connection style:
 - a. Flush, wall-mounted, and drop clappers.

2.9 FIRE DEPARTMENT VALVES AND FIRE HOSE CABINETS

- A. Components and assemblies UL listed and FM approved.
- B. Outlet threads shall match local fire department standards.
- C. Valves:
 - 1. Minimum 175 PSI non-shock cold-water working pressure.
- D. Cabinet:
 - 1. For use with fire department valves and fire hoses.
 - 2. Surface mounted cabinet, one-piece:
 - a. 18 GA with baked white enamel inside and out.
 - 3. Door frame:
 - 4. For use with recessed and semi-recessed cabinets.
 - a. 16 or 18 GA steel.
 - 5. Door:

- a. Continuously hinged 20 GA steel.
- E. Fire Department Valves:
- 1. General:
 - a. 2-1/2 x 2-1/2 IN valve.
 - b. Cap and chain.
 - c. Pattern: Straight or angle.
 - 2. FDV, Fire department valve without cabinet:
 - a. Finish: Polished brass.
 - 3. FVC-1, Fire department valve with cabinet:
 - a. Cabinet mounting:
 - 1) Recessed.
 - b. Door style:
 - 1) Solid with lever handle cam latch.
 - c. Cabinet and door finish:
 - 1) Prime painted.
 - d. Valve finish:
 - 1) Rough brass.
 - e. Mark: "FIRE DEPARTMENT VALVE".
 - 4. FVC-2, Fire department valve with cabinet:
 - a. Cabinet mounting:
 - 1) Surface.
 - b. Door style:
 - 1) Solid with lever handle cam latch.
 - c. Cabinet and door finish:
 - 1) Prime painted.
 - d. Valve finish:
 - 1) Rough brass.
 - e. Mark: "FIRE DEPARTMENT VALVE".
- F. Fire Hose Cabinets (FHC):
- 1. Components and assembly UL listed and FM approved.
 - 2. Provide hose-rack assembly with each FHC:
 - a. Covered, one-piece, semi-automatic: Assembly operable by one person allows valve to be open without water flow until last fold of hose is removed.
 - b. Provide permanently affixed instruction label stating "Fire Hose for Use by Occupants."
 - c. Rack Finish: Red enamel.
 - d. Hose valve:
 - 1) Adjustable, pressure-restricting angle pattern. Maximum pressure: 100 PSI.
 - 2) Configuration: As indicated.
 - 3) Finish: As indicated.
 - e. Rack nipple.
 - f. Hose:
 - 1) 1-1/2 IN lined, approved for hose rack installation.
 - 2) Length: As indicated.
 - g. Nozzle:
 - 1) Industrial, adjustable fog nozzle.
 - 2) Finish: Polished brass.
 - h. Polished brass escutcheon at valve base.
 - 3. FHC-1:
 - a. Cabinet mounting:
 - 1) Recessed.
 - b. Door style:
 - 1) Solid with lever handle cam latch.
 - c. Cabinet and door finish:
 - 1) Prime painted.
 - d. Valving configuration:

- 1) One 1-1/2 IN valve (Class II).
- e. Valve finish:
 - 1) Rough brass.
- f. Hose length:
 - 1) 75 FT.
- g. Size cabinet to accommodate fire extinguisher (See section 10 44 00 for size of extinguisher).
- h. Mark:
 - 1) "FIRE HOSE AND EXTINGUISHER."
- 4. FHC-2:
 - a. Cabinet mounting:
 - 1) Surface.
 - b. Door style:
 - 1) Solid with lever handle cam latch.
 - c. Cabinet and door finish:
 - 1) Prime painted.
 - d. Valving configuration:
 - 1) One 1-1/2 IN valve (Class II).
 - e. Valve finish:
 - 1) Rough brass.
 - f. Hose length:
 - 1) 75 FT.
 - g. Size cabinet to accommodate fire extinguisher (See section 10 44 00 for size of extinguisher).
 - h. Mark:
 - 1) "FIRE HOSE AND EXTINGUISHER."

2.10 FIRE SYSTEM VALVES

- A. UL listed and FM approved.
- B. Body: Ductile or cast iron.
- C. Pressure rating: 175 PSI non-shock cold-water working pressure.
- D. 2 IN and smaller: Threaded.
- E. 2-1/2 IN and larger: Flanged or grooved.
- F. Trim to meet NFPA requirements.
- G. Trim to meet performance as indicated in descriptions of fire protection systems.
- H. Deluge Valve:
 - 1. Cast bronze clapper, clamp ring, and valve seat.
 - 2. Teflon coated valve seat.
 - 3. Neoprene diaphragm and seat rubber.
 - 4. Stainless steel seat-rubber retaining ring.
 - 5. Locks open upon actuation.
 - 6. Trim for priming, connecting alarms, testing alarms, draining system, preventing water logging, and reading water pressures.
 - 7. Where used in pre-action systems, provide additional trim for connecting air supply and reading air pressure.
 - 8. Provide release controls for supplemental fire detection system.
 - 9. Provide release controls for manual-actuation station when station is indicated in system description.
- I. Dry Pipe Valves:
 - 1. Cast bronze clapper, clamp ring, and valve seat.
 - 2. Teflon coated valve seat.
 - 3. Neoprene diaphragm and rubber seat.

4. Stainless steel seat-rubber retaining ring.
5. Locks open upon actuation.
6. Trim for priming, connecting alarms, testing alarms, draining system, preventing water logging, reading air and water pressures, and connecting air supply.

2.11 MANUAL VALVES

- A. Isolation Valves:
 1. Gate valves:
 - a. 2 IN and smaller: V-49.
 - b. 2-1/2 IN and larger: V-50.
 2. Butterfly valves:
 - a. 2 IN and smaller: V-55.
 - b. 2-1/2 IN and larger: V-51.
 3. Butterfly valves with tamper switches:
 - a. 2-1/2 IN and smaller: V-59.
 - b. 3 IN and larger: V-61.
- B. Check Valves 2-1/2 IN and larger: V-53 or V-54.
- C. Grade-type Post Indicator Valve Assembly:
 1. Valve: V-52.
 2. Post: UL listed and FM approved indicator post to fit V-52.
- D. Outside Valve Boxes:
 1. 3 piece cast iron, extension type, 5-1/4 IN shaft, 5-1/4 IN drop lid, screw or slip type.
 2. Screw type lid: Tyler 6860 with No.6 bell base.
 3. Slip type lid: Tyler 6865 with No.8 bell base.
 4. Mark lids with WATER cast in metal.
- E. Automatic Ball Drip Valve:
 1. 1/2 IN straight or angle cast-brass ball drip shall close against pressure.
 - a. When pressure drops, valve shall open to drain pipe.

2.12 SPRINKLERS

- A. UL listed sprinklers of style and type required for service indicated.
- B. Sprinklers in systems sized from pipe schedules shall have 1/2 IN nominal orifices.
- C. Finish of exposed parts: As indicated.
- D. Sprinkler types: Metallic fusible link or glass bulb.
- E. Sprinkler Styles:
 1. Upright:
 - a. Finish: Standard bronze.
 2. Pendant:
 - a. Finish: Standard bronze.
 3. Pendant with escutcheon:
 - a. Finish: Chrome.
 4. Recessed pendant:
 - a. Deflector: 1 to 1-1/2 IN below finished ceiling.
 - b. Escutcheon: Two-piece with 1/2 IN adjustment.
 - c. Removal of escutcheon and ceiling tile shall not disturb sprinkler or drop assembly.
 - d. Finish: Chrome.
 5. Flush pendant:
 - a. Escutcheon: 1/2 IN adjustment.
 - b. Finish: Chrome.
 6. Tamper-proof flush pendant:
 - a. Escutcheon: 1/2 IN adjustment.

- b. Specifically designed to prevent occupant from using sprinkler to injure themselves or others.
 - c. Finish: Chrome.
- 7. Concealed pendant:
 - a. Ceiling plate flush with finished ceiling.
 - b. Housing: 1/2 IN adjustment.
 - c. Finish: White.
- 8. Horizontal sidewall:
 - a. Finish: Chrome.
- 9. Horizontal sidewall, extended coverage:
 - a. Finish: Chrome.
- 10. Dry pendant:
 - a. For coverage of exterior area from interior wet-pipe system.
 - b. For systems with piping that is subject to freezing.
 - c. Finish: Chrome.

2.13 SYSTEM ACCESSORIES

- A. Alarm Test Device:
 - 1. Optional replacement for alarm test loop.
 - 2. Single device or unit that provides visual verification of waterflow in a fire sprinkler system and allows for draining of all or a portion of that system.
 - 3. Contains sight glass, inspector test valve, auxiliary drain valve and test orifice.
 - 4. UL listed and FM approved.
- B. Pressure Gauges:
 - 1. UL listed and FM approved.
 - 2. See Section 20 05 19.
- C. Spare Parts:
 - 1. Tools:
 - a. Furnish one emergency rubber ball shutoff on long handle to be used for temporary closing of sprinkler after fire has been extinguished.
 - b. Furnish testing apparatus capable of producing the heat or impulse necessary to operate supplemental fire detection systems in manner recommended by manufacturer of detection system.
 - 2. Sprinkler cabinet, Wall mounted:
 - a. Provide spare sprinklers of each type and sprinkler wrench for each type in quantities required by NFPA-13.
- D. Sprinkler Guards:
 - 1. UL listed.
 - 2. Heavy duty welded wire.
 - 3. Red baked enamel finish.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate with other trades to ensure adequate space for equipment and piping placement.
- B. Review plans, specifications and shop drawings of other trades to coordinate work.
- C. Do not begin installation until after Agency approvals have been submitted to Architect.
- D. Test systems in accordance with System Standards, manufacturers' instructions, and applicable NFPA publications.
- E. Install systems in accordance with System Description, manufacturers' instructions, and approved shop drawings.

1. Modifications to system design or arrangement after approval of drawings may only be made after receiving written approval of Architect and authority(ies) having jurisdiction.
 2. Such modifications do not include minor relocations in piping or sprinkler placement.
 3. Make revisions in accordance with NFPA.
- F. Maintain fire and smoke ratings where mechanical items penetrate fire and fire/smoke rated building elements.
- G. Field quality control: Give advance notice and arrange for field tests and inspections by authority(ies) having jurisdiction.

3.2 PIPING, SPRINKLERS, AND SUPPORTS

A. Piping - General:

1. Install sprinkler piping within first 6 IN of space under floor construction.
 - a. Where conditions of construction require piping installation at a lower elevation, route piping to avoid interference with work of other trades.
2. Avoid interconnecting standpipes through sprinkler system piping.
3. Offset, crossover and otherwise route piping to install system in available space.
 - a. Not every offset is indicated.
4. Install chromed escutcheons on finished-area sides of pipe penetrations.
 - a. Secure escutcheons so they make contact with floor, wall, or ceiling.
5. When risers are concealed, provide wall flange at each FDV and within cabinets.
6. Pitch branch lines, cross mains, feed mains and risers to drains.
7. Paint fire sprinkler piping in accordance with Section 09 91 23.
8. Flush outside fire-main piping prior to connecting to inside system.

B. Sprinklers - General:

1. Install sprinklers to provide and maintain minimum 18 IN clear between bottom of deflector and top of storage, files, shelving, and cabinets.
2. Standard-application temperature rating:
 - a. Sprinkler type:
 - 1) Glass bulb: 155 DEGF.
 - 2) Fusible link: 165 DEGF.
 - b. Where non-standard applications exist, use higher rating.
 - 1) Use sprinklers rated at least 50 DEGF higher than anticipated ambient temperature.

C. Supports:

1. Install in accordance with NFPA-13 and NFPA-14.

D. Testing - General:

1. Test sprinkler and standpipe piping, including outside supplies, under hydrostatic pressure of 200 PSI for 2 HRS.
 - a. Prove system tight to satisfaction of Architect.
 - b. Inside piping shall indicate no leakage.
 - c. Leakage in underground piping shall be in accordance with NFPA-24.

E. Piping and Sprinkler - Application by room type:

1. Areas subject to freezing:
 - a. Sprinkler styles: Upright or dry pendant.
 - 1) Temperature rating: As required for room type.
 - b. Provide sprinkler guards on pendant sprinklers.
2. Electrical rooms/closets:
 - a. Sprinkler styles: Upright, pendant, or horizontal sidewall (standard or extended coverage).
 - b. Provide sprinkler guards.
3. Elevator machine rooms:
 - a. Provide shielding to protect electrical elevator equipment from sprinkler system discharge.

- 1) Coordinate with elevator installer.
 - 2) Coordinate with authority(ies) having jurisdiction.
 - b. Sprinkler styles: Upright, pendant, or horizontal sidewall (standard or extended coverage).
 - 1) Glass bulb temperature rating: 200 DEGF.
 - 2) Fusible link temperature rating: 220 DEGF.
 - c. Provide sprinkler guards.
- 4. Finished rooms (rooms with ceilings):
 - a. Sprinkler styles:
 - 1) Concealed pendant.
 - 2) Horizontal sidewall, standard or extended coverage.
 - b. Where ceiling is being replaced in existing areas, relocate existing sprinklers to coordinate with new ceiling layout.
 - c. Where ceiling exists in area subject to freezing, comply with requirements for areas subject to freezing.
 - d. Locate sprinklers to coordinate with ceiling layout.
 - 1) Locate sprinklers centered in ceiling tile and in center of metal strip in linear metal ceilings, if such location makes added sprinklers necessary, provide added sprinklers as required to meet code.
- 5. Mechanical equipment rooms:
 - a. Sprinkler styles: Upright, pendant, or horizontal sidewall (standard or extended coverage).
 - 1) Glass bulb temperature rating: 200 DEGF.
 - 2) Fusible link temperature rating: 220 DEGF.
 - b. Provide sprinkler guards.
- 6. MRI rooms:
 - a. Sprinkler style: As indicated for finished rooms.
 - b. Sprinkler type: Glass-bulb.
- 7. Parking garages:
 - a. Sprinkler styles: Upright or dry pendant.
 - 1) Glass bulb temperature rating: 286 DEGF.
 - 2) Fusible link temperature rating: 286 DEGF.
 - b. Provide sprinkler guards on pendant sprinklers.
- 8. Psychiatric patient areas and secure holding rooms:
 - a. Do not run exposed piping.
 - b. Sprinkler style: Tamper-proof flush pendant.
- 9. Smoke compartments containing sleeping rooms:
 - a. Sprinkler style: As indicated for finished rooms.
 - b. Sprinkler type: Quick-response.
- 10. Substations:
 - a. Sprinkler styles: Upright, pendant, or horizontal sidewall (standard or extended coverage).
 - 1) Glass bulb temperature rating: 200 DEGF.
 - 2) Fusible link temperature rating: 220 DEGF.
 - b. Provide sprinkler guards.
- 11. Telephone/Communication rooms/closets:
 - a. Sprinkler styles: Upright, pendant, or horizontal sidewall (standard or extended coverage).
 - b. Provide sprinkler guards.
- 12. Unfinished rooms (rooms without ceilings):
 - a. Sprinkler styles: Upright, pendant, or horizontal sidewall (standard or extended coverage).

3.3 ALARM AND SIGNAL DEVICES

- A. Where multi-zone, wet-pipe fire protection sprinkler systems exist, provide waterflow detector at each zone take off immediately after isolation valve.

- B. Install valve tamper switch on each isolation valve indicated below:
 - 1. Valves at bases of standpipes.
 - 2. Valves at fire system valves.
 - 3. Valves in fire pump suction piping including valves across water meters and backflow protection devices.
 - 4. Valve at fire pump discharge.
 - 5. Sprinkler-zone valves.
 - 6. Post indicator valves.

3.4 FIRE PROTECTION SYSTEMS

- A. Factory trained Engineer shall supervise installation of fire protection systems.
- B. On combination sprinkler and standpipe-and-hose systems, do not interconnect standpipes through sprinkler piping.
- C. Factory trained Engineer shall provide following services:
 - 1. Supervise installation of fire protection systems.
 - 2. Instruct Owner's personnel in systems operations.
- D. Test completed alarm systems including control and signal circuits wired by Electrical installer.
 - 1. Coordinate with electrical.
 - 2. Complete testing prior to substantial completion.

3.5 FIRE DEPARTMENT CONNECTIONS, FIRE DEPARTMENT VALVES, AND FIRE HOSE CABINETS

- A. Install fire department connections, fire department valves, and fire hose cabinets at height required by authority having jurisdiction.
 - 1. Position valve to allow 12 IN spanner wrench clearance for connecting hoses.

3.6 MANUAL VALVES

- A. Provide isolation valves at following locations:
 - 1. Bases of standpipes.
 - 2. Fire system valves.
 - 3. Suction and discharge of fire pump.
 - a. Suction isolation valve must be OS&Y type.
 - b. Discharge isolation valve must be indicating type.
 - 4. Flow test system:
 - a. Inlet to hose valve manifold.
 - b. Inlet and outlet of flow meter.
 - 5. On combination sprinkler and standpipe-and-hose systems, provide isolation valve at each sprinkler-zone take off from standpipes.
- B. Provide check valves at following locations:
 - 1. Outlet of fire pump: In-line, spring-actuated check.
 - 2. Fire department connection.
- C. Install indicator posts approximately 3 FT above grade.
- D. Provide automatic ball drip at low points.
 - 1. Piping between outside fire department connection and check valve.
 - 2. Piping between outside fire department connection and pump test header shutoff valve.
- E. Provide valve boxes at each underground valve (except PIV's).

3.7 SYSTEM ACCESSORIES

- A. Alarm Test Loops:
 - 1. Provide after each waterflow detector.
 - 2. Alarm test loop consists of two parallel branches.

- a. First branch: Inspector's test branch shall contain a shutoff valve and a restricting orifice imitating the flow through the smallest sprinkler on the system. Provide means for inspector to observe water flow (e.g., drain water within sight of valve or provide sight glass).
 - b. Second branch: Drain branch shall contain shutoff valve.
 - c. Alarm test loop sizing criteria:
 - 1) Riser or Main is 2 IN or smaller: 3/4 to 2 IN.
 - 2) Riser or main is 2-1/2 to 3-1/2 IN: 1-1/4 to 2 IN.
 - 3) Riser or main is 4 IN or larger: 2 IN.
 - 3. Extend loops to nearest floor drain or mop sink.
 - a. Loops may be terminated outside when approved by authority having jurisdiction.
 - 4. Label valves and outlets.
- B. Drains:
- 1. Permit complete draining of systems without disconnection of piping.
 - 2. Drain consists of dirt leg, valve, and piping.
 - 3. Extend drain piping to nearest floor drain or mop sink.
 - 4. Required locations:
 - a. At low points of systems.
 - b. At fire pump.
 - c. At alarm test loops.
 - d. At fire system valves.
 - e. At bases of risers and standpipes.
 - 1) 1-1/2 IN hose threads that match local fire department threads may be provided instead of extending piping.
 - 5. Size drain valve and piping according to alarm test loop sizing criteria in this section.
 - 6. At offsets, plugs may be substituted for drains when approved by authority having jurisdiction.
- C. Pressure Gauges:
- 1. Provide at following locations:
 - a. On each discharge pipe from fire pump.
 - b. At service entrance to building.
 - c. At top of each standpipe.
 - d. At inlet and outlet of pressure reducing valves.
 - e. At top of each sprinkler riser.
 - f. At alarm test loops.
 - g. At other indicated locations.
 - 2. Provide shutoff valve and drain for each gauge.
- D. Sprinkler Cabinets:
- a. Install _____.

3.8 ELECTRICAL WIRING

- A. Provide Following:
- 1. Wiring diagrams for devices.
 - 2. Supplemental fire detection systems and their wiring.
 - 3. Wiring not specified but required to provide an operating system.
 - 4. Control wiring from fire pump controller to pressure switch(es).
 - 5. Interlock wiring between fire pump and emergency generator(s).
- B. Electrical Installer shall provide following:
- 1. Alarm and signal device wiring:
 - a. Tamper switches: Supervised wiring to Fire Alarm System Control Panel.
 - b. Waterflow detectors: Supervised wiring to Fire Alarm System Control Panel.
 - c. Alarm pressure switches: Supervised wiring to Fire Alarm System Control Panel.
 - d. Pressure supervising switches: Supervised wiring to Fire Alarm System Control Panel.
 - e. Supervised wiring from waterflow detector to outside alarm bell.

- 2. Supplemental fire detection systems:
 - a. Supervised wiring to Fire Alarm System Control Panel.

END OF SECTION

4-18-2017		
05-03-2016		
0		



DIVISION 22

PLUMBING



SECTION 22 08 00

COMMISSIONING OF PLUMBING SYSTEMS

1.1 COMMISSIONING AUTHORITY

The Commissioning Authority (CxA) has been contracted directly with the Architect for this project. Commissioning involves all parties to the design and construction process, including the Division 22 Plumbing Contractor, and all Subcontractors within Division 22 as required.

1.2 CONTRACTOR RESPONSIBILITY

The Division 22 Plumbing Contractor's responsibilities are defined in Section 01 91 00 of the Specifications. These responsibilities apply to all Subcontractors and vendors within Division 22. Each Contractor and vendor shall review Section 01 91 00, and their proposals shall include for carrying out the work described, as it applies to each Section within the Division 22 specifications, individually and collectively.

SECTION 22 10 16
PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Plumbing Piping, as indicated, in accordance with provisions of Contract Documents.
- B. Systems and Products Included:
 - 1. Systems:
 - a. Cold, hot, and circulating domestic water piping systems within building and to 5 FT outside building wall.
 - b. Drainage piping systems:
 - 1) Soil, waste, vent, indirect, and storm piping within building and to 5 FT outside building wall.
 - 2) Acid resistant waste, and acid vent within building.
 - c. Pressure drainage piping.
 - d. Grease pumping line piping system.
 - e. Film processor replenishment system containment conduit.
 - f. Exposed piping in finished areas.
 - C. Definitions:
 - 1. Caulked: Tamped lead and oakum joint.
 - 2. Drainage piping: Soil, waste, vent, acid waste, acid vent, indirect, and storm piping.
 - 3. Brazing: High temperature soldering.
 - 4. Pressure drainage piping: Branch piping from discharge of sump pump or sewage ejector to connection with gravity drainage piping.
 - D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Outside Utilities: See Section 20 10 10.
- B. Pipe and fittings standards: See Section 20 11 00.
- C. Fire Protection Systems: See Section 21 10 00.
- D. Valve standards: See Section 20 05 23 (for valves labeled "V-__").
- E. American Water Works Association Standard AWWA C601: Sterilization Standard.
- F. Plumbing and Drainage Institute Standard WH201: Water hammer arrester standard.
- G. Plumbing and Drainage Institute Standard G10: Grease interceptor standard..
- H. American Society for Sanitary Engineering Standard ASSE 1001: Pipe Applied Atmospheric Type Vacuum Breakers.
- I. American Society for Sanitary Engineering Standard ASSE 1013: Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
- J. Standard: American Society for Sanitary Engineering Standard ASSE 1020: Pressure Vacuum Breaker Assembly.
- K. Comply with NSF 61 for potable domestic water piping and components that come in contact with potable water.

1.3 SUBMITTALS

- A. Shop Drawings:

1. Piping layout drawings at 1/4 IN/FT scale.
 2. Waste holding tank assembly:
 - a. Tank fabrication drawings.
 - b. Stand fabrication drawings.
 - c. Piping arrangement and positioning of 55 GAL drums.
- B. Product Data:
1. Include sufficient information to verify compliance with specifications:
 - a. Backflow protection devices.
 - b. Drains.
 - c. Grease interceptors.
 - d. Grease pumping line piping system.
 - e. Neutralization tanks.
 - f. Valves.
 - g. Temperature maintenance cable.
 - h. Water hammer arresters.
 - i. Water meters.
- C. Contract Closeout Information:
1. Pressure test reports.
 2. Disinfection test report.
 3. Operation and Maintenance Data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Reduced Pressure Principle Backflow Protection Device:
1. Base:
 - a. Watts Regulator.
 2. Optional:
 - a. Febco.
 - b. Hersey Measurement.
 - c. Wilkins Regulator.
- B. Vacuum Breakers Backflow Protection Devices:
1. Base:
 - a. Watts Regulator.
 2. Optional:
 - a. Febco.
 - b. Wilkins Regulator.
- C. Cleanouts and Drains:
1. Base:
 - a. Wade Division/Tyler Pipe.
 2. Optional:
 - a. Watts Drainage - Ancon.
 - b. Josam Company.
 - c. JONESPEC Plumbing Products.
 - d. Jay R. Smith Manufacturing Co.
 - e. Zurn Industries, Inc.
 - f. Mifab.
- D. Rainwater Catch Basin "CB-1":
1. Base:
 - a. Oldcastle Precast.
 - b. Model Number: FGP-16F
 - c. Inlet ID: 16 in X 16 in

- d. Depth: Standard Depth 20 inches or custom order.
 - e. Filtered Flow Capacity: 0.7 CU FT per Sec.
 - f. By Pass Capacity: 4.7 CU FT per Sec.
 - g. Verify the depth requirement of rainwater catch basin depend on pipe running across below building grade beam. Use custom order depth if required depth is more than 20" of standard depth.
 - 2. Optional:
 - a. Other equal precast product.
- E. Grease Interceptors "GT-1":
 - a. Oldcastle Precast.
 - b. Model No.: GT-3000
 - c. Capacity: 3000 Gallons
 - d. Dimension ID: 6'-0" X 12'-0" X 7'-0"
 - e. Manhole size: 24 inch diameter.
 - f. Sampling Vault Model Number: 444-GGI sampling Vault
 - 2. Optional:
 - a. Other equal precast product.
- F. Temperature Maintenance Cable:
 - 1. Base:
 - a. Thermon Manufacturing.
 - 2. Optional:
 - a. Raychem.
- G. Automatic Trap Primer Valves:
 - 1. Base:
 - a. Precision Plumbing Products.
 - 2. Optional:
 - a. Jay R. Smith Manufacturing Co.
 - b. Wade Division/Tyler Pipe.
- H. Backwater Valves:
 - 1. Base:
 - a. Josam Company.
 - 2. Optional:
 - a. Jay R. Smith Manufacturing Co.
 - b. Watts Drainage-Ancon, Inc.
- I. Hot water Balancing Valves:
 - 1. Base:
 - a. Bell and Gossett Circuit Setter Balance Valve.
 - 2. Optional:
 - a. Flow Design Inc. - Autoflow.
 - b. Preso.
- J. Pressure Reducing Valves:
 - 1. Base:
 - a. Watts Regulator.
 - 2. Optional:
 - a. Fisher.
 - b. Wilkins Regulator.
- K. Water Hammer Arresters:
 - 1. Base:
 - a. Sioux Chief water hammer arrestor.
 - 2. Optional:
 - a. Wade Division/Tyler Pipe.

- b. Jay R. Smith Manufacturing Co.
 - c. Josam Company.
 - d. Zurn Industries, Inc.
- L. Water Meters:
- 1. Base:
 - a. Hersey Measurement.
 - 2. Optional:
 - a. Badger Meter.
 - b. Sensus Technologies.
 - 3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 PIPE AND FITTINGS

- A. Domestic Water Piping:
- 1. Domestic water piping at service entrance from 1 FT inside building to 5 FT outside: Same as indicated for outside utilities.
 - 2. 2 IN and smaller after service entrance:
 - a. Above grade:
 - 1) Copper, type L, with solder joints, and wrought copper or cast brass fittings.
 - 2) Optional fitting:
 - a) Ring Seal Crimp fitting system: With approval of local authority having jurisdiction.
 - b. Below grade:
 - 1) Copper, type K soft, with brazed joints and wrought copper or cast brass fittings.
 - 2) Where below grade run of piping is shorter than 50 FT, below-grade joints are not acceptable.
 - 3. 2-1/2 IN and larger after service entrance:
 - a. Non-softened cold water:
 - 1) Schedule 10 stainless steel pipe and joints, ASTM 312, A 778 or B36.19 as allowed by code.
 - 2) Copper, type L, with soldered joints and wrought copper or cast brass fittings.
 - 3) Copper, type L, with roll groove joints and wrought copper or cast brass fittings.
 - b. Hot water and soft water:
 - 1) Schedule 10 stainless steel pipe and joints, ASTM 312, A 778 or B36.19 as allowed by code.
 - 2) Copper, type L, with solder joints and wrought copper or cast brass fittings.
 - 3) Copper, type L, with roll groove joints and wrought copper or cast brass fittings.
- B. Drainage piping (soil, waste, vent, indirect, and storm):
- 1. Above grade:
 - a. Cast iron, hubbed pipe and fittings with lead and oakum or elastomeric push joints, as allowed by code.
 - b. Cast iron, hubless pipe, fittings, and elastomeric sealing sleeves with stainless steel or cast iron clamps, as allowed by code.
 - c. Copper (type DWV or heavier), with soldered joints and wrought copper or cast brass drainage and vent fittings, as allowed by code.
 - 1) Piping within MRI shielding shall be copper.
 - 2. Below grade:
 - a. 2 IN diameter or larger.
 - b. Cast iron, hubbed pipe and fittings with lead and oakum or elastomeric push joints, as allowed by code.
 - c. Cast iron, hubless pipe, fittings, and elastomeric sealing sleeves with stainless steel or cast iron clamps, as allowed by code.
- C. Drainage piping (Acid resistant):
- 1. Above grade:
 - a. Acid resistant glass, with mechanical joints and glass fittings.

- b. Acid resistant cast iron pipe and fittings, with mechanical joints (except, where local codes prohibit mechanical joints, use bell and spigot joints).
 - 2. Below grade:
 - a. Acid resistant cast iron pipe and fittings, with mechanical joints.
- D. Pressure drainage piping:
 - 1. Cast iron pressure pipe and fittings, with mechanical joints.
- E. Underground hot and cold water piping containment conduit.
 - 1. Schedule 40 PVC-U.
 - a. Manufacturer: George Fisher
 - b. Model: Contain it containment pipe PVC-U
- F. Exposed piping in finished areas:
 - 1. Chrome or nickel plated brass to wall or floor.
 - 2. Piping 2 IN and larger may be provided with chrome or nickel plated brass sleeves to cover pipe and fittings.
 - a. See Section 20 05 00.
- G. Trap primer pipe between primer device and drain:
 - 1. Above grade: Copper, type L, with solder joints, and wrought copper or cast brass fittings.
 - 2. Below grade: Copper, type K soft, with solder joints, and wrought copper or cast brass fittings.

2.3 BACKFLOW PROTECTION DEVICES

- A. Backflow protection devices, general:
 - 1. Approved by local Public Utilities Bureau and the state Environmental Protection Agency.
- B. Reduced Pressure Principle Backflow Preventer (BFP):
 - 1. Two check valves, test cocks, pressure differential relief valve, isolation valves and accessories assembled as an integral unit, horizontally mounted. Tested and certified in conformance with ASSE Standard No. 1013.
 - 2. Threaded ends: 2 IN and smaller.
 - 3. Flanged ends: 2-1/2 IN and larger.
 - 4. Provide 3/4 IN drain line from relief to floor drain, floor sink, mop sink, or service sink.
 - 5. Isolation valves:
 - a. 2 IN and smaller: Ball valve.
 - b. 2-1/2 IN and larger:
 - c. Provide No. 1 test cock on inlet valve.
 - 6. Size BFP's to have a pressure loss less than 14 PSI at flows indicated below (refer to plans for pipe sizes):
 - a. 1/2 IN pipe: 2.2 GPM.
 - b. 3/4 IN pipe: 6 GPM.
 - c. 1 IN pipe: 13 GPM.
 - d. 1-1/4 IN pipe: 22 GPM.
 - e. 1-1/2 IN pipe: 35 GPM.
 - f. 2 IN pipe: 75 GPM.
 - g. 2-1/2 IN pipe: 125 GPM.
 - h. 3 IN pipe: 170 GPM.
 - i. 4 IN pipe: 315 GPM.
 - j. 6 IN pipe: 720 GPM.
 - k. 8 IN pipe: 1250 GPM.
 - l. 10 IN pipe: 1965 GPM.
- C. Pressure type vacuum breakers (PTVB):
 - 1. Designed to protect against back siphonage in continuous pressure piping systems. Tested and certified in conformance with ASSE Standard No. 1020.
 - 2. Bronze body and lightweight internal floats designed to eliminate spillage.
 - 3. Provide isolation ball valve on inlet and outlet of PTVB.

4. Provide outlet connection on VB compatible with equipment/fixture being served.
 5. Mount bottom of VB at least 12 IN above the flood level rim of the equipment/fixture being served.
 6. Provide test cocks.
 7. Match VB size to pipe size indicated on plans.
- D. Atmospheric vacuum breakers (VB):
1. Bronze body and lightweight internal float designed to eliminate spillage. Tested and certified in conformance with ASSE Standard No. 1001.
 2. Provide isolation valve immediately upstream of VB.
 3. Provide outlet connection on VB compatible with equipment/fixture being served.
 4. Mount bottom of VB at least 6 IN above the flood level rim of the equipment/fixture being served.
 5. Match VB size to pipe size indicated on plans.

2.4 CLEANOUTS

- A. Cleanouts, general:
1. Provide flashing collars and clamps for CO bodies being installed in floors with finishes installed over waterproofing.
 - a. Coordinate with Division 09 and Room Finish installers.
 2. Dimensions are nominal.
 3. Body material (unless indicated otherwise): Coated cast iron.
 4. Cleanout plugs:
 - a. Extra heavy, threaded, tapered, brass plug with solid hexagonal nut.
 - b. Comply with Plumbing Code.
 - c. Provide with American Standard pipe threads.
 5. Cleanouts on lines completely accessible from within pipe chases do not require covers.
 6. Cleanouts in exposed piping in equipment rooms do not require special covers.
- B. Interior Floor Mounted Cleanouts:
1. Extra heavy, flanged, cast iron ferrule, tapped for cleanout plug with spigot or inside caulk outlet.
- C. Example:
1. Two piece, threaded, adjustable housing.
 - a. ANSI load class: Light duty, unless noted otherwise.
 - b. Example: [Wade 6000](#).
 2. Top and cover as specified below by floor finish.
 - a. Resilient tile and sheet finish: Round flange top with scoriated cover.
 - b. Ceramic tile finish: Square flange top with scoriated cover.
 - c. Poured finish: Round, wide flange top with scoriated cover.
 - d. Carpet finish: Round top with standard top tapped for carpet marker bolt.
 - e. Terrazzo finish: Round top with recessed for terrazzo cover.
 - f. Quarry tile finish: Square, heavy duty top with heavy duty scoriated cover.
 - g. Concrete finish in unfinished areas:
 - 1) Heavy, round frame; satin bronze, scoriated tractor top.
 - 2) ANSI load class: Heavy duty.
 - 3) Example: [Wade 6000Z](#).
- D. Cleanouts in vertical piping:
1. Tapped cleanout tee.
 2. Extra heavy, threaded, brass plug with solid hexagonal nut.
- E. Cleanouts in hubs of combination wye and eighth bends or wyes.
1. Tapped spigot.
 2. Extra heavy, threaded, brass plug with solid hexagonal nut.
- F. Cleanouts at ends of hubless combination wye and 1/8th bends or wyes.
1. Blind plug.

- G. Covers over cleanouts in concealed vertical piping:
 - 1. Square, nickel bronze frame with secured, smooth, stainless steel access cover.
 - 2. 6 x 6 IN for pipe sizes 4 IN and less.
 - 3. 9 x 9 for pipe sizes 5 IN and larger.
 - 4. Example: [Wade W-8480-S](#).
- H. Exterior cleanouts: See section 20 10 00.

2.5 DRAINS

- A. Drains - General:
 - 1. Provide flashing clamps with seepage openings for drain bodies with flashing collars being installed in floors with finishes installed over waterproofing.
 - a. Coordinate with Division 09 and Room Finish installers.
 - 2. Provide underdeck clamps for drain bodies except those installed in slabs on grade.
- B. Air Gap Fittings:
 - 1. Inlet: Female IPS or collar with set screw.
 - 2. Outlet: Spigot or IPS.
 - 3. Material: Cast iron or bronze.
 - 4. Minimum air gap area: 2 times inlet area.
 - 5. Examples: Jay R. [Smith 3950 series](#).
- C. Downspout Nozzles:
 - 1. DSN-1:
 - a. Cast bronze nozzle with rough bronze finish and flange for securing nozzle to wall.
 - b. Example: Jay R. Smith 1770.
- D. Floor drains:
 - 1. General:
 - a. Dimensions are nominal.
 - b. Provide trap primer taps where trap primer valves are required: See paragraph on trap primer valves.
 - c. Material (unless indicated otherwise): Coated cast iron.
 - 2. FD-1:
 - a. 9 IN diameter flashing collar.
 - b. Adjustable top.
 - c. 5 IN diameter, removable.
 - d. Nickel Bronze strainer.
 - e. Basic of design: JR Smith 2005
 - f. Option: Trap Primer Connection
 - 3. FD-2:
 - a. 12 IN diameter flashing collar.
 - b. Reversible flashing clamp with seepage openings and tapped opening for strainer body.
 - c. 8-1/2" diameter Medium duty cast iron strainer.
 - d. Basic of design: JR Smith 2110.
 - 4. FD-3:
 - a. 12 IN diameter flashing collar.
 - b. Reversible flashing clamp with seepage openings and tapped opening for strainer body.
 - c. 8-1/2" diameter dome grate.
 - d. Basic of design: JR Smith 2110.
- E. Floor sinks:
 - 1. General:
 - a. Dimensions are nominal.
 - b. Provide trap primer taps where trap primer valves are required: See paragraph on trap primer valves.
 - c. Material, unless indicated otherwise) Coated cast iron.
 - d. Provide flashing collars.

2. FS-1:
 - a. 12 x 12 x 8 IN floor sink.
 - b. 14 gauge type 304 Stainless Steel body.
 - c. Stainless steel bottom doom strainer.
 - d. Stainless steel half grade.
 - e. Basic of design: JR Smith model 3003.
 - f. Option: Trap primer connection
 1. FS-2:
 - a. 12 x 12 x 8 IN floor sink.
 - b. 14 gauge type 304 Stainless Steel body.
 - c. Stainless steel bottom doom strainer.
 - d. Stainless steel half grade.
 - e. Basic of design: JR Smith model 3003.
 2. FS-3:
 - a. 8-1/2" x 8-1/2" x 6 IN floor sink.
 - b. Cast Iron flanged receptor with seepage holes, acid resistant coated interior, nickel bronze rim and secured grate.
 - c. Bottom doom strainer.
 - d. Nickel bronze rim and half grade.
 - e. No hub connection.
 - f. Basic of design: JR Smith model 3001Y.
- F. Roof drains:
1. General:
 - a. Dimensions are nominal.
 - b. Material (unless indicated otherwise): Coated cast iron.
 - c. Provide deck clamps.
 - d. Provide bearing pan/sump receiver where occurring at steel decks.
 2. RD-1:
 - a. Flashing collar diameter: 16 to 19 IN.
 - b. Flashing clamp with gravel stop.
 - c. Mushroom dome: coated cast iron.
 - d. Mushroom dome height: 5 IN.
 - e. Mushroom dome diameter: 11 to 14 IN.
 - f. Provide bearing pan/sump receiver.
 - g. Provide solid or adjustable extension to allow for insulation thickness between concrete deck and waterproof membrane.
 - 1) Coordinate extension height with roof insulator.
 - h. Basic of design: JR Smith Fig 1010
 3. OD-1 (overflow drain):
 - a. Flashing collar diameter: 16 to 19 IN.
 - b. Flashing clamp with integral 2 IN tall water dam.
 - c. Mushroom dome and dam: coated cast iron.
 - d. Mushroom dome height: 5 IN.
 - e. Mushroom dome diameter: 11 to 14 IN.
 - f. Provide bearing pan/sump receiver.
 - g. Provide adjustable extension to allow for insulation thickness.
 - 1) Coordinate extension height with roof insulator.
 - h. Basic of design: JR Smith Fig 1010

2.6 DRIP PANS OVER CRITICAL AREAS

- A. Drip pans:
1. Field or shop fabricated: See detail.

2.7 FLASHINGS

- A. On floors above grade, allow for flashings provided by others at penetrations in floors with finishes installed over waterproofing.
 - 1. Coordinate with Division 09 and Room Finish installers.

2.8 TRAPS

- A. Traps, general:
 - 1. Cast brass or cast iron, one piece pattern, 3 IN minimum seal.
 - 2. Same material, coating, and finish as piping system into which they are installed except traps 2 IN NPS and under, not buried in earth, shall be cast brass with union and cleanout.
 - 3. Place trap cleanouts in accessible locations.
- B. Provide deep seal traps for drain bodies in ventilation housings: Traps need to maintain seal against static pressure in fan housing.
- C. Traps for drains with buried outlet: Cast iron P-traps, unless otherwise indicated.

2.9 VALVES

- A. Automatic trap primer valves.
 - 1. General:
 - a. Rebuildable.
 - b. Integral vacuum breaker on drain branch.
 - c. Connections: Soldered or threaded.
 - d. Provide trap primers as indicated on plans.
 - 2. Automatic trap primer valve:
 - a. Serves single drain.
 - b. 1/2 IN bronze.
 - c. Designed to be installed in the supply line to an individual fixture with branch extended to drain.
 - d. Examples: [Wade 2400](#), [Smith 2699](#).
 - 3. Automatic trap primer valve:
 - a. Serves one to four drains.
 - b. 1/2 IN brass.
 - c. Integral backflow preventer.
 - d. Designed to be installed at end of dead-end line with continuation to drain.
 - 1) Activated by 5 PSI drop or more in main.
 - e. Automatically adjusts to line pressures between 35 and 75 PSIG.
 - f. Example: Precision Plumbing Products Prime Rite.
 - 4. Automatic trap primer valve:
 - a. Serves one to eight drains.
 - b. Body: Polypropylene.
 - c. Internal parts: Stainless steel, monel metal.
 - d. Integral backflow preventer.
 - e. Designed to be installed at end of dead end line with continuation to drain.
 - 1) Activated by 3 PSI drop or more in main.
 - f. Automatically adjusts to line pressures between 35 and 75 PSIG.
 - g. Example: Precision Plumbing Products Oregon #1.
 - 5. Trap primer distribution reservoir.
 - a. Copper reservoir with brass fittings and clear plastic inspection cover.
 - 1) Feeds up to four traps through separate lines.
 - 2) Provide mounting brackets.
 - b. Example: [Precision Plumbing Products](#).
- B. Balancing valves, constant flow control:
 - 1. Factory calibrated, direct acting, automatic pressure compensating.
 - 2. Control flow rates within 5 PCT of flow rating over operating pressure differential range.
 - a. Set flow rating according to pipe sizes indicated on plans:

- 1) 1/2 IN: 1.0 GPM.
 - 2) 3/4 IN: 2.5 GPM.
 - 3) 1 IN: 6 GPM.
 - 4) 1-1/4 IN: 9 GPM.
3. Pressure differential range:
 - a. 4-57 PSID.
 4. Threaded brass or copper sweat body with stainless steel internal parts.
 5. Provide a metal identification tag with chain for each installed valve.
 - a. Identify zone or location, valve model number, flow rate, direction of flow, and differential pressure range.
 6. Provide with integral unions to allow field exchange of internal components without removing valve body from pipeline.
 7. Provide manual valve upstream and downstream of each valve.
- C. Check Valves:
1. 2 IN and smaller: V-24 or V-25.
 2. 2-1/2 IN and larger: V-28 or V-29.
- D. Manual Valves, Potable Water:
1. 2 IN and less: V-13 or V-14.
 2. 2-1/2 to 4 IN:
 3. 6 IN and larger:
 - a. V-34 or V-35 or V-62.
 - b. Totally enclosed gear operator and wheel handle.
 - c. At equipment and at service entrance:
 - 1) Use lug type valves, V-33.
 - 2) Use groove end type valves, V-62.
 4. Balancing cocks:
 - a. Constant flow control balancing valves.
- E. Manual Valves, Waste Water:
1. Drainage piping shut off: V-37.
 2. Pressure drainage piping:
 - a. Shut off: V-2.
 - b. Check: V-28.
- F. Pressure Reducing Valves:
1. Use pilot operated or direct acting PRV based on pipe size indicated on plans.
 - a. 2 IN and smaller: direct acting.
 - b. 3 IN and larger: pilot operated.
 2. Direct acting PRV.
 - a. Bronze bodied, diaphragm and spring type valve with integral thermal bypass and removable, stainless steel strainer.
 - b. Size PRV's to have a maximum fall off pressure of 15 PSIG at flows indicated below (refer to plans for pipe sizes):
 - 1) 1/2 IN pipe: 2.2 GPM.
 - 2) 3/4 IN pipe: 6 GPM.
 - 3) 1 IN pipe: 13 GPM.
 - 4) 1-1/4 IN pipe: 22 GPM.
 - 5) 1-1/2 IN pipe: 35 GPM.
 - 6) 2 IN pipe: 75 GPM.
 3. Pilot operated PRV.
 - a. Hydraulically operated, pilot controlled diaphragm type valve.
 - 1) Pilot control: Direct acting, adjustable, spring loaded, normally open.
 - b. Single removable seat and resilient disc.
 - c. Fixed orifice in control system.
 - d. Pressure rating: 125 class.
 - e. Temperature rating: 180 DEGF.

- f. Valve body: Cast iron ASTM A48.
- g. Stainless-steel trim.
- h. Provide thermal relief if PRV is installed on cold-water side of water heater.
- i. Adjustment range: 15 to 75 PSI.
- j. Pipe size indicated on plans: 3 IN.
 - 1) Min PRV flow rate: 15 GPM.
 - 2) Normal maximum flow rate: 150 GPM.
 - 3) Maximum intermittent flow rate: 260 GPM.
- k. Pipe size indicated on plans: 4 IN.
 - 1) Min PRV flow rate: GPM.
 - 2) Normal maximum flow rate: 310 GPM.
 - 3) Maximum intermittent flow rate: 475 GPM.
- l. Pipe size indicated on plans: 6 IN.
 - 1) Min PRV flow rate: 50 GPM.
 - 2) Normal maximum flow rate: 720 GPM.
 - 3) Maximum intermittent flow rate: 1000 GPM.
- m. Pipe size indicated on plans: 8 IN.
 - 1) Min PRV flow rate: 115 GPM.
 - 2) Normal maximum flow rate: 1250 GPM.
 - 3) Maximum intermittent flow rate: 1870 GPM.
- n. Pipe size indicated on plans: 10 IN.
 - 1) Min PRV flow rate: 200 GPM.
 - 2) Normal maximum flow rate: 1965 GPM.
 - 3) Maximum intermittent flow rate: 2950 GPM.

2.10 WATER HAMMER ARRESTERS

- A. Engineered, and certified in accordance with Plumbing and Drainage Institute (PDI) Standard WH-201.
- B. Type and construction:
 - 1. Bellows type and constructed entirely of stainless steel.
 - 2. Piston type is not acceptable.
- C. Water hammer arrestors shall be bellows type and constructed entirely of stainless steel.

2.11 WATER METERS

- A. Use threaded fittings on meters 2 IN and less in size.
- B. Use flanged connections on meters 2-1/2 IN and larger.
- C. Provide valve on each side of meter.
- D. Public utility water meter:
 - 1. Provide type and size approved by local utility.
 - 2. Provide full size bypass line around meter with a sealed valve.
 - 3. Provide capped tee immediately downstream of meter.
 - a. Verify size with local utility.
- E. Private water meters:
 - 1. Provide vertical shaft turbine meters on make up water lines to HVAC equipment.
 - 2. Match size to pipe size indicated on drawings.

PART 3 - EXECUTION

3.1 GENERAL

- A. General:

1. Install piping as indicated and to provide fixtures and items of equipment with proper drainage, vent, and water connections as required by governing codes.
2. Hold piping as close to structure as possible to maintain maximum head room.
3. Run piping concealed wherever possible.
4. Under no circumstances reduce pipe size indicated without written consent of Architect.
5. Size branches to individual fixtures as scheduled.
6. Consult the following before roughing in piping:
 - a. Manufacturer's data.
 - b. Large scale Architectural, and Mechanical Drawings of rooms containing equipment and plumbing fixtures.
7. Stub piping through wall directly behind item being served (e.g., equipment, plumbing fixtures, vending machines).
 - a. Cap and protect until such time as installation is performed.
 - b. Exception: Upon approval of Architect, piping mains and/or branches may be run in lab benches, in built in counters, and in cabinet work.
8. Plug or cap piping immediately after installation.
9. Install chromed escutcheons on finished area sides of pipe penetrations.
 - a. Secure escutcheons so they make contact with floor, wall, or ceiling.
10. Install equipment in accordance with manufacturer's instructions.
11. Connect equipment furnished by Owner or other divisions in accordance with Section 20 05 00.
12. Install piping supports, sleeves, and seals as indicated in Section 20 05 29.

3.2 DOMESTIC WATER PIPING SYSTEMS

- A. General:
 1. Install plumbing without cross or inter connections between potable and non-potable lines.
 2. Provide unvalved system drains on trapped portions of systems: See Section 20 05 19.
 3. Provide thermometers and pressure gauges where indicated on drawings: See Section 20 05 19.
- B. Service entrance installation through exterior wall: See Section 20 05 29 (water stop pipe sleeves).
- C. Backflow Protection Devices.
 1. Provide at following locations:
 - a. At fixtures and equipment as indicated and required by Code.
 - b. Where specified in Section 22 42 00: Plumbing Fixtures.
 - c. Where specified in Section 22 67 00: High Purity Water Systems.
 2. Pipe drain from reduced pressure principle backflow preventers to drain or mop sink.
 3. Install vacuum breakers over mop sink or over drain in unfinished area.
- D. Balance Hot Water Circulation System.
- E. Provide manual isolation valves at following locations.
 1. To isolate groups of fixtures and equipment on branch runouts from piping mains.
 2. On each branch serving a rest room.
 3. On inlet and outlet of each equipment.
 4. On each branch to hose bib or wall hydrant.
 5. At main feed points to domestic water pipe risers.
 6. As indicated and as required to adequately service parts of systems and equipment.
- F. Wire isolation valves on emergency showers open and tag "Do Not Close".
- G. Provide water hammer arresters on hot and cold water lines in accordance with PDI Standard WH-201 sizing and placement data; the Contractor shall be responsible for sizing of water hammer arrestors in accordance with this standard.
- H. Testing of Domestic Water System:

1. Upon completion of system or a section of system, test piping hydrostatically to pressure not less than 50 PCT in excess of pipe's working pressure, but in no case less than 150 PSI.
 - a. System shall hold pressure for 24 HRS.
 2. Repair leaks or replace defective pipe disclosed by tests.
 3. Repeat tests until piping indicates tight.
- I. Sterilization of Domestic Water System:
1. Sterilize system as indicated or in accordance with AWWA C652 or CS186.
 2. Thoroughly flush potable water systems.
 3. After flushing, introduce chlorine or chlorine compound into system with dosage sufficient to give an initial residual chlorine content of 50 PPM.
 4. Collect samples from various taps and fixtures throughout buildings during introduction of chlorine to assure uniform distribution.
 5. Open and close valves several times.
 6. After a 24 HR contact period, flush traces of heavily chlorinated water from systems.
 7. After flushing is complete, indicate effectiveness of disinfection by submitting laboratory reports of bacteriological tests on samples taken from system.
 8. If unsatisfactory results are obtained, repeat disinfection process until satisfactory.
 9. Do not put system into service until tests are approved by Plumbing Inspector.

3.3 DRAINAGE PIPING SYSTEMS

- A. General:
1. Changes of direction and junctions: Make with wye fittings and eighth bends.
 - a. Use sanitary tee fittings in vertical pipe only.
 - 1) Sanitary crosses not allowed.
 2. Provide P-trap for each direct waste pipe connection to equipment.
 3. Trap fixtures as required by governing code.
 4. For ice makers, provide either of the indirect drain options listed below:
 - a. Floor sink.
 - b. Dedicated, under counter P-trap.
 5. Provide air gaps at indirect drains.
- B. Slopes:
1. Install horizontal soil, waste, and storm lines with following slopes:
 - a. 3 IN and smaller pipes:
 - 1) 1/4 IN/FT.
 - b. 4 IN and larger pipes:
 - 1) 1/4 IN/FT.
 - c. Slopes indicated on plans override those indicated here.
- C. Vents:
1. Run vent stacks parallel to soil and waste stacks to receive branch vents from fixtures.
 - a. Each vent stack shall originate from a soil or waste stack at its base.
 2. To permit proper flashing, offset through the roof piping away from walls on roof before passing through roof.
 3. Carry vent stacks 4 IN and larger full size through roof.
 4. Install vent lines so they will drain and not trap water.
 5. Where possible combine soil, waste or vent stacks before passing through roof to minimize roof openings.
 6. Where minimum vent through roof size is larger than vent size, provide increaser minimum of 12 IN below roof line.
 - a. Minimum vent through roof size:
 - 1) 4 IN.
 7. Extend vent stacks at least 12 IN above roofing.
- D. Provide cleanouts on drainage piping as indicated below and on plans.
1. Locations:
 - a. At dead ends.

- b. At changes of direction greater than 45 DEG.
 - c. At junction of building drain and building sewer.
 - d. 36 IN to 48 IN above finished floor in vertical piping that connects to horizontal soil, waste, or storm piping immediately below in ceiling space or under grade.
 - e. As test tee to receive test plugs in each riser at least every other floor.
 - f. At maximum 50 FT intervals in horizontal 4 IN and smaller drains.
 - g. At maximum 100 FT intervals in horizontal, 5 IN and larger drains.
2. Sizes:
- a. 4 IN diameter and smaller piping: Match pipe size.
 - b. 5 IN diameter and larger piping: Not less than 4 IN.
3. Where cleanouts occur in concealed spaces, provide with extensions to wall or to floor above.
- a. Make extensions using long sweep ells or wye and eighth bends.
4. Where cleanouts are indicated in ceiling spaces above critical areas, extend cleanouts through floor above.
5. Install carpet marker bolts after carpet installation.
- E. Install piping and drains to allow for flashings provided under Roofing System section.
- 1. Coordinate with Roofing installer.
- F. Area Drains, Floor Drains and Floor Sinks:
- 1. At locations with waterproofing: Set top of flashing collar 1/2 IN below level of waterproofing.
 - 2. At locations without waterproofing: Place drain integrally with poured concrete. Set top of drain flush with finished floor.
 - 3. Set over P-traps.
- G. Drip Pans:
- 1. Provide under drainage piping that runs over critical areas.
 - 2. Critical areas include the following:
 - a. Operating rooms.
 - b. Recovery rooms.
 - c. Delivery rooms.
 - d. Nurseries.
 - e. Food preparation areas.
 - f. Food serving areas.
 - g. Food storage areas.
 - h. Central service areas.
 - i. Electronic data processing areas.
 - 3. Provide drain piping from pans. Spill drain piping to drain in exposed area.
- H. Testing of Drainage Piping Systems:
- 1. Do not insulate, conceal, or install furring around pipe until it has been tested to satisfaction of Owner and Plumbing Inspector.
 - a. If inspection or test indicates defects, replace such defective work or material and repeat inspection and tests.
 - 2. Test piping at completion of installation of each stack or section of piping.
 - a. Fill system with water to highest point and check joints and fittings for leaks.
 - b. Eliminate leaks before proceeding with work or concealing piping.
 - c. Minimum test height: 10 FT.
 - d. Make repairs to piping with new material.
 - e. Peening and chiseling of holes or screwed joints is not allowed.

END OF SECTION

4-18-2017		
22-02-2017		

05-03-2016		
15 April 15		

SECTION 22 11 00
WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Water Distribution System, as indicated, in accordance with provisions of Contract Documents.
- B. Definitions:
 - 1. Unsuitable Material: Debris and/or soil material judged unsuitable by Engineer for support of slabs or other site improvements.
 - 2. Engineer: Soils Engineer employed by Owner, empowered to conduct inspections and make approvals.
 - 3. Rock Excavation: Excavation of rock material which is sufficiently solid and of such strength that it cannot be loosened or broken down in a single pass with following equipment.
 - a. Late model tractor mounted hydraulic ripper equipped with single digging point sized to use with and propelled by crawler type tractor rated at a minimum 200 net flywheel horsepower, operating in low gear.
 - b. A 3/4 cubic yard hydraulic backhoe with a rock tooth.
- C. Completely coordinate with work of other trades.

1.2 EXTRA WORK

- A. Removal and replacement of unsuitable material will be paid for as extra work.
 - 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 - 2. Recorded quantity will be basis for payment.
 - 3. Include unit price on Bid Form.
- B. Rock excavation will be paid for as extra work.
 - 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 - 2. Recorded quantity will be basis of payment.
 - 3. Include unit price on Bid Form.

1.3 QUALITY ASSURANCE

- A. Compaction Density Test:
 - 1. Standard Proctor, ASTM D698.
- B. Owner will hire an independent soils laboratory to conduct in place moisture and density tests.
 - 1. Contractor to pay for retests of material failing initial tests.

1.4 SUBMITTALS

- A. Project Information:
 - 1. Manufacturer's certification for materials.

1.5 JOB CONDITIONS

- A. Verify location of existing utilities and structures and underground utilities.
- B. Protect existing utilities and structures and replace if damaged.
- C. Repair if damaged by this work.
- D. Lengths indicated on drawings are for information only.
- E. Furnish lengths as required.

- F. Perform no pipe work in fill areas until embankment or fill has been completed to at least 2 FT above top of pipe and has been properly compacted.
- G. Verification of existing utilities and structures.
 - 1. Plans indicate existing utilities as indicated on site survey.
 - 2. Verify accuracy, location and depth of each utility prior to trenching or tunneling.
 - 3. If pipe adjustment is necessary due to location of other utilities, secure approval from Engineer.
- H. Revisions to Contract Drawings.
 - 1. If it becomes necessary to change location of lines due to building construction, secure prior written approval from Architect.
 - 2. If Contractor initiated, make approved changes without added cost to Owner.
- I. Do not change pipe sizes without securing prior written approval from Architect.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Water Mains:
 - 1. Cast iron pipe and fittings: ANSI/AWWA C106/A21.6, ANSI/AWWA C108/, ANSI/AWWA C111/A21.11, and ANSI/AWWA C110/21.10, cement mortar lined in accordance with ANSI/AWWA C104/A21.4; with mechanical joints or push on joints; or:
 - 2. Ductile iron pipe and fittings: ANSI/AWWA C151/A21.51, ANSI/AWWA C105/A21.5, ANSI/AWWA C111/A21.11, and ANSI/AWWA C110/A21.10, thickness Class 52, or heavier, cement mortar lined in accordance with ANSI/ AWWA C104/A21.4.
- B. Service lines 3 IN and smaller:
 - 1. ASTM B88 copper tubing type “K” hard drawn, with solder type bronze fittings.
- C. Valves:
 - 1. AWWA C500, gate type, with mechanical joint ends or as otherwise may be necessary; cast iron body, bronze mounted, parallel seat, double disk, non-rising stem, open left (counter clockwise), working pressure 200 PSI; valves from a single manufacturer.
- D. Valve Boxes:
 - 1. Roadway type, cast iron, two (2) section, adjustable screw type, proper length and base size for depths required; word “water” cast in cover; compatible with valves.
- E. Fire Hydrants:
 - 1. AWWA C502, dry barrel type designed for 150 PSI working pressure.
 - 2. Valve opening at least 5 IN in diameter.
 - 3. 6 IN bell connection.
 - 4. Two 2-1/2 IN hose connections.
 - 5. One 4-1/2 IN pumper connection.
 - 6. Outlets: American National fire hose coupling threads.
 - 7. Working parts: Bronze.
 - 8. Latest stock pattern produced by manufacturer.
 - 9. Opening counterclockwise.
- F. Corporation and Service Stops:
 - 1. Bronze with flange joint coupling, threads on inlet end conforming to AWWA C800; tested to minimum hydraulic pressure of 200 PSI.
- G. Buttresses:
 - 1. Portland cement concrete, 6 bag mix.
 - 2. Minimum 28 day compressive strength: 3,000 PSI.
- H. Backfill Material:
 - 1. As approved by Engineer.

2. Free of rock, cobbles, roots, sod, organic matter and frozen material.
3. Moisture content at time of placement:
 - a. 3 PCT plus/minus of optimum moisture content.
 - b. Wet dry material, as required.
 - c. Dry wet material, as required.
 - d. Furnish off site material at no additional cost to Owner.

PART 3 - EXECUTION

3.1 TRENCH EXCAVATION

- A. Excavate trenches by open cut method to depth indicated and necessary to accommodate work.
 1. Permission may be granted for tunnel work for crossing under crosswalks, driveways or existing utility lines.
 2. Such tunnels are limited to 10 FT in length.
- B. Open no more than 300 LF of trench at one time, or less, as required by Engineer.
- C. Failure to comply may necessitate shutdown of entire project until backfilling is performed.
- D. Carry rock excavations minimum of 12 IN below indicated invert elevations.
- E. Do not excavate below indicated grades unless required to remove unsuitable material.
- F. Backfill over excavations in maximum 8 IN lifts compacted to specified density.
- G. Trench Size:
 1. Excavate only sufficient width to accommodate free working space.
 2. Cut trench walls vertically from bottom of trench to top of pipe, conduit, or utility service.
 3. Trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than following dimensions:

Overall Diameter of Utility Service	Excess Dimension
Less than 33 IN	16 IN
More than 33 IN	24 IN

- H. Brace and sheet trenches as soil conditions dictate. Do not remove until backfilling has progressed to a stage that no damage to piping, utility service, or conduit will result due to removal.
- I. Keep trenches free of water.

3.2 PREPARATION FOR PIPE LAYING

- A. See drawings and specific pipe material sections for embedment requirements.
- B. When discrepancy exists between those requirements and these specifications, provide type of embedment which provides greatest load factor.
- C. Types of Embedment:
 1. Class A: Concrete cradle.
 - a. Load factors:
 - 1) 2.2 - Lightly Tamped.
 - 2) 2.8 - Carefully tamped.
 - 3) 3.4 - Reinforced Concrete with p=0.4 PCT.
 2. Class 4: Concrete arch type bedding.
 - a. Load factors:
 - 1) 2.8 - Plain Concrete.
 - 2) 3.4 - Reinforced Concrete with p=0.4 PCT.

- 3) 4.8 - Reinforced Concrete with $p=1.0$ PCT.
 - 3. Class B: First-class bedding.
 - a. Shaped bottom with tamped backfill, or:
 - b. Compacted granular bedding with tamped backfill.
 - c. Load factor:
 - 1) 1.9 - Carefully compacted backfill.
 - 4. Class C: Ordinary bedding.
 - a. Granular bedding with tamped backfill.
 - b. Load factor:
 - 1) 1.5 - Lightly compacted backfill.
- D. Form bell holes in trenches such that only barrel of pipe is firmly supported by bedding material.

3.3 CLEANING PIPES

- A. Thoroughly clean pipes and fittings before laying.
- B. Keep clean until acceptance of Work.
- C. Thoroughly clean inside of every pipe and fitting just before lowering into trench, to remove foreign matter.
- D. Carefully lower into trench in manner to exclude foreign matter while jointing to other pipe.
- E. At close of each work day, or during period when job is not being actively pursued, tightly seal pipe ends with an expansion type stopper or other approved type of watertight seal so that no foreign substance or water may enter line.
- F. Keep seal in place until pipe laying is again resumed.
- G. Under no circumstances use pipe that has been contaminated inside with petroleum products or other liquid that will soak into cement lining or soften bituminous lining.
- H. In event that foreign matter or water enters pipe that has already been laid, immediately cease work and lay no more pipe until contamination has been removed to satisfaction of Architect.

3.4 LAYING PIPE

- A. Use only proper and suitable tools and appliances for safe and convenient handling and laying of pipes and fittings.
- B. Carefully place pipe, fittings and valves into trench.
- C. Do not dump or roll pipe or fittings into trench.
- D. Do not allow pipe or fitting to drop against pipe or fitting already in trench.
- E. Take care to prevent damage to pipe lining and coating.
- F. Repair lining or coating damaged to satisfaction of Architect.
- G. Install pipe so ends of pipe abut and there is no shoulder or unevenness inside main.
- H. Take special care to insure that pipes are well bedded on a solid foundation.
- I. Repair defects due to settlement at Contractor's expense.
- J. Dig bell holes large enough to ensure proper jointing.
- K. Do not allow pipe to rest on rock.
- L. Whenever a pipe or fitting requires cutting, perform work in a satisfactory manner with tools which leave smooth right angle cuts without damaging lining or pipe.
- M. Make such cuts at no added cost to Owner.
- N. Do not spring joints to effect a change in direction unless directed to do so by Architect.

- O. Secure pipe, fittings and valves in place on concrete foundation, thrust blocks or by strapping, as indicated.
- P. Where foundation or thrust blocks are not indicated, secure pipe, fittings and valves in place as directed by Architect.

3.5 PERMISSIBLE DEFLECTION AT JOINTS

- A. Wherever it is necessary to deflect pipe from a straight line, either in vertical or horizontal plane, amount of deflection allowed shall not exceed that required for satisfactory calking or assembly of joint.
- B. Make such necessary deflection in accordance with values and tolerances established by pipe manufacturer.

3.6 JOINTS

- A. Cast Iron or Ductile Iron Mechanical Joint Pipe:
 - 1. Rubber gasket, cast iron gland ring and T bolts with hex nuts.
 - 2. Before joint is made, insure that outside of spigot and inside of bell are entirely free of oil, tar and greasy substances to insure to tight bond.
 - 3. Make joint in accordance with manufacturer's instructions.
 - 4. Tighten bolts with a torque wrench set between 50 and 60 LB.
- B. Cast Iron or Ductile Iron Push-on Joint Pipe:
 - 1. Circular rubber gasket which fits into specially designed bell or socket end of pipe and a specially prepared lubricant.
 - 2. Make joints in following manner:
 - a. Thoroughly clean gasket seat and gasket.
 - b. Wipe with a cloth and apply thin film of lubricant to inside surface of gasket which will come into contact with entering pipe.
 - c. Use only lubricant furnished with pipe.
 - d. In no case use mineral oil or petroleum base lubes.
 - e. Thoroughly clean plain end of pipe to be jointed and start it into socket so it is in contact with gasket.
 - f. Apply a thin film of lubricant to outside of plain end for about 1 IN back from end.
 - g. Complete joint by exerting sufficient force on entering pipe so that its plain end is moved past gasket until it makes contact with socket base.
 - h. Method, which does not harm pipe, may be used to hone pipe.

3.7 FITTINGS AND VALVES

- A. Place fittings, gate and air valves, blowoff connections and valves, valve and blow off vaults, air valve manholes and valve boxes along water mains as indicated or where designated by Architect.
- B. Place in accordance with requirements as provided elsewhere in these specifications.
- C. Set fittings and valves and join to pipe in manner specified for cleaning, laying and jointing pipe.
- D. Where valves are placed on end of a pipe line place a cast iron plug secure in exposed bell before backfilling.
- E. Provide valve box for every nut operated valve and grease case enclosed operating mechanism valve.
- F. Carefully place valve box at right angle to main.
- G. Do not allow valve box to transmit shock or stress to valve; center it plumb over wrench nut of valve, with box cover flush with surface of finished pavement, or set to elevation indicated.
- H. Rest flange at bottom of top section on planks which extend 8 IN into solid ground on trench sides.

- I. Take care in tamping backfill around valve to keep box in place and firmly supported to preclude settlement.
- J. Remove and reset boxes found out of place or not firmly supported at no added cost to Owner.
- K. Determine whether valve or valves are in proper working order before and after installation.
- L. If not, notify Architect and replace.

3.8 HYDRANTS

- A. Install hydrants in accordance with AWWA C600 or C603, as applicable, except as modified herein.
- B. Set operating nut not over 4 FT above finish grade.
- C. Thoroughly compact backfill around hydrants to grade.
- D. Make hydrant available for beneficial use.
- E. Set hydrant on slab of stone or concrete, minimum 4 IN thick and 15 x 15 IN.

3.9 CONNECTION TO EXISTING WATER SYSTEM

- A. Make connections to water system as indicated.
- B. Make connections at such hours, determined by Architect, to cause least disturbance of water supply to existing consumers.
- C. Notify Architect at least 3 days in advance of time Contractor desires to make connections.
- D. Make no connections without Architect's prior approval.
- E. Include expense of making connections in bid price.

3.10 ARTIFICIAL FOUNDATION

- A. When directed, lay pipe upon an artificial foundation, consisting of gravel, sills, wedges, plank or timber, or of concrete, sized and placed as directed by Architect.
- B. Include necessary excavation for such construction.

3.11 TESTING WATER MAINS

- A. Test completed water mains for leakage.
- B. Test sections as directed or approved by Architect.
- C. Maximum allowable leakage not exceeding 1.0 GAL/1000 FT of pipe per hour for 16 IN pipe when tested at 150 PSI.
- D. Fill length of water main under test with water and bring to test pressure of 150 PSI.
- E. Operate valves in test section during test.
- F. After valves have been tested and deficiencies corrected; fill length of main under test with water, taking care to eliminate air from line.
- G. Raise pressure to test pressure by means of compressed air.
- H. Maintain at test pressure for at least 2 HR.
- I. At end of test period, again fill pipe with water from either measured receptacle or an accurately calibrated meter and determine leakage.
- J. Repair every leak which Architect deems important, and every section of line in which leakage exceeds maximum allowable amount, whether or not trench has been filled.
- K. Replace every pipe, fitting, valve, etc., which gives evidence under test of being defective.
- L. If line indicates excessive leakage during any phase of test, retest line after correction of defects.

- M. Continue correcting defects until leaks exceeding allowable leakage have been remedied.
- N. Repair leaks and defects or otherwise remedy at no added expense to Owner and to complete satisfaction of Architect, at whatever time that they become apparent.

3.12 STERILIZATION OF WATER MAINS

- A. Sterilize water mains as specified and directed.
- B. Perform sterilization by either of following methods:
 - 1. By introducing a chlorine gas/water mixture by means of a solution/feed chlorinating device.
 - 2. By introducing a mixture of calcium hypochlorite (comparable to commercial products known as HTH or Perchloron) and water.
- C. Prior to beginning of sterilizing operations, submit for Architect's approval, schedule listing details of procedure to be followed.
- D. Before beginning sterilization, remove dirt and foreign matter from mains by a thorough flushing with clean water.
- E. Introduce water slowly and introduce sterilant through corporation cocks at rate 1 LB chlorine gas/2400 GAL of water, or at rate of 1 LB calcium hypochlorite (measured in a dry state prior to preparation of slurry) per 1,680 GAL of water.
- F. After sterilizing agent has been in pipe minimum of 3 HR, take samples and analyze.
- G. If less than 5 MG/L residual chlorine is indicated, drain pipe and repeat treatment.
- H. If more than 5 MG/L residual is indicated, drain lines to waste and refill with clear water.
- I. Take care to prevent contamination of sterilized pipe.

3.13 BACKFILLING

- A. Do not backfill until tests are performed on system, and system complies with specified requirements.
- B. Hand or pneumatic tamp backfill around and over pipe in lifts not exceeding 8 IN loose thickness.
- C. Compact to specified density.
- D. Exercise care in backfilling operations to avoid displacing pipe joints either horizontally or vertically and to avoid breaking pipe.
- E. Do not water flush or puddle to consolidate backfill.

3.14 COMPACTION

- A. Compact trench backfill in areas under paved roads, parking areas, sidewalks and other structures as directed by Engineer to at least 95 PCT of maximum dry density.
- B. In locations where trench will not be under paved areas, compact backfill to minimum 90 percent of maximum dry density.

3.15 MAINTENANCE DURING WARRANTY PERIOD

- A. If prior to expiration of warranty period, broken pipes or defects are found in mains or in their appurtenances, remove and replace with proper material and workmanship, at no added cost to Owner.
- B. Carefully examine materials for defects prior to placing; do not place defective material.

END OF SECTION

SECTION 22 11 23
PLUMBING PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Plumbing Pumps, as indicated, in accordance with provisions of Contract Documents.
- B. Systems Included:
 - 1. Circulating pumps.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Pipe and fittings standards: See Section 20 11 00.
- B. Manual-valve and check-valve standards: See Section 20 05 23 (for valves labeled "V-__").
- C. Standards:
 - 1. UL 778: Motor Operated Water Pumps.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Circulating pumps.
 - a. Include pump curves with point of operation indicated.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - 2. Owner instruction reports.

1.4 WARRANTY

- A. Eighteen (18) months from start up.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Circulating pumps:
 - 1. Base:
 - a. Bell & Gossett, ITT.
 - 2. Optional:
 - a. Armstrong Pumps.
 - b. Grundfos.
 - c. Taco.
 - d. Thrush.
 - e. Aurora.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Pumps - General:
 - 1. Motors: Section 20 05 00.
 - 2. Motor data: As scheduled.
 - 3. Pump capacities: As scheduled.
 - 4. Provide disconnects.
 - 5. Provide starters for 3-phase motors.

6. Basins: As detailed.
- B. Vibration Isolation:
1. Provide in accordance with Section 20 05 50.

2.3 CIRCULATING PUMPS

- A. Circulating Pumps:
1. In-line centrifugal.
 2. Pump casing and impeller: Bronze, designed for domestic water circulating.
 3. Pump shall be lead free type.
 4. Fractional-horsepower pumps: Seal-less.

PART 3 - EXECUTION

- A. Install as indicated and in accordance with manufacturer's instructions and recommendations.
- B. Furnish piping, isolation valves, check valves, and fittings per manufacturer recommendation.
- C. Provide manual isolation valves at following locations:
1. On inlet and outlet of each circulating pump.
 2. As indicated and as required to adequately service parts of systems and equipment.
- D. Provide check valve at outlet of each pump.
- E. Valve Requirements:
1. See Section 22 10 16.

END OF SECTION

SECTION 22 13 00
SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Sanitary Sewers, as indicated, in accordance with provisions of Contract Documents.
- B. Definitions:
 - 1. Engineer: Soils Engineer employed by Owner, empowered to conduct inspections and make approvals.
 - 2. Unsuitable Material: Debris and/or soil material judged unsuitable by Engineer for support of slabs or other site improvements.
 - 3. Rock Excavation: Excavation of rock material which is sufficiently solid and of such strength that it cannot be loosened or broken down in a single pass with following equipment.
 - a. A material shall be defined as rock if it cannot be effectively loosened or broken down by ripping by a single pass of a late model Caterpillar D-8 equipped with a standard hydraulically activated ripper tooth which is at least 36 IN-long or equivalent bulldozer equipped with the same ripper tooth.
 - b. A material shall be defined as rock if it cannot be removed by a Case 450 backhoe equipped with a standard 24 IN-wide bucket or equivalent backhoe equipped with a standard bucket.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Soil Testing and Compaction Requirements:
 - 1. See Section 31 23 33.
- B. Compaction Density Test:
 - 1. Standard Proctor, ASTM-D698.
- C. Owner will hire an independent soils laboratory to conduct in place moisture and density tests.
 - 1. Contractor pay for retests of material not passing initial tests.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Precast manhole drawings showing size and type of structure base.
- B. Product Data:
 - 1. Manufacturer catalog cuts and literature for pipe, manholes, manhole frame and covers and cleanouts.
- C. Project Information:
 - 1. Manufacturer's certification for materials.

1.4 JOB CONDITIONS

- A. Verify locations of existing and new underground utilities and coordinate installation with all other utility installers.
- B. Verification of Existing Utilities and Structures.
 - 1. Plans indicate existing utilities indicated on site survey.
 - 2. Verify accuracy, location and depth of each utility prior to trenching or tunneling.
 - 3. If pipe adjustment is necessary due to location of other utilities, secure approval from Architect.

- C. Protect existing structures and utilities from damage.
 - 1. Repair if damaged by this work.
- D. Lengths indicated on drawings are for information only.
 - 1. Furnish lengths as required.
- E. Perform no pipe work in fill areas until embankment or fill has been completed to at least 2 FT above top of pipe and has been properly compacted.
- F. Revisions to Contract Drawings:
 - 1. If it becomes necessary to change location of sanitary lines due to building construction, secure prior written approval from Architect.
 - 2. If Contractor initiated, make approved changes without added cost to Owner.
- G. Do not change pipe sizes without securing prior written approval from Architect.
- H. Site utility installer and building plumbing installer shall interface work 5 FT outside face of building:
 - 1. Building plumbing installer shall provide necessary materials (adaptors).

1.5 EXTRA WORK

- A. Removal and replacement of unsuitable material will be paid for as extra work.
 - 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 - 2. Recorded quantity will be basis for payment.
 - 3. Include unit price per cubic yard on Bid Form.
- B. Rock excavation will be paid for as extra work.
 - 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 - 2. Recorded quantity will be basis for payment.
 - 3. Include unit price on Bid Form.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Vitrified Clay Pipe and Fittings:
 - 1. ASTM C700, standard or extra strength bell and spigot with ASTM C425 elastomeric compression joints.
- B. Plain Concrete Sewer Pipe and Fittings:
 - 1. ASTM C14, Class 1 or 2 with ASTM C443 rubber gasket joints for lines less than 12 IN diameter.
- C. Reinforced Concrete Sewer Pipe and Fittings:
 - 1. ASTM C76, Class I, II or III with ASTM C443 rubber gasket joints for lines 12 IN diameter and larger.
- D. Cast iron Soil Pipe and Fittings:
 - 1. ASTM A74 Class SV with ASTM C564 rubber gasket joints.
- E. Ductile Iron Pipe and Fittings:
 - 1. AWWA C150, thickness Class 50 with AWWA C111 rubber gasket joints.
 - 2. Pipe fittings: AWWA C110.
- F. Polyvinyl Chloride (PVC) Pipe and Fittings:
 - 1. 4 IN through 15 IN diameter: ASTM D3034, SDR 35 with ASTM D3212 flexible elastomeric gasket joint.
 - 2. 4 IN through 48 IN diameter: ASTM F794 Series 46 for ribbed sewer pipe with smooth interior with ASTM D3212 flexible elastomeric gasket joint.
- G. Force Main Sewer Pipe and Fittings:
 - 1. ASTM D2241 PVC with ASTM F477 elastomeric gaskets.

2. AWWA C150 ductile iron thickness Class 50 with AWWA C111 rubber gasket joints.
- H. Concrete Materials:
1. Comply with requirements of Division 03.
 2. Minimum compressive strength 4000 PSI at 14 days.
- I. Precast Concrete Manhole:
1. Precast concrete manhole risers, base sections and tops: ASTM C478. Base and riser shall be monolithic and top cone shall be eccentric. Diameter shall be as shown on drawings.
 2. Rubber gaskets for joints between manhole riser sections and top sections: ASTM C443.
 3. Resilient connectors for joints between manhole and entering or leaving pipes: ASTM C923.
- J. Frames and Covers:
1. ASTM A48 cast iron with minimum tensile strength of 30,000 PSI and machined horizontal and vertical bearing surfaces, non-rocking type.
 2. Cover: Solid, non-ventilated with words "SANITARY SEWER" cast in cover.
 3. Frame and cover:
 - a. Minimum clear opening 23 IN.
 - b. In paved areas subject to traffic - Heavy duty type with minimum weight of 400 LBS.
 - c. In areas not subject to traffic - Medium duty type with minimum weight of 150 LBS.
- K. Manhole Steps:
1. Use at manholes under 12 FT in depth.
 2. ASTM A48, cast iron epoxy coated, nonslip surface, designed to support a concentrated load of 500 LBS.
 3. Minimum tread length 12 IN.
 4. Minimum tread width 1 IN.
- L. Ladders:
1. Use at manholes over 12 FT in depth.
 2. Ladders: ANSI A14.3 steel fixed-rail type.
 3. Ladders and accessories shall be galvanized.
 4. Rungs: Solid-section rods, fitted into punched holes in rails, welded, and ground smooth, spaced out 12 IN.
 5. All splices and connections shall have a smooth transition with original members without projections that are sharp or more extensive than required for joint strength.
 6. Rails shall be fitted with brackets at 5 FT intervals for anchorage to structure.
- M. Cleanout Covers:
1. ASTM-A48, cast iron with machined bearing surfaces.
- N. Brick:
1. ASTM C32, Grade-MS.
 2. ASTM C62, Grade-SW.
 3. Saturation coefficient not over 0.8.
- O. Mortar for Masonry:
1. ASTM C270, Type M mortar mixed in proportions of 1 part portland cement, 1/4 part lime paste, 3 to 3-3/4 parts sand, water as required for consistency for brick work or for bedding cast iron frames in masonry.

PART 3 - EXECUTION

3.1 EXCAVATION, BACKFILL AND COMPACTION

- A. Excavate trenches to depth indicated on plans and necessary to accommodate work.
- B. Keep trenches free of water.

- C. Form bell holes in trench or bedding materials as indicated so only barrel of pipe is firmly supported by shaped subgrade or bedding.
- D. Compact bedding material under and around pipe up to spring line of pipe in lifts not exceeding 8 IN loose thickness.
- E. Compact-trench backfill evenly on both sides of pipe to top of excavation or to a depth such that pipe will not be injured by subsequent compaction used to achieve required density.
- F. Backfill and compact remainder of trench in 8 IN lifts to specified density.
- G. Exercise care in backfilling operations to avoid displacing pipe joints either horizontally or vertically and to avoid breaking pipe.
- H. Do not water flush for consolidation.
- I. Compact trench backfill in areas under paved roads, parking areas, sidewalks and other structures, to minimum 95 PCT of specified density.
- J. Remove materials which cannot be compacted as specified.
- K. Replace with suitable material and compact.

3.2 INSTALLATION OF PIPE

- A. Lay pipelines on uniform grades between inverts.
- B. Locate structures as indicated and construct lines between them.
- C. Lay pipe upgrade beginning at lower end with bell ends of pipe upstream.
- D. Provide proper facilities for lowering pipe into trench.
- E. Do not lay pipe in water.
- F. Do not lay pipe when trench condition or weather is unsuitable for such work.
- G. Remove sections of pipe already placed found to be out of alignment, defective or damaged.
- H. Relay or replace without additional cost to Owner.
- I. Bedding:
 - 1. Lay pipe directly on shaped subgrade.
 - 2. No blocking permitted.
 - 3. Form a continuous bearing with a minimum width of bearing equal to 0.6 of outside diameter of pipe, for full length of pipe, except for portion excavated for joint.

3.3 CLEANOUT STRUCTURES

- A. Construct cleanout risers of 6 IN pipe laid on angle on undisturbed natural ground.
- B. Tamp backfill around and above pipe in layers not exceeding 8 IN depth so that no settlement occurs.
- C. Lay base of cleanout on concrete block.

3.4 WYE BRANCHES

- A. Install where sewer connections are indicated or required.
- B. Cutting into piping for connections not permitted except as approved by Architect.

3.5 FRAMES AND COVERS

- A. Unless otherwise indicated, set frames and covers with top flush with finished pavement grade or 2 IN above unpaved areas.

3.6 CONNECTIONS TO EXISTING MANHOLES

- A. Pipe connections to existing manholes shall be made that finish work will conform to essential applicable requirements specified for new manholes, including concrete work, cutting, and shaping.

3.7 BUILDING CONNECTIONS

- A. Building connections shall include lines to and connection with building waste drainage piping at a point approximately 5 FT outside building, unless otherwise indicated. Where building drain piping is not installed, terminate building connections approximately 5 FT from site of building and plug pipe end.

3.8 LEAKAGE TESTS

- A. Test lines for leakage by low pressure air testing or exfiltration tests, as appropriate:
 - 1. Low pressure air testing ASTM C828.
 - 2. Exfiltration test: Fill line to be tested with water so that a head of at least 2 FT is provided above both water table and top of pipe at upper end of pipeline to be tested. Allow filled line to stand until pipe has reached its maximum absorption, but not less than 4 HRS. After absorption, head shall be re-established. Amount of water required to maintain this water level during a 2-hour test period shall be measured.
 - 3. Leakage as measured shall not exceed 250 gallons per inch diameter per mile of pipeline per day.
 - 4. When leakage exceeds maximum amount specified, satisfactory correction shall be made and retesting accomplished.

END OF SECTION

SECTION 22 14 00
STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Storm Drainage System, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 DESCRIPTION

- A. Definitions:
 - 1. Engineer: Soils Engineer employed by Owner, empowered to conduct inspections and make approvals.
 - 2. Unsuitable Material: Debris and/or soil material judged unsuitable by Engineer for support of slabs or other site improvements.

1.3 QUALITY ASSURANCE

- A. Storm drainage standards: State of Texas, Department of Transportation, Standard Specifications for Road and Bridge Construction, as amended to date.
- B. Should conflicts arise between standard specifications of government agencies mentioned herein and Contract Documents, the more stringent shall govern.
- C. Where a particular type of material or method is specified, no other type of material or method will be permitted, except as specified in Section 00 26 00. Balance of State Specifications apply.
- D. Compaction density test:
 - 1. Standard Proctor, ASTM-D698.
- E. Owner will hire an independent soils laboratory to conduct in place moisture and density tests.
 - 1. Contractor to pay for retests of material failing initial tests.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Manhole, inlet and headwall coordination drawings (enlarged plans and sections/elevations) indicating at a minimum the following:
 - a. Size and type of structure.
 - b. Incoming/outgoing pipe sizes and locations with invert elevations of each.
 - c. Rim elevation of structure.
 - 2. Detention grate assembly drawings and installation details.
 - 3. Inlet grates with locking device or security bolts.
 - 4. Manhole frame and cover with locking device and removable key.
- B. Product Data:
 - 1. Manufacturer's literature for materials.
- C. Project Information:
 - 1. Manufacturer's certification for materials.

1.5 JOB CONDITIONS

- A. Verify locations of existing and new underground utilities.
 - 1. Coordinate installation with utility installers.
- B. Protect existing structures and utilities from damage.
 - 1. Repair if damaged by this work.

- C. Lengths indicated on drawings are for information only.
 - 1. Furnish lengths as required.
- D. Perform no pipe work in fill areas until embankment or fill has been completed to at least 2 FT above top of pipe and has been properly compacted.
- E. Verification of existing utilities and structures.
 - 1. Plans indicate existing utilities as indicated on site survey.
 - 2. Verify accuracy, location and depth of each utility prior to trenching or tunneling.
 - 3. If pipe adjustment is necessary due to location of other utilities, secure approval from Architect.
- F. Revisions to Contract Drawings.
 - 1. If it becomes necessary to change location of storm drainage lines due to building construction, secure prior written approval from Architect.
 - 2. If Contractor initiated, make approved changes without added cost to Owner.
- G. Do not change pipe sizes without securing prior written approval from Architect.
- H. Building plumbing installer and site utility installer to interface work 5 FT outside face of buildings:
 - 1. Building plumbing installer to provide necessary materials (adapters).

1.6 EXTRA WORK

- A. Removal and replacement of unsuitable material below design elevations will be paid for as extra work.
 - 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 - 2. Recorded quantity will be basis for payment.
 - 3. Include unit price on Bid Form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Storm Drainage System:
 - 1. Pipe and fittings:
 - a. Base:
 - 1) Manufacturer who has produced pipe successfully for minimum five (5) years.
 - 2. Pipe joint sealing compound:
 - a. Base:
 - 1) K T Snyder.
 - 3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Reinforced Concrete Pipe (RCP):
 - 1. Pipe and fittings: ASTM C76, Classes as indicated.
 - 2. Joints:
 - a. Compression type: Removable rubber gasket, ASTM C443.
 - b. Install in accordance with manufacturer's recommendations.
 - 3. Sizes: As indicated.
- B. Reinforced Concrete Box Section:
 - 1. ASTM C1433.
 - 2. Joints:
 - a. Field applied preformed compound; KT Snyder, RAM-NEK or RUBR-NEK.
 - b. Field applied plastic bituminous compound: Federal Specification SS-C-153, Type I, Asphaltic Base.
 - c. Install in accordance with manufacturer's recommendations.
 - 3. Sizes: As indicated on drawings.

- C. Pipe material for Storm Drain Piping:
 - 1. Above ground Storm Drain Pipes
 - a. Service weight hubless cast iron pipe comply with CISPI 301 standard.
 - b. Coupling: Stainless steel hubless coupling comply CISPI 310 standard.
 - 2. Below ground Storm Drain Pipes
 - a. Polyvinyl Chloride Pipe (PVC).
 - 3. Below ground Storm Drain Pipes connections for Catch Basins.
 - a. Corrugated Polyvinyl Chloride pipe (PVC).
- D. Rainfall rate:
 - 1. Storm drain piping shall be sized to rainfall rate 6" per hour per Denton County standard.
- E. Polyvinyl Chloride Pipe (PVC):
 - 1. Pipe and fittings: ASTM D3034, SDR 35.
 - 2. Joints: Compression type, ASTM D3212.
 - a. Rubber gasket: ASTM F477.
 - 3. Bedding:
 - a. Granular material from 6 IN below pipe to 6 IN above top of pipe.
 - 4. Sizes: As indicated.
 - 5. Install in accordance with manufacturer's recommendations.
- F. Corrugated Polyvinyl Chloride Pipe (PVC):
 - 1. Pipe and fittings: ASTM F949.
 - a. Extruded with smooth interior and corrugated exterior.
 - b. Manufacturer: A2000 by Contech Construction Products, Middletown, Ohio.
 - c. Available sizes: 4 IN to 18 IN.
 - 2. Joints: Compression type, ASTM D3212.
 - a. Rubber gaskets: ASTM F477, ASTM C425.
 - 3. Bedding:
 - a. Granular material from 6 IN below pipe to 6 IN above top of pipe.
 - 4. Sizes: As indicated.
 - 5. Install in accordance with manufacturer's recommendations.
- G. Corrugated Polyethylene Pipe (PE):
 - 1. Pipe and fittings: ASTM D3350 and AASHTO M294, Type S, and AASHTO M252.
 - a. Extruded with smooth interior and corrugated exterior.
 - b. Manufacturer: Hi-Q by Hancor, Findlay, Ohio or N-12 by Advanced Drainage Systems, Columbus, Ohio.
 - c. Available sizes:
 - 1) Hancor: 4 to 18 IN.
 - 2) ADS: 4 to 36 IN.
 - 2. Joints:
 - a. Polyethylene coupler.
 - 3. Bedding:
 - a. Granular material from 6 IN below pipe to 6 IN above top of pipe.
 - 4. Sizes: As indicated.
 - 5. Install in accordance with manufacturer's recommendations.
- H. Concrete: Class _____, air entrained.
- I. Reinforcement Bars: ASTM A615, Grade-60.
- J. Manholes:
 - 1. Precast reinforced concrete, ASTM C478, risers, flat top sections, eccentric cone, adjuster sections as required with cast in place concrete base slab.
 - 2. Diameter: Minimum 48 IN.
 - 3. Wall thickness: Minimum 5 IN.
 - 4. Use adjuster rings for top 6 to 18 IN.

5. Compressive strength of concrete: Minimum 3000 PSI.
 6. Base slab: 66 IN diameter minimum, 6 IN thick, reinforced with No.4 bars at 12 IN OC.
- K. Manhole Frame and Cover:
1. Cast or ductile iron, ASTM A48, Class 35 minimum, free of imperfections, with machined horizontal surfaces.
 2. Heavy duty: Minimum total weight 350 LB.
 3. Cover: Perforated, ventilated.
 4. Clear opening: Minimum 24 IN.
 5. Marking on cover: "STORM."
- L. Manhole Steps:
1. Copolymer polypropylene plastic manhole step.
 - a. ASTM A615.
 - b. 1/2 IN dia., Grade-60 steel reinforcement.
 - c. M.A. Industries, Peachtree, GA, or approved equal.
 2. ASTM C478 (section pertaining to steps).
 3. Copolymer polypropylene: ASTM D4101.
 4. Width of step surface: 12 IN nominal.
 5. End of rung from wall: 5-3/4 IN nominal.
 6. Vertical spacing: 16 IN.
 7. Install steps in manholes and inlets where depth exceeds 4 FT.
 8. Comply with OSHA requirements.
- M. Inlets and Castings: Provide as detailed.
- N. Cap Abandoned Utilities:
1. Cap open ends of abandoned utilities which are indicated to remain in place.
 2. Cap with concrete of 6 IN minimum thickness.
- O. Granular Bedding Material for Non-perforated Plastic Pipe:
1. Free draining sands and gravel or crushed rock.
 - a. Size: No.4 sieve to 100 mesh.
- P. Backfill Material:
1. As approved by Engineer.
 2. Free of rock, cobbles, roots, sod, organic matter, and frozen material.
 3. Moisture content at time of placement:
 - a. 3 PCT plus/minus of optimum moisture content.
 - b. Wet dry material, as required.
 - c. Dry wet material, as required or:
 - d. Furnish off site material at no additional cost to Owner.

PART 3 - EXECUTION

3.1 EXCAVATION, BACKFILL AND COMPACTION

- A. Excavate trenches to depth indicated on plans and necessary to accommodate work.
- B. Keep trenches free of water.
- C. Form bell holes in trench so only barrel of pipe is firmly supported by shaped subgrade.
- D. For concrete pipe, compact backfill under and around pipe up to 24 IN above top of pipe in lifts not exceeding 8 IN loose thickness.
- E. For plastic pipe, compact granular bedding material under and around pipe up to 6 IN above top of pipe.
- F. Compact evenly on both sides of pipe to top of excavation or to a depth such that pipe will not be injured by subsequent compaction used to achieve required density.

- G. Backfill and compact remainder of trench in 8 IN lifts to specified density.
- H. Exercise care in backfilling operations to avoid displacing pipe joints either horizontally or vertically and to avoid breaking pipe.
- I. Do not water flush for consolidation.
- J. Compact trench backfill in areas under paved roads, parking areas, sidewalks and other structures, to minimum 95 PCT of specified density.
- K. In locations where trench is not under paving or structures, compact backfill to minimum 90 PCT of specified density.
- L. Remove materials which cannot be compacted as specified.
- M. Replace with suitable material and compact.

3.2 INSTALLATION OF PIPE

- A. Lay pipelines on uniform grades between inverts.
- B. Locate structures as indicated and construct lines between them.
- C. Lay pipe upgrade beginning at lower end.
- D. Provide proper facilities for lowering pipe into trench.
- E. Do not lay pipe in water.
- F. Do not lay pipe when trench conditions or weather is unsuitable for such work.
- G. Remove sections of pipe already placed found to be out of alignment, defective or damaged.
- H. Relay or replace without additional cost to Owner.
- I. Bedding for Non-plastic Pipe:
 - 1. Lay pipe directly on shaped subgrade.
 - 2. No blocking permitted.
 - 3. Form a continuous bearing with a minimum width of bearing equal to 0.6 of outside diameter of pipe, for full length of pipe, except for portion excavated for joint.
- J. Bedding for Plastic Pipe (PVC and PE):
 - 1. Excavate 6 IN below bottom of pipe.
 - 2. Install granular bedding material below pipe.
 - 3. Backfill with bedding material and compact under and around pipe up to 6 IN above top of pipe.

3.3 DRAINAGE STRUCTURES

- A. Concrete Work:
 - 1. Conform to applicable requirements of State Specifications.
 - 2. Form, size, and brace so finished structures conform to details indicated.
- B. Concrete Manholes:
 - 1. Install precast concrete sections per regulating agency requirements.
 - 2. Form flow channels at invert with concrete.
 - 3. Top of channel to match center of pipe.
 - 4. Place concrete collar around casting frame.
 - 5. Trim pipes flush with inside wall of manhole.
- C. Adjust new and existing rims to finished grade.

3.4 FIELD QUALITY CONTROL

- A. Check each line with a light.
- B. Each line indicate a good light circle throughout its length.

- C. Should these tests indicate line to be defective, remove defective portions and replace.
- D. Retest.

END OF SECTION

SECTION 22 31 16
WATER SOFTENER

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Water Softener, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Water softener.
- B. Contract Closeout Information:
 - 1. Owner instruction report.
 - 2. Operation and Maintenance Data.
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Water Softening System:
 - 1. Vertical pressure type ion exchanger system with regenerating equipment, complete with components required to insure proper operation.
- B. Softener Tank:
 - 1. Welded construction of quality carbon steel with dished heads, equipped with reinforced openings for piping connections.
 - 2. Provide 6 x 4 IN hand hole at top and bottom and tank supports of structural steel.
 - 3. ASME Code rated at 150 PSI working pressure.
 - 4. Provide with earthquake resistant structural legs with bolt downs.
- C. Internal Distribution:
 - 1. Design underdrain system to uniformly collect softened water as well as distribute backwash laterally across entire bed.
 - 2. Header-lateral construction with minimum of 2 plastic strainers per 1 SQFT of bed area.
 - 3. Furnish gravel sub-fill only, not extending above strainers.
- D. Upper Distribution System:
 - 1. Header-lateral manifold type arranged for uniform distribution of both brine solution and raw waste, as well as collection of backwash.
 - 2. Construct both upper and lower distributors of an approved non-corrosive material.
- E. Ion Exchange Resin:
 - 1. High capacity sulfonated polystyrene type requiring no chemicals other than sodium chloride to obtain specified capacity.
- F. Controls:
 - 1. Provide with one automatic pilot valve controller of multi-port design driven by synchronous motor to automatically cycle through regeneration cycle by electrical contact from automatic reset water meter.
 - 2. Timing of each step adjustable.
 - 3. Controller capable of manual operation should electric power fail.
 - 4. Operate valves hydraulically or pneumatically.

5. Water meter:
 - a. Adjustable 115V automatic reset register with 6 IN vertical dial for each softener tank.
 6. Lock-out device to prevent simultaneous regeneration of both tanks.
 7. Aqua-sensor may be used to control regeneration in lieu of reset meter provided above mentioned lock-out is furnished.
 8. Provide pressure gauges with sample cocks on inlet and outlet of each tank.
- G. Regenerating Tank:
1. Rigid, molded polyethylene, FRP or welded steel with flat bottom with bitumastic coating inside and rust inhibiting primer on exterior.
 2. Fresh make-up water shall flow downward through solid salt controlled by float valve in salt storage tank.
 3. Filter brine through 5 IN layer of graded gravel and collect by suitable collector.
 4. Provide automatic valve to control amount of brine draw.
 5. Furnish with 6 IN support legs.
 6. Provide necessary valves, educator and piping.
 7. Provide with earthquake resistant structural legs with bolt downs.

2.2 TEST KIT

- A. Provide water testing kit to make chemical tests necessary for controlling operation and adjustments of brine dosage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install complete system with piping, valves and wiring.

3.2 START-UP

- A. Provide services of competent supervising engineer from water softener manufacturer to inspect completed installation, start water softening system and instruct operators in proper operation and maintenance of equipment.

END OF SECTION

SECTION 22 33 00
DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Domestic Water Heaters, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Factory testing: Subject tank and elements to hydrostatic test pressure, 150 PCT in excess of working pressure. Certify that components are free of leaks.
- B. Manufacturing standard: ASME Pressure Vessel Code.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Water heaters.
- B. Contract Closeout Information:
 - 1. Owner instruction report.
 - 2. Operation and Maintenance Data.
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Gas Fired Storage Water Heater:
 - 1. Base:
 - a. Lochinvar.
 - 2. Optional:
 - a. AO Smith Water Products
- B. Temperature/Pressure Relief Valves.
 - 1. Base:
 - a. Watts.
 - 2. Optional:
 - a. A W Cash.
 - b. Wilkins.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS - GENERAL

- A. High temperature limits shall prevent delivery of water that is hotter than that selected for delivery from heater.
- B. Concrete linings shall comply with MIL-T-12295.
- C. Unless indicated otherwise, water pressure drop through heater shall not exceed 10 PSI.

2.3 GAS-FIRED STORAGE WATER HEATER

- A. Gas Fired Storage Water Heater:
 - 1. Factory-assembled, packaged commercial water heater with storage tank, heater section, controls, and other components as indicated.

2. Completely factory assemble water heater so that installation involves only setting, leveling, anchoring, and connection of piping and electrical services.
 3. Designed for potable water service.
 4. UL listed and AGA certified.
 5. Factory fabricated steel supports.
 6. Provide manufacturer's standard enamel finish.
- B. Scheduled Information:
1. Entering water temperature.
 2. Leaving water temperature.
 3. Recovery capacity.
 4. Gas pressure.
 5. Power:
 6. Storage tank capacity.
- C. Storage Tank:
1. Labeled ASME Code construction with minimum working pressure of 150 PSIG.
 2. Vertical, floor mounted.
 3. Provide two 4 IN handhole cleanouts.
 4. Steel outer jacket with undercoat and baked enamel finish.
 5. Glass lined steel tank with anode rods.
 6. Insulation: Minimum 1-1/2 IN thick fiberglass, minimum.
 7. Brass drain valve.
- D. Atmospheric Burner Heater Section:
1. Removable.
 2. Natural gas.
 3. Electronic, intermittent ignition.
 4. Gas pressure regulator.
 5. Flame inspection port.
- E. Controls:
1. Control leaving water temperature within 5 DEGF of selected temperature.
 2. Adjustable leaving water temperature range: 110-180 DEGF.
 3. High-temperature limit with adjustable set point.
 4. Low-water cutoff.
 5. Upper and lower thermostats.
- F. Other Components:
1. Temperature/pressure relief valve.
 2. Temperature gauge.
 3. Barometric draft regulator.

2.4 TEMPERATURE/PRESSURE RELIEF VALVES

- A. Temperature/Pressure Relief Valves.
1. AGA and ASME-approved, tight-shutoff, self-closing, bronze-bodied.
 2. Threaded inlet and outlet.
 3. Test lever.
 4. Capacity: Same power as water heater. See schedule.
 5. Relief setting: 210 DEGF/150 PSIG unless otherwise required by code.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install units in accordance with manufacturer's instructions.
- B. Install units to allow complete access for servicing including removal of heater sections.

C. Set thermostat so heater will deliver scheduled leaving water temperature.

3.2 GAS-FIRED STORAGE WATER HEATERS

A. Provide piping, fittings, and valving between heater and storage tank as recommended by manufacturer.

1. Provide drain valve to completely drain water from heater and storage tank.

B. Insulate storage tank: See Section 20 07 00.

C. Extend gas regulator relief to outside.

3.3 PARALLEL PIPING MANIFOLD

A. Pipe groups of heaters serving the same system in parallel:

1. Provide equal-distance water-piping manifolds so that pressure drops through each heater branch are identical.

a. Equal-distance manifolds:

1) Cold-water manifold: Developed distances are equal between each heater's cold-water inlet and common tee that splits cold-water flow to heaters.

2) Hot-water manifold: Developed distances are equal between each heater's hot-water outlet and common tee that combines the hot-water flow from heaters.

3) Hot-water recirculation manifold: Developed distances are equal between each heater's cold-water inlet and common tee that splits recirculation-water flow to heaters.

b. Equal developed distances include equal quantities of fittings and valves.

c. Connect heaters' inlets and outlets to straight-through ports of common tees. Tees' branch ports are the common ports.

END OF SECTION

SECTION 22 42 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Plumbing Fixtures, as indicated, in accordance with provisions of Contract Documents.
- B. Definitions:
 - 1. Aerator: Device that mixes room air with faucet's water stream.
 - 2. Ledge mounted faucet: Faucet with body mounted on top of faucet ledge and covered by faucet housing or single escutcheon.
 - 3. Bottom-mounted faucet: Faucet with body mounted beneath faucet ledge; each penetration is covered by single escutcheon.
 - 4. Semi-cast: Fittings, return bends, and nuts are cast brass. Waste arms and wall bends are tubular.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manual Valve Standards:
 - 1. See Section 20 05 23, for valves labeled "V-__".
- B. Design and Installation Standards:
 - 1. ANSI Z358.1: Standard for Emergency Eyewash and Shower Equipment.
 - 2. ASSE 1016: Individual Thermostatic Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings.
 - 3. ASSE 1017: Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
 - 4. NSF standard: Comply with NSF 61: "Drinking Water System Components-Health Effects", for fixture materials that will be in contact with potable water.
- C. Accessibility Manufacturing and Installation Standards:
 - 1. Americans with Disabilities Act (Public Law 101-336).
 - 2. ANSI-A117.1, current edition.
 - 3. Local authorities.
 - 4. State authorities.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Assemble submittals by mark number. Include sufficient information to verify compliance with descriptions.
 - 2. Where model numbers differ from descriptions, submit to meet description requirements:
 - a. Hose bibbs.
 - b. Hose reels.
 - c. Interceptors.
 - d. Lavatories.
 - e. Mixing valves.
 - f. Sinks.
 - g. Water closets.
 - h. Undersink protective covers.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Two Handled Faucets:
 - 1. Base:
 - a. Chicago Faucet.
 - 2. Optional:
 - a. T&S Brass & Bronze Works.
 - b. Delta Commercial.
- B. Flush Valve:
 - 1. Base:
 - a. Sloan Valve.
 - 2. Optional:
 - a. American Standard.
- C. Security, Stainless Steel Plumbing Fixtures:
 - 1. Base:
 - a. Willoughby Industries.
 - 2. Optional:
 - a. Acorn Engineering.
- D. Stainless Steel Plumbing Fixtures:
 - 1. Base:
 - a. Just Sink.
 - 2. Optional:
 - a. Elkay.
 - b. American Standard
- E. Vitreous China Plumbing Fixtures:
 - 1. Base:
 - a. American Standard.
 - 2. Optional:
 - a. Kohler.
- F. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Construct or equip fixtures with air gap or anti-siphon devices to prevent siphoning non-potable water into potable water supply system.
- B. Piping exposed in finished areas including fittings and trim:
 - 1. See Section 22 10 16.
- C. Dimensions:
 - 1. Dimensions are Nominal.
 - 2. Multiple dimensions:
 - a. First dimension: Side-to-side.
 - b. Second dimension: Front-to-back.
 - c. Third dimension: Top-to-bottom.
- D. Manufacture accessible fixture assemblies to meet requirements of accessibility standards.
- E. Faucets - General:
 - 1. Following general conditions apply unless detailed otherwise in specific descriptions:
 - a. Renewable cartridges with integral seats (or renewable seats and stems).
 - b. Materials:
 - 1) Brass, bronze, copper, stainless steel, ceramic.
 - 2) Plastic components are not acceptable.
 - c. Finish:

- 1) Chrome.
 - d. Gooseneck spouts:
 - 1) Discharge at least 5 IN above rim of fixture.
 - e. Electric, sensor-operated faucets:
 - 1) Mount transformer and control panel in concealed but accessible location.
 - 2) Coordinate with Electrical and Casework contractors.
 - f. If mixing valve is not included in faucet description, provide a tempering, under-counter mixing valve. Mechanical mixing valves shall not be used.
 - g. Comply with NSF 61- "Drinking Water System Components – Health Effects" for fixture materials that will be in contact with potable water.
2. Metering valve faucets:
- a. Adjustable run time.
 - b. Self-closing.
- F. Flow Control Devices - General:
- 1. Provide flow control devices with indicated maximum flow rates on listed fixtures:
 - a. Private lavatory: 1.5 GPM.
 - 1) Private lavatories shall be considered those used in patient rooms.
 - b. Public lavatory: 0.5 GPM
 - 1) All locations shall be considered public, except as specifically identified above for private.
 - c. Sinks: 1.5 GPM at 60 PSI.
 - 2. Material: Brass.
 - 3. Finish: Chrome.
 - 4. Accomplish controlled flow without aeration of water stream. Aerators are not acceptable unless specifically identified in the faucet description.
 - 5. Flow control devices shall be disinfectable.
 - 6. Comply with NSF 61- "Drinking Water System Components – Health Effects" for fixture materials that will be in contact with potable water.
- G. Lavatory Fixtures - General:
- 1. Following general conditions apply unless detailed otherwise in specific descriptions:
 - a. Vitreous china and enameled, cast-iron fixtures:
 - 1) Color: White.
 - 2) Overflows: Integral.
 - b. Stainless steel fixtures:
 - 1) Finish: Softsatin.
 - 2) Type: 304 (18-8).
 - 3) Thickness: 14 GA.
 - 4) Sound deadening that covers complete underside of bowl.
 - c. Provide integral faucet ledge with holes:
 - 1) Coordinate hole quantities, locations, and centerings with faucet types indicated in fixture descriptions.
 - 2) Provide exact number of holes necessary.
 - a) Use of faucet hole covers is not acceptable.
- H. Mixing Valves - General:
- 1. Following general conditions apply unless detailed otherwise in specific descriptions:
 - a. Materials:
 - 1) Brass, bronze, copper, stainless steel, ceramic.
 - 2) Thermostatic mixing valves:
 - a) Thermostat may contain plastic parts.
 - 3) Escutcheon may be pot metal.
 - b. Finish of exposed surfaces:
 - 1) Chrome.
 - c. Hot/cold color coding.
 - d. Coordinate number of ports with trim indicated in fixture descriptions.

- 1) Four-port valves:
 - a) If diverter spout is indicated in fixture description, provide built in choke.
 - b) If external diverter valve is indicated in fixture description, provide without choke.
- e. Comply with NSF 61- "Drinking Water System Components – Health Effects" for fixture materials that will be in contact with potable water.
- f. Tempering Type Mixing Valve:
 - 1) ASSE 1016 Type: T/P.
 - 2) Integral checks and service stops on inlets.
 - 3) Inlet screens: stainless steel.
 - 4) Adjustment: adjustable locking type.
 - 5) Connections:
 - a) 3/8 IN.
 - 6) Example:
 - a) Powers model e480.
- g. Pressure Balanced Mixing Valves:
 - 1) Renewable stainless steel piston with brass seat.
 - 2) Integral checks and service stops on inlets.
 - 3) Temperature control with built-in shut off; opens from cold to hot.
 - 4) Single lever handle.
 - 5) Adjustable, temperature-limit stops.
 - 6) "OFF-COLD-HOT" marking in block type letters minimum 7/32 IN high.
- h. Thermostatic Mixing Valves:
 - 1) ASSE 1017 compliant.
 - 2) Renewable thermostatic and pressure-balance elements.
 - 3) Compensates for changes in both temperature and pressure.
 - 4) Integral checks and service stops.
 - 5) Temperature control with built-in shut off; opens from cold to hot.
 - 6) Single lever handle.
 - 7) Adjustable, temperature-limit stops.
 - 8) "OFF-COLD-HOT" marking in block type letters minimum 7/32 IN high.
2. Mixing Valve Trim - General:
 - a. Cabinets:
 - 1) Stainless steel construction.
 - 2) Hinged doors:
 - a) Removable when in the open position.
 - b) Hinge on side.
 - 3) Size cabinets to hold valve and accessories as required in each description.
 - b. Thermometers:
 - 1) 3-1/2 IN dial.
 - 2) Hermetically sealed.
 - 3) Bimetal element.
 - 4) Range: Minus 0 to 140 DEGF.
 - 5) Construction: Welded stainless steel.
 - 6) White-faced, three-color dial.
 - c. Vacuum breakers and valves:
 - 1) See "Faucets, general" in Article 2.01.
3. Semi-cast P-traps and Continuous Wastes:
 - a. P-trap:
 - 1) Semi-cast:
 - 2) 1-1/4 or 1-1/2 IN NPS cast brass return bend with clean out.
 - 3) 17 GA x 1-1/4 or 1-1/2 IN OD copper tube tailpiece.
 - 4) Nuts: Cast brass.
 - b. Continuous Waste:
 - 1) Semi-cast:
 - 2) 1-1/2 IN NPS cast brass tee.

- 3) 17 GA x 1-1/2 IN OD copper tube tailpieces.
 - 4) Nuts:
 - a) Cast brass.
- I. Sink Fixtures - General:
- 1. Following general conditions apply unless detailed otherwise in specific descriptions:
 - a. Vitreous china: White.
 - b. Stainless steel:
 - 1) Finish: Softsatin.
 - 2) Type: 302 (18-8) or 304 (18-8).
 - 3) Sound deadening that covers complete undersides of each bowl.
 - 4) Thickness:
 - a) Sink depth less than or equal to 10 IN: 18 GA.
 - b) Sink depth greater than 10 IN: 16 GA.
 - c. Molded stone and terrazzo:
 - 1) Marble chips in reinforced Portland cement.
 - a) 7-day compressive strength:
 - (1) 3000 PSI.
 - b) Exposed surfaces:
 - (1) Ground smooth, grouted and sealed to resist staining.
 - 2) Drain body opening: Integrally cast.
 - 3) Color:
 - a) As selected from manufacturer's standard line by Architect.
 - d. Enameled cast-iron:
 - 1) Color: White.
 - e. Countertop sinks:
 - 1) Self-rimming.
 - f. Provide integral faucet ledge with holes:
 - 1) Coordinate hole quantities, locations, and centerings with the following:
 - a) Faucets and trim indicated in fixture descriptions.
 - b) Hot-water dispensers.
 - c) High-purity water faucets.
 - 2) Provide exact number of holes necessary.
 - a) Use of faucet hole covers is not acceptable.

2.3 FIXTURE CARRIERS

- A. Fixture Carriers:
- 1. Application:
 - a. This paragraph describes carriers for wall hung valves and wall hung fixtures except water closets.
 - b. See Water Closet article for closet carriers.
 - 2. Carriers consist of uprights, floor anchors, and fixture supports:
 - a. Fixture-support types are concealed-arm, exposed-arm, hanger-plate, and clinical-service-sink.
 - b. Include associated hardware.
 - 3. Materials:
 - a. Coated cast iron.
 - b. Steel.
 - 4. Weight of construction: Institutional.
 - 5. Uprights: Rectangular structural steel.
 - 6. Floor anchors:
 - a. Non-adjustable cast-iron floor anchors bolted to uprights; or steel-plate floor anchors integrally welded to uprights.
 - b. 4-hole anchoring to floor.
 - 7. Concealed-arm fixture supports:
 - a. Header couplings:

- 1) Vertically adjustable with horizontally adjustable cross tie.
 - 2) Integral pipe sleeves.
 - b. Secure arms to pipe sleeves with threaded or set-screw connections.
 - c. Hardware for vitreous china fixtures:
 - 1) Leveling screws for four corners of fixture.
 - 2) Non-slip devices to lock fixture into place on arms.
 - d. Hardware for cast-iron fixtures:
 - 1) Threaded eye bolts with leveling hardware.
 - e. For flat-slab fixtures requiring set out from wall, provide 2 IN chromed wall escutcheons.
- 8. Exposed-arm fixture supports:
 - a. Header couplings: Vertically adjustable with horizontally adjustable cross tie.
 - b. Coated with white acid-resistant enamel.
 - c. Hardware:
 - 1) Leveling screws for front two corners of fixture.
 - 2) Toggle bolts to lock fixture into place on arms.
- 9. Hanger-plate fixture supports:
 - a. Bolted attachment to uprights.
 - b. Drilled/slotted to match fixture.
 - c. Hardware for attaching fixture.
 - d. Provide in adequate size and quantity to anchor fixture at every anchoring point on the fixture.
- 10. Clinical-service-sink fixture supports:
 - a. Two heavy-duty hanger plates, one with cast-iron waste-outlet coupling.
 - b. Hardware for attaching fixture and waste piping.
- 11. Match lengths, mounting locations, and sizes to fixture requirements.

2.4 HOSE BIBBS

- A. Hose Bibb – General:
 - 1. Following general conditions apply unless detailed otherwise in specific descriptions:
 - a. Material: Brass.
 - b. Finish: As indicated.
- B. HB-1, Rough Brass Sill Faucet with Vacuum Breaker:
 - 1. Fixture:
 - a. 3/4 IN IPS female flanged inlet, key or screwdriver controlled slot, chrome plated, vacuum breaker, 3/4 IN garden hose outlet.
 - 1) T&S Brass B-0737-RGH.

2.5 HOSE REELS

- A. HRA-1, Wall mounted Hose Reel Assembly:
 - 1. Fixture:
 - a. 8" wall mounted mixing faucet with polished chrome plated brass body, compression cartridges with spring checks, lever handles, 1/2" NPT female inlets, 16" riser, control valve, 40 inches riser, wall bracket, continuous pressure vacuum breaker, 36 inches flexible water hose connector with stainless steel quick disconnect, enclosed coated hose reel with 3/8" x 30 FT heavy-duty non-marking hose, ratcheting system, high flow spray valve with swivel, multi-fit bracket and adjustable hose bumper. Certified to ASSE 1056.
 - 1) T&S Brass B-1433.

2.6 LAVATORIES

- A. L-1, Lavatory, Wall Hung, Accessible:
 - 1. Fixture:
 - a. 20-1/2 IN x 18-1/4 IN, wall hung, vitreous china, backsplash, concealed arm support.
 - 1) American Standard Plumbing Lucerne 0356.015.

- b. Fixture carrier: Concealed-arm type.
 - 2. Faucet:
 - a. Bottom mounted, 8 IN spread, two 4 IN wrist blades 5 IN reach fixed gooseneck.
 - 1) Chicago Faucets 1100-G2AE35VP317AB.
 - 2) Flow rate: 1.5 GPM
 - 3. Trim:
 - a. Supplies: Chrome, 3/8 IN OD, soft copper tube, loose key stops, escutcheons.
 - b. Grid drain: Chrome, 1-1/4 IN cast brass with 17 GA x 1-1/4 IN OD copper tube tailpiece.
 - c. P-trap: Chrome, 1-1/4 IN or D1-1/2 IN semi-cast with cleanout, with 17 GA x 1-1/4 IN or 1 17 GA x 1-1/2 IN OD copper tube trap arm.
- B. L-2, Lavatory, Wall Hung, Accessible:
 - 1. Fixture:
 - a. 20 x 18 IN, wall hung, 18 gauge type 304 stainless steel, backsplash.
 - 1) Just A-33338.
 - b. Fixture carrier: Stainless steel wall clip and integral flange for wall mounting.
 - 2. Faucet:
 - a. Ledge mounted, 4 IN center set, two 4 IN wrist blades, 5 IN reach fixed gooseneck.
 - 1) Chicago Faucet 894-E35-317ABCP.
 - 2) Flow rate: 1.5 GPM
 - 3. Trim:
 - a. Supplies: Chrome, 3/8 IN OD, soft copper tube, loose key stops, escutcheons.
 - b. Grid drain: Chrome, 1-1/4 IN cast brass with 17 GA x 1-1/4 IN OD copper tube tailpiece.
 - c. P-trap: Chrome, 1-1/4 IN or 1-1/2 IN semi-cast with cleanout, with 17 GA x 1-1/4 IN or 17 GA x 1-1/2 IN OD copper tube trap arm.

2.7 MIXING VALVES

- A. "TMV-1", exposed valve with cabinet:
 - 1. Mixing Valve:
 - a. Thermostatic, exposed valve:
 - 1) Leonard TM-186-820B-LF.
 - b. Operating parameters:
 - 1) Flow control range: 1 GPM to 40 GPM.
 - 2) Output temperature range: 65-115 DEGF.
 - 3) HW supply temperature: 115 DEGF.
 - 4) Supply pressure range: 40-80 PSIG.
 - 5) Pressure drop: 10 PSI at 40 GPM.
 - 2. Mixing-valve trim:
 - a. Volume-control and shut-off valve: In-line, exposed.
 - b. Thermometer: Exposed.
 - 3. Provide wall mounting bracket.
- B. "TMV-2", exposed valve with cabinet:
 - 1. Mixing Valve:
 - a. Thermostatic, exposed valve:
 - 1) Leonard TM-186-520B-LF.
 - b. Operating parameters:
 - 1) Flow control range: 1 GPM to 29 GPM.
 - 2) Output temperature range: 65-115 DEGF.
 - 3) HW supply temperature: 115 DEGF.
 - 4) Supply pressure range: 40-80 PSIG.
 - 5) Pressure drop: 10 PSI at 29 GPM.
 - 2. Mixing-valve trim:
 - a. Volume-control and shut-off valve: In-line, exposed.
 - b. Thermometer: Exposed.

3. Provide wall mounting bracket.

2.8 SINKS

- A. See Article 2.01 MATERIALS – GENERAL
- B. SK-1, Single bowl, wrist blades and gooseneck, Accessible:
 1. Fixture:
 - a. 17-1/2 x 19 x 6.5 IN, Countertop, stainless steel, single-bowl, 3-1/2 IN outlet.
 - 1) Just sink SL-ADA-17519-A-GR.
 2. Faucet:
 - a. Ledge-mounted, 8 IN spread, two 4 IN wrist blades, 8 IN reach fixed gooseneck.
 - 1) Chicago Faucet 1100-GN8AE35-317AB.
 3. Trim:
 - a. Supplies: Chrome, 3/8 IN OD, soft copper tube, loose key stops, escutcheons.
 - b. Chrome plated brass grid drain for 3-1/2 IN outlet with 17 GA x 1-1/2 IN OD copper tube tailpiece.
 - c. P-trap: Chrome, 1-1/2 IN semi-cast with cleanout, with 17 GA x 1-1/2 IN OD copper tube trap arm.

2.9 SINKS, MOP

- A. See Article 2.01 MATERIALS – GENERAL
- B. MS-1:
 1. Fixture:
 - a. One-piece, 14 gauge type 304 stainless steel, floor-mounted basin, DN80 3 IN brass or stainless steel drain body, removable strainer, vinyl or stainless steel wall guard on side wall.
 - 1) Willoughby Industries WMS 32326. 32 IN X 32 IN X 6 IN deep.
 2. Faucet:
 - a. Wall mounted, combination service-sink fitting, two handles, fixed spout, integral vacuum breaker, 3/4 IN hose threads, adjustable wall brace, pail hook, flanged female adjustable arms with integral stops.
 - 1) Speakman SC-5812.

2.10 SPARE PARTS

- A. Provide two of each type of renewable cartridge, stem, and seat.

2.11 WATER CLOSETS

- A. See Article 2.01 MATERIALS - GENERAL
- B. Fixture carriers for wall hung water closets:
 1. Carriers consist of drainage fitting, faceplate, foot supports, closet coupling, and associated hardware.
 2. Style:
 - a. Adjustable:
 - 1) Capable of being installed to accept accessible and standard-height closets at each carrier by adjusting only the face-plate position.
 - b. Floor anchored.
 3. Material: Coated cast iron.
 4. Weight of construction: Institutional.
 5. Extension:
 - a. When distance between carrier and closet exceeds manufacturer's recommended distance, provide longer closet coupling, longer fixture studs, and additional foot supports.
 6. Provide anchor foot assembly for single carriers.
 7. Closet couplings: Cast iron.
 8. Hardware:

- a. Provide hardware to assemble carrier and to mount fixture to carrier.
 - b. Match hardware to fixture requirements.
 - 9. Finish on exposed parts: Chrome unless indicated otherwise in fixture description.
- C. Water-closet fixtures, general (Following general conditions apply unless detailed otherwise in specific descriptions):
 - 1. Wall hung closets: Provide fixture carriers.
 - 2. Close-coupled tanks:
 - a. Provide closet supplies: 3/8 IN OD, chromed, soft copper tube, loose key stop, escutcheon.
 - b. Provide anti-siphon, brass ballcocks.
 - c. Flush handles: Chrome.
 - 3. Floor-mounted closets: Provide bolt caps with retainers.
 - 4. Bowls: Elongated.
 - 5. Color: White.
 - 6. Fixture material: Vitreous china.
 - 7. Spud material: Brass.
 - 8. Spud size: DN40 1-1/2 IN.
 - 9. Nominal flush volume: 6 Liters per flush 1.6 GPF.
- D. Water-closet Seats, General:
 - 1. Solid plastic.
 - 2. Color: White.
 - 3. Resistant to scratching, stains, chemicals, and cleaning agents.
 - 4. Elongated-bowl style.
 - 5. Stainless steel hinge pins, bolts, and hardware.
 - 6. Check hinges.
- E. WC-1, Public wall hung, accessible:
 - 1. Fixture:
 - a. Wall hung, siphon jet, top spud.
 - 1) American Standard Plumbing AFWall 2294.011EC.
 - 2. Flushometer valve:
 - a. Chrome finished brass, 12 IN tall, lever-operated, diaphragm type, integral vacuum breaker, flush connection and spud coupling for 1-1/2 IN top spud, 1 IN screwdriver back-check angle stop. Match flush volume to fixture requirements.
 - 1) Sloan Royal 111.
 - 2) Flow rate: 1.6 GPF
 - 3. Seat:
 - a. Open-front seat without cover.
- F. WC-2, security water closet, accessible:
 - 1. Fixture:
 - a. Floor mounted, combination water closet and lavatory.
 - 1) Willoughby Industries 3696 Series.
 - 2) Flow rate: 1.28 GPF
 - 3) See plumbing plan and choose for right hand or left hand configuration.
 - 2. Seat:
 - a. Elongated stainless steel toilet bowl with contoured seat.

2.12 UNDERSINK PROTECTIVE COVERS

- A. Undersink protective covers, vinyl:
 - 1. Material: Molded closed cell vinyl.
 - 2. Minimum thermal conductivity at mean temperature:
 - a. $k \leq 1.17, 75 \text{ DEG F}$.
 - 3. Attachment method: Reusable snap clips or seamless pre-wrapped.
 - 4. Service: Covers to cleanouts and valves to be removable without damage to clips.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install fixtures in first class manner with proper connections to water, drainage and vent systems.
- B. Install fixtures at manufacturer's suggested height unless noted otherwise.
- C. Install fixtures in accordance with manufacturers' instructions.
- D. See that proper grounds are set to form a secure base and an absolutely rigid setting for each fixture.
- E. Provide guards and boxing as may be required to protect fixtures against damage from operations of other trades.
- F. Where pipes penetrate walls, floors, or ceilings, conceal penetrations with chrome escutcheons or stainless steel plates.
- G. Connect exposed traps and supply pipes for fixtures and equipment to rough piping systems at wall, unless otherwise specified.
- H. Where plumbing fixtures abut to walls, floors, and countertops, seal with silicone sealant: See Section 07 92 16.
- I. On flushometer valves with pipe supports, mount pipe support to wall two-thirds of flush-valve height above fixture spud.
- J. Provide undersink protective covers on water supply and waste lines exposed beneath accessible fixtures.

3.2 FIXTURE CARRIER LEVELING

- A. Level fixture carriers by shimming floor anchors with steel washers of varying thicknesses.

3.3 ACCESSIBLE FIXTURES

- A. Install accessible fixture assemblies to meet requirements of accessibility installing standards

3.4 INTERCEPTORS

- A. Install interceptors with manufacturer's recommended clearances for cleaning access.

3.5 WATER CLOSET FIXTURE CARRIERS

- A. Install each carrier to accept accessible and standard-height water-closet installations so that future change from one height to the other can be accomplished by adjusting only the position of the face plate.

3.6 ADJUST AND CLEAN

- A. Valves with adjustable temperature-limit stop: Adjust stop to deliver maximum 110 DEGF.
- B. Remove dirt from fixtures, fittings and traps.
- C. Secure escutcheons against wall.

END OF SECTION



DIVISION 23

HEATING, VENTILATING, AND AIR
CONDITIONING (HVAC)



SECTION 23 08 00

COMMISSIONING OF MECHANICAL SYSTEMS

1.1 COMMISSIONING AUTHORITY

The Commissioning Authority (CxA) has been contracted directly with the Architect for this project. Commissioning involves all parties to the design and construction process, including the Division 23 Mechanical Contractor, and all Subcontractors within Division 23 as required.

1.2 CONTRACTOR RESPONSIBILITY

The Division 23 Mechanical Contractor's responsibilities are defined in Section 01 91 00 of the Specifications. These responsibilities apply to all Subcontractors and vendors within Division 23. Each Contractor and vendor shall review Section 01 91 00, and their proposals shall include for carrying out the work described, as it applies to each Section within the Division 23 specifications, individually and collectively.

SECTION 23 11 23
NATURAL GAS PIPING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Natural Gas Piping System, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Piping standards: See Section 20 11 00.
- B. Manual valve standards: See Section 20 05 23 (for valves labeled "V-__").

1.3 SUBMITTALS

- A. Product Data:
 - 1. Pressure regulators.
- B. Contract Closeout Information:
 - 1. Test reports.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Pipe wrapping:
 - 1. Base:
 - a. Republic.
- B. Pipe field wrap:
 - 1. Base:
 - a. Republic.
- C. Gas Regulators:
 - 1. Base:
 - a. American Meter Company.
 - 2. Optional:
 - a. Maxitrol Company.
 - b. Fisher Regulators.
- D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. NATURAL GAS PIPING
 - 1. Gas piping above ground:
 - a. Black steel.
 - b. 2 IN and smaller: welded joints, with socket welding fittings.
 - c. 2 IN and smaller, exposed in mechanical rooms or outdoors: Black malleable threaded fittings.
 - d. 2 1/2 and larger: Welded joints, with butt welding fittings.
 - 2. Pipe wrapping for black steel piping: Factory installed, Republic X-Tru-Coat.
 - 3. Pipe field wrap for black steel piping: Republic X-Tru-Tape, 1 IN and less wide.
- B. VALVES
 - 1. Ball valves (2 IN and smaller): V-16.

2. Plug valves:
 - a. 2 IN and smaller: V-60.
 - b. 2-1/2 IN and larger: V-41.
 3. Butterfly valves (2 IN and smaller): V-57.
- C. GAS PRESSURE REGULATORS
1. Provide gas pressure regulators where the gas supply pressure is higher than the pressure at which the gas utilization equipment is designed to operate.
 2. Gas pressure regulators shall be designed for a maximum pressure drop of 0.25 psig at maximum flow. Provide at service entrance or as shown on the drawings.
 3. Equipment capacities: As scheduled.

PART 3 - EXECUTION

3.1 NATURAL GAS PIPING INSTALLATION

- A. Install in accordance with codes, local Gas Company regulations and ordinances.
- B. Contact the local gas utility company to cap the existing natural gas service. Remove old piping from building to the main.
- C. Provide new service to buildings.
- D. Provide new service regulator and meter.
- E. Provide gas pressure regulators at every gas burning appliance where inlet pressure is greater than allowable.
- F. Vent regulators in accordance with NFPA 54, International Fuel Gas Code, and Authority Having Jurisdiction. For regulators installed inside the building, manhole, or in an enclosed space extend vent piping full size from the regulator to the exterior of the building or provide approved vent limiting devices in accordance with ANSI Z21.80 and CSA 6.22.
- G. For regulators installed outside the building provide a full size vent extension that extends a minimum of 12" above snow level and then curves down to prevent the accumulation of moisture in the vent outlet and terminate with screened weather cap.
- H. All piping running up on the outside of walls shall be secured by pipe standoffs.
- I. Gas piping located on the roof shall be mounted on pipe stands and spaced according to the manufacturer's recommendations.
- J. Gas piping outdoor and located on the roof shall be painted with corrosion resistant painting for natural gas, black steel pipe outdoor. Provide at least 3 coats.
- K. Provide shut-off valves, dirt leg, and unions on all appliances and equipment.
- L. Provide shut-off valves before every gas pressure regulator.
- M. Where flexible connections are required, they shall be CSA approved.
- N. Provide an approved permanent tag or label that identifies the pressure upstream of all gas regulators.

3.2 TESTING

- A. Before piping is covered, test system in presence of Owners Representative.
- B. Perform a 100 PSI air test for 6 hours without pressure drop.

END OF SECTION

SECTION 23 21 13
HYDRONIC PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Hydronic Piping Systems, as indicated, in accordance with provisions of Contract Documents.
- B. Systems and Products Included:
 - 1. Systems:
 - a. Condensate and cooling coil drain piping.
 - 2. Products:
- C. Work installed but not furnished:
 - 1. Automatic valves: Furnished in Section 25 50 00.
 - a. Provide fittings and reducers required for installation of automatic valves.
 - 2. Electronic flow measurement devices: Furnished in Section 25 50 00.
- D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Outside Utilities: Section 20 11 10.
- B. Piping standards: Section 20 11 00.
- C. Manual valve standards: Section 20 05 23 (for valves with "V" prefix).

1.3 SUBMITTALS

- A. Product Data:
 - 1. Pressure and temperature test stations, combination.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data for items requiring operational instructions or periodic maintenance such as: air vents, constant flow control valves, pressure relief valves, triple duty valves, water flow measurement devices, water treatment system, glycol feed systems, etc.
 - 2. Field test reports.

PART 2 - PRODUCTS

2.1 MATERIALS

2.2 VIBRATION ISOLATION

- A. Vibration Isolation: Section 20 05 50.

PART 3 - EXECUTION

3.1 GENERAL

- A. Connect equipment.

3.2 CONDENSATE DRAINS

- A. Pipe condensate drains for all equipment (i.e. air handling units, fan coil units, kitchen condensing units, etc.) and route to nearest floor drain, mop sink, etc. Coordinate final location with architect.

3.3 VIBRATION ISOLATION

A. Vibration Isolation: Section 20 05 50.

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Refrigerant Piping System, as indicated, in accordance with provisions of Contract Documents.
- B. Systems Include:
 - 1. Refrigeration piping.
 - 2. Refrigeration valves.
 - 3. Refrigeration specialties.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Piping standards: See Section 20 11 00.
- B. Valve standards: See Section 20 05 23.

1.3 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Test reports.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Refrigerant piping specialties:
 - 1. Base:
 - a. Sporlan Valve.
- B. Expansion valves:
 - 1. Base:
 - a. Sporlan Valve.
 - b. Alcoa Building Products.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Pipe And Fittings
 - 1. Refrigerant piping: Copper, dehydrated, with high-temperature soldered joints and wrought copper (400 PSIG) fittings.
 - a. For underground use: Type K.
 - b. For above ground use: Type L.
 - 2. For field assembled units, size refrigeration lines in accordance with manufacturer's published tables using pressure or temperature drops as follows:
 - a. Suction lines: 2 DEGF.
 - b. Liquid lines: 1 DEGF or 2 PSI.
 - c. Hot gas lines: 1 DEGF or 3.6 PSI.
 - d. Size discharge and hot gas risers for positive oil return to compressors.
 - 3. Hangers: See Section 20 05 29.
- B. Refrigerant Piping SPECIALTIES
 - 1. Moisture indicator: indicate presence of moisture in system by change of color.
 - a. Install adjacent to filter.

- b. In bypass line use Sporlan SA-12S.
 - 2. Strainers: Design to permit removing screen without removing strainer from piping system.
 - a. Provide with screens of not larger than 80 mesh.
 - b. Provide strainers on liquid line serving each thermostatic expansion valve and in suction line serving each refrigerant compressor not equipped with integral strainer.
 - 3. Oil traps:
 - a. Provide in lines as indicated.
- C. Valves
 - 1. Valves: Bronze.
 - a. In lines 2 IN and smaller: Solder ends.
 - b. In lines 3 IN and over: Four bolt union ends.
 - 2. Shut off valves: Packed type with gas tight cap seal and hard metal seats and shoulders which permit packing stuffing boxes wide open under pressure; or sealed diaphragm type.
 - a. Wheel, globe, angle or "T" handle.
 - 3. Check valves:
 - a. In liquid lines 5/8 IN and smaller: Lift check type.
 - b. In lines 3/4 - 2 IN: Swing check type.
 - c. In lines 3 IN and over: Wafer type swing check with bronze disc.
 - 4. Expansion valves: Sized by manufacturer for refrigerant used.
 - a. Provide one in each circuit with liquid distributor connection immediately after.
 - 5. Vent and test valves: Angle cap type with seal and outlet caps.

PART 3 - EXECUTION

3.1 REFRIGERANT PIPING ASSEMBLY

- A. Install in accordance with Section 20 11 00.
- B. Thoroughly clean piping of dirt and grease on inside with a suitable cleaning solution just before soldering.
- C. Polish end of tube and inside of fitting.
- D. Purge refrigerant piping of air while connections of refrigerant piping are being made.
 - 1. Shut off valves.
 - 2. Connect tank of dry nitrogen to line on back side of valve.
 - 3. Introduce dry nitrogen into line as refrigerant piping joints are successively made up from valve to each condenser.

3.2 TESTING

- A. Test refrigerant piping to hold pressure of twice normal working pressure for period of 72 HRS before refrigerant is added.
- B. Testing pressure shall not exceed maximum rating of weakest component of system.
 - 1. Place an initial charge of Freon in system for detection purposes.
 - 2. Use dry nitrogen gas for pressure testing.
 - 3. Low side to be valved off and tested to 200 PSI.
- C. Check joints with an electronic leak detector.
- D. Cut out joints found to be leaky and replace with new material.

3.3 CLEANING

- A. After complete system is tested, disconnect suction and discharge lines from compressor for cleanup.
- B. Valve or blank off system into three separate systems for purpose of cleanup.
 - 1. Suction side including cooling coils.
 - 2. Discharge side including air cooled condenser.

3. Hot gas reheat side including heating DX coils.
- C. Clean uncontaminated system(s) by evacuation and purging procedures currently recommended by refrigerant and refrigerant equipment manufacturers, and as specified herein, to remove small amounts of air and moisture. Systems containing moderate amounts of air, moisture, contaminated refrigerant or any foreign matter shall be considered contaminated systems.
- D. Restore contaminated system(s) to clean condition including disassembly, component replacement, evacuation, flushing, purging, and re-charging using current refrigerant and refrigeration manufacturer's procedures. Restoring contaminated systems shall be at no additional cost to the Owner.
- E. Notify Engineer for a visual inspection of both cleaning process and completely cleaned system.

3.4 EVACUATION AND DRYING

- A. After tests and cleaning have been completed and system proved tight, charge each circuit with dry clean Freon to approximately 50 PSI of gas pressure.
- B. Evacuate to 100 micron Hg and hold for 48 HRS.
 1. Use laboratory type vacuum pump capable of holding absolute pressure of 50 micron Hg.
- C. Admit another drying charge of Freon and allow 4 to 6 HRS to absorb moisture and install dryer cores.
- D. Use second evacuation to remove Freon and moisture.
- E. After second evacuation, charge system with Freon.
- F. Add refrigerant to system as required after final evacuation.

END OF SECTION

SECTION 23 31 13
AIR DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Air Distribution System, as indicated, in accordance with provisions of Contract Documents.
- B. Systems Included:
 - 1. High and low pressure ductwork, fittings and accessories.
 - 2. Acoustical duct liner.
 - 3. Kitchen exhaust ductwork.
 - 4. Dampers.
 - 5. Fire and smoke dampers.
 - 6. Diffusers, registers and grilles.
 - 7. Air blenders.
 - 8. Louver blank-off plates.
 - 9. Duct access doors.
- C. Work Installed but Not Furnished:
 - 1. Automatic dampers: Section 25 50 00.
 - 2. Airflow measuring stations: Section 25 50 00.
- D. Definitions:
 - 1. Low and high pressure ductwork:
 - a. See Article 2.2 of this section.
 - 2. Gage:
 - a. Steel sheet and wire: U S Standard Gage.
 - b. Aluminum sheet: Browne & Sharpe Gage.
 - c. Steel wire: Washburn and Moen Gage.
 - 3. Concealed insulated surfaces:
 - a. Piping, ductwork and equipment in walls, partitions, floors, pipe chases, pipe shafts, duct shafts and above suspended ceilings.
 - 4. Exposed insulated surfaces:
 - a. Piping, ductwork and equipment located in mechanical rooms, tunnels and rooms without suspended ceilings.
- E. Duct sizes indicated are based upon internal dimensions.
 - 1. Where acoustical liner is applied to interior of a duct, increase size to maintain interior dimensions.
- F. Location of diffusers, registers and grilles are indicated on Architectural Reflected Ceiling Plans.
- G. Dampers:
 - 1. Factory built and assembled.
- H. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE):
 - 1. ASHRAE Handbook - HVAC Systems and Equipment: Current chapter on duct construction.
 - 2. ASHRAE Standard 70-72, Method of Testing for Rating the air flow performance of outlets and inlets.
- B. Air Diffusion Council (ADC):

1. ADC Standard 1062: GRD-84, Test Code for Grilles, Registers and Diffusers.
 2. ADC Test Code FD 72-R1, Flexible Air Duct Test Code.
- C. Air Movement and Control Association International (AMCA):
1. AMCA Standard 210, Test Code for Air Moving Devices.
- D. National Fire Protection Association (NFPA):
1. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems, current edition.
 2. NFPA 96 Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment, current edition.
 3. NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials
- E. Sheet Metal & Air Conditioning Contractors National Association (SMACNA):
1. SMACNA HVAC Duct Construction Standard - Metal and Flexible, Current Edition.
 2. SMACNA Duct Cleanliness for New Construction, Current Edition.
- F. ASTM International (ASTM):
1. ASTM A109 Standard Specification for Steel, Strip Carbon (0.25 Maximum Percent), Cold-Rolled.
 2. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process.
 3. ASTM B23 Standard Specification for White Metal Bearing Alloys (Known Commercially as Babbit Metal).
 4. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 5. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
- G. Underwriters Laboratories (UL):
1. UL 181A Closure Systems for Use with Rigid Air Ducts.
 2. UL 181B Closure Systems for Use with Flexible Air Ducts and Air Connectors.
 3. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials
- H. International Mechanical Code 2012 Edition.
- I. International Energy Conservation Code 2012 Edition.

1.3 SUBMITTALS

- A. Shop Drawings:
1. Ductwork layout at 1/4 IN to 1 FT scale.
 - a. Layout drawings to include sign-off from balancing contractor indicating the contractor has reviewed the documents to ensure volume damper installation is in compliance with the requirements of this section.
 - b. Shop drawings may not be copied, traced, or any other reproduced version of the construction documents.
 - c. Shop drawings should show progress from coordination with other trades, ductwork elevations, fittings, joints, sheet metal gauges, and any other pertinent information related to the layout, installation, or construction of the ductwork.
- B. Product Data:
1. Ductwork and fittings.
 2. Dampers.
 3. Diffusers, registers and grilles.
- C. Contract Closeout Information:
1. Operation and Maintenance Data:
 - a. Including but not limited to fire and smoke dampers, control dampers and combination louvers.
 - b. See Section 01 78 23.

2. Test reports.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. High Pressure Flat Oval and Round Spiral Ductwork:
 1. Base:
 - a. United McGill Airflow Corporation.
 2. Optional:
 - a. Semco Incorporated.
 - b. Sheet Metal Connectors, Inc.
 - c. Eastern Sheet Metal, Inc.
 - d. Spiral Pipe of Texas.
- B. Factory Fabricated Duct Connection Systems:
 1. Base:
 - a. Ductmate Industries.
 2. Optional:
 - a. Nexus.
 - b. Ward Industries, Inc.
- C. Sealants, Mastics and Adhesives:
 1. Base:
 - a. Hardcast.
 2. Optional:
 - a. United McGill Airflow Corporation.
 - b. Foster (Division of HB Fuller).
- D. Turning Vanes:
 1. Base:
 - a. Aerodyne Controls.
 2. Optional:
 - a. Airsan.
 - b. Tuttle & Bailey.
 - c. Titus.
 - d. VentProducts.
- E. Flexible Fan Connections:
 1. Base:
 - a. Ventfabrics.
 2. Optional:
 - a. Duro-Dyne.
 - b. Elgin.
- F. Preinsulated Flexible Duct:
 1. Base:
 - a. Atco.
 2. Optional:
 - a. Flexible Technologies, Thermaflex.
 - b. Hart and Cooley.
 - c. Flexmaster.
- G. Access Doors, Low Pressure:
 1. Base:
 - a. Ruskin Manufacturing.
 2. Optional:
 - a. Air Balance.
 - b. Nailor-Hart Industries, Inc.

- c. Ventfabrics.
 - d. CESCO products.
 - e. Safe-Air of Illinois.
- H. Access Doors, Low and High Pressure:
- 1. Base:
 - a. Ductmate.
 - 2. Optional:
 - a. Ward Industries.
 - b. United McGill Airflow Corporation.
- I. Acoustical Duct Liners:
- 1. Base:
 - a. Knauf Fiber Glass.
 - 2. Optional:
 - a. CertainTeed Insulations.
 - b. Owens-Corning Fiberglass.
 - c. Johns Manville Corporation.
- J. Calcium Silicate Fireproof Board:
- 1. Base:
 - a. Pabco, Division of Fibreboard.
- K. Dampers, Manual, and Backdraft:
- 1. Base:
 - a. Ruskin Manufacturing.
 - 2. Optional:
 - a. Arrow Louvers and Dampers, Inc.
 - b. American Warming & Ventilating.
 - c. Air Balance.
 - d. Cesco Products.
 - e. Greenheck.
- L. Fire and Smoke Dampers:
- 1. Base: Pottorff
- M. Diffusers, Registers and Grilles - Not including laminar flow in ceiling systems and radial throw diffusers:
- 1. Base: Price
- N. Air Blenders:
- 1. Base:
 - 2. Optional:
 - a. Kees.
- O. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Sheet Metal:
- 1. Galvanized steel (G90): ASTM A653/A653M.
 - 2. Black steel: ASTM A109.
 - 3. Stainless steel: ASTM A167.
- B. Duct Sealer:
- 1. NFPA rating of "Non-Combustible".
 - 2. Flame spread rating: 25 or lower, in dry condition.
 - 3. Smoke developed rating: 50 or lower, in dry condition.
 - 4. Resistant to water and water vapors.
 - 5. Pressure rupture rating: 16 IN WG , minimum.

6. Durkee-Atwood Permatite Class I Duct Sealer; Hardcast Iron Grip 601 and Duct Seal 321; or United McGill Sheet Metal Uni-Mastic 181 Duct Sealer and United Duct Sealer.
- C. Solder:
1. Grade-50B per ASTM B23.
- D. Duct Sealing Tape:
1. NFPA rating of "Non-Combustible".
 2. Flame spread rating: 25 or lower, in dry condition.
 3. Smoke developed rating: 50 or lower, in dry condition.
 4. Adhesive: Specifically compounded for maximum adhesion to galvanized and stainless steel.
 5. Listings/Labels: UL 181A or UL 181B.
- E. Duct Liner Adhesive and Mastic:
1. NFPA rating of "Non-Combustible".
 2. Flame spread rating: 25 or lower, in dry condition.
 3. Smoke developed rating: 50 or lower, in dry condition.
 4. Compounded for maximum adhesion to galvanized and stainless steel ductwork.
 5. Listings/labels: UL 181A or UL 181B
- F. RTV Foam:
1. UL listed room temperature vulcanized silicone rubber foam.
- G. Ductwork:
1. Maintain full areas and suitable shapes at every point.
 2. Shapes may be changed to fit unusual space conditions.
 - a. Cross sectional area to be maintained.
 - b. Modifications increasing system pressure drop require Architect approval.
 - c. Modifications increasing aspect ratio beyond 5:1 require Architect approval.
 3. Provide necessary transitions and offsets to complete systems.
 4. Construct systems of G90 galvanized steel.
 5. Ductwork, Low Pressure, Sheet Metal:
 - a. Construct in accordance with SMACNA HVAC Duct Construction Standard per appropriate SMACNA table.
 - 1) Ductwork for systems operating between 2 IN WG and 3 IN WG static pressure, positive or negative:
 - a) Rectangular duct.
 - b) Round spiral seam duct.
 - 2) Ductwork systems operating under 2 IN WG positive or negative:
 - a) Rectangular duct.
 - b) Round duct: spiral or longitudinal seam.
 - b. Low pressure ductwork includes but is not limited to:
 - 1) Supply ductwork on outlet side of single and dual duct air terminal units.
 - 2) Return, relief air, and outside air ductwork.
 - 3) Exhaust air for other exhaust systems operating less than 3 IN WG static pressure, positive or negative.
 - 4) Supply ductwork for constant volume systems without air terminal units.
 - c. Transverse joints, rectangular:
 - 1) Ducts with longest side 36 IN and longer:
 - a) Use factory fabricated flanged duct connection systems (e.g. Ductmate 35/25 slide on systems).
 - b) Non-proprietary SMACNA defined T-22 or T-24 flanged connections
 - c) Seal transverse flanged duct connections with pressure sensitive, high density, closed cell, neoprene or polyurethane tape gasket.
 - 2) Ducts with longest side shorter than 35 IN :
 - a) Flanged duct connection systems as defined above are optional.

- b) Refer to SMACNA HVAC Duct Construction Standard for proper duct construction.
 - d. Longitudinal seam: Use Pittsburgh lock seam only.
 - e. Seal low pressure ducts to Seal Class A requirements.
 - f. Runouts to diffusers, register and grilles:
 - 1) Flexible duct.
 - 2) Provide rigid ductwork where ducts pass through smoke or fire rated walls, floors or ceilings.
 - 3) Maximum flexible duct length: 5 FT.
 - 4) Minimum turning radius:
 - a) As recommended by manufacturer.
 - b) Do not kink, bend or restrict free area of duct.
- 6. Ductwork, Exposed to Weather:
 - a. Construct using flanged duct connection systems.
 - b. Seal flanged ends with pressure sensitive, high density, closed cell, neoprene or polyurethane tape gasket.
 - c. Provide continuous cleat seals on top joints of ducts.
 - d. Supports, pedestals and curbs:
 - 1) See Section 07 76 16.
- 7. Ductwork, High Pressure:
 - a. Construct in accordance with SMACNA HVAC Duct Construction Standard per following:
 - 1) Rectangular duct: Table 1-8, 6 IN 6G static pressure, positive or negative.
 - 2) Round duct: Table 3A & Fig. 3-1, X IN WG static pressure.
 - b. Transverse joints, rectangular:
 - 1) Use factory fabricated flanged duct connection systems (e.g. Ductmate 35/25 slide on systems).
 - 2) Non-proprietary SMACNA defined T-22 or T-24 flanged connections
 - 3) Seal transverse flanged duct connections with pressure sensitive, high density, closed cell, neoprene or polyurethane tape gasket.
 - c. Longitudinal seam: Pittsburgh lock seam.
 - d. High pressure ductwork includes:
 - 1) Supply ductwork from air handling unit discharge to connection with single and dual duct air terminal units.
 - 2) Exhaust or return ductwork for other exhaust systems operating over 3 IN WG static pressure.
 - e. Runouts to air terminal units: Rigid or flexible ductwork.
 - 1) Maximum flexible duct length: 3 FT .
 - 2) Minimum turning radius:
 - a) As recommended by manufacturer. Do not kink, bend or restrict free area of duct as to generate additional pressure drop or noise.
 - 3) Provide rigid ductwork on units located in rated corridors or corridors requiring smoke tight construction, where ducts pass through smoke or fire rated walls, floors or ceilings, and connections to air terminal units for exhaust or return systems.
 - f. Seal high pressure duct to seal Class A requirements.

H. Duct Hangers and Supports:

- 1. High and low pressure sheet metal ductwork:
 - a. SMACNA HVAC Duct Construction Standard.

I. Duct Fittings and Joints:

- 1. Low Pressure Systems:
 - a. Radius elbows without vanes:
 - 1) Radius ratio (R/W) of 1.5 and greater.
 - b. Connections to diffusers, grilles and registers: Fitted securely to necks or collars provided behind diffuser, grille, or register face area.

- c. Branch connections:
 - 1) Round: Factory built short cone or bellmouth type. Air scoops are not acceptable.
 - 2) Rectangular: 45 degree entry type or radius elbow.
 - d. Provide necessary transition pieces and duct collars to make connections to ductwork from neck sizes scheduled or indicated on drawings.
 - e. Where building walls, floor and ceilings form portions of duct or plenum, provide gasketed angles or channels at junction points, securely bolted to building structure.
2. High Pressure Systems:
- a. Elbows 3-8 IN diameter: Die stamped, for minimum air friction loss, with continuous corrosion resistance welds.
 - b. Elbows over 8 IN diameter: Welded segment type, not less than 5 pieces for 90 degree elbows, and not less than 3 pieces for 45 degree elbows, using corrosion resistant welds.
 - c. Tees: "Low loss, short cone type", unless specifically detailed otherwise for space limitations.
 - d. "Y's" 45 degree type. 60 degree type may be used if space conditions dictate.
 - e. Install "Y's" as indicated.
 - f. Where tees are indicated, "Y's" may be substituted if space is available.
 - g. "Y's": Straight sided type (no cone).
 - h. Takeoffs from air handling unit plenums: Standard Bellmouth fittings.
 - 1) Construct in accordance with SMACNA HVAC Duct Construction Standards.
 - i. "Y" takeoffs from horizontal ceiling mounted ducts to serve boxes: May be straight sided, shop fabricated type by accurately cutting and welding "Y's" into spiral ducts without use of fittings.
- J. Turning Vanes, Square Elbows:
- 1. Velocities up to 2500 FPM : Single vane, runner Type 2, with 3/4 IN trailing edge, 2 IN vane radius and 1.5 IN vane spacing, minimum 24 GA.
 - a. For widths over 36 IN install vanes in 2 or more sections or use tie rods to limit unbraced vane length.
 - 2. Where inlet and outlet dimensions of elbows are not equal, set 2 or more sections at 45 degrees angle to give optimum turning.
 - 3. Radius elbows without vanes: Radius ratio (R/W) of 1.5 and greater.
 - 4. Radius elbows with vanes: Radius ratio (R/W) less than 1.5; use where space limitations occur.
 - a. R/W = 0.75 to 1.0: Provide 3 vanes in elbow.
 - b. R/W = 1.0 to 1.25: Provide 2 vanes in elbow.
 - c. R/W = 1.25 to 1.5: Provide 1 vane in elbow.
 - d. Provide vane spacing per SMACNA HVAC Duct Construction Standards.
 - 5. Where square elbows are indicated or required, provide with turning vanes.
- K. Partitions and Blank-Off Plates:
- 1. Where used as part of an air handling unit, construct of 14 GA sheet metal with 1-1/2 IN standing seams.
 - 2. Partitions 8 FT long or less: Provide additional bracing of 1-1/2 x 1/4 IN angles spaced 2 FT on center.
 - 3. Partitions over 8 FT long: Provide additional bracing of 2 x 1/4 IN angles spaced 2 FT on center.
- L. Flexible Fan Connections:
- 1. Material: Neoprene double coated closely woven glass fabric flexible connections.
 - 2. Fasten fabric to sheet metal duct work and to fan collar extension with 3/16 IN rivets spaced not more than 5 IN OC.
 - 3. Locate in inlet and outlet of fans, as close to fan as possible.
 - 4. Provide at ducts crossing building expansion joints and as indicated on drawings.
 - 5. Connections shall not be under tension.
 - 6. Provide minimum separation distance of 1 IN across the connection.

M. Flexible Ducts, Preinsulated:

1. Low pressure construction:
 - a. Liner: Steel wire helix encapsulated with chlorinated polyethylene (CPE) film.
 - b. Insulation:
 - 1) 1 IN x 3/4LB/CF fiberglass insulation, minimum resistance of R-4.2.
 - c. Jacket:
 - 1) Bi-directional metalized polyester.
 - 2) Permeability: Not to exceed 0.05 perms when tested in accordance with ASTM E96 Procedure A.
2. High pressure construction:
 - a. Liner: Heavy gauge corrugated aluminum with watertight continuous lock seams.
 - b. Insulation: 1 IN x 3/4LB/CF fiberglass insulation, minimum resistance of R-4.2.
 - c. Jacket:
 - 1) Bi-directional metalized polyester.
 - 2) Permeability: Not to exceed 0.05 perms when tested in accordance with ASTM E96 Procedure A.
 - 3) Flex duct must also meet any other local or state requirements for flexible duct construction and performance.
3. Rated working pressure:
 - a. Low pressure duct: Positive 4 IN WG minimum; negative 1 IN WG minimum, for return or exhaust air connections.
 - b. High pressure duct: Positive 8 IN WG minimum; negative 8 IN WG minimum for return or exhaust air connections
4. Fire resistant, self extinguishing, UL-181, Class 1, with flame spread of 25 or less and smoke development not to exceed 50.
5. Thermal conductance(C): 0.23 BTU/ h-FT²-F .
6. Low pressure connections:
 - a. Secure duct to collar or sleeve with screws, or metal or nylon clamps or bands.
 - b. Seal connection with 2 wraps of duct tape.
7. High pressure connections:
 - a. Secure duct to collar or sleeve with duct sealer and 1/2 IN aluminum or galvanized steel bands or clamps.
 - b. Secure insulation jacket with 2 wraps of duct tape.
8. Turn radius: Not less than R/D equal to 1.0.
9. Provide flexible duct supports in accordance with SMACNA HVAC Duct Construction Standards.
10. As applicable, all products or assemblies to meet local or state code requirements.

N. Access Doors:

1. Provide at fire dampers, smoke dampers, fire and smoke dampers, duct mounted automatic dampers, duct mounted coils (except air terminal unit reheat coils) and where indicated on Drawings.
2. Position access doors to permit easy visual inspection and allow maintenance and resetting of device served.
3. Increase duct dimensions at devices when necessary to accommodate required access.
4. Install access doors above accessible lay-in ceilings.
5. Where access doors are installed above gypsum wall board ceilings or within shafts, provide access panels per Section 20 05 00.
6. Access doors at low pressure ductwork:
 - a. Minimum Sizes:
 - 1) Access doors in ducts less than 600 mm 24 IN wide: 300 mm X 300 mm 12 IN X 12 IN.
 - b. To install doors in round ducts or rounded side of flat oval duct, provide duct boot.
 - 1) Ruskin ADC22.
7. Low and high pressure ductwork:
 - a. Access doors:

- 1) Removable, double wall construction.
 - 2) 1 IN thick fiberglass insulation.
 - 3) Closed cell neoprene gasket and attachment bolts.
 - 4) Air tight seal to static pressures of 20 IN WG.
- b. Sizes:
- 1) For ducts 18 IN and under, the minimum door size shall be 10 IN X 6 IN.
 - 2) For ducts 19 IN to 24 IN, the minimum door size shall be 16 IN X 12 IN.
 - 3) For ducts over 24 IN the minimum door size shall be 24 IN X 18 IN.
- c. Provide duct boot to install doors in round ducts or rounded side of flat oval duct.
- O. Acoustical Duct Liner:
1. Flexible mat-faced fiberglass.
 2. Meet NFPA-90A and NFPA-90B Standards for fire safety.
 3. Comply with erosion test of UL-181.
 4. Thermal conductivity (k factor): 0.26 BTU-IN/SF- degF-HR at 75 degF mean temperature.
 5. Density:
 - a. 2 LB/CF for 1/2 IN thick liner.
 - b. 1-1/2 LB/CF for 1 IN thick liner.
 6. Sound Absorption Coefficient at NRC: As determined by ASTM C1071 and ASTM C423.
 7. Provide acoustical duct liner in following duct systems:
 - a. Return air ductwork: 1/2 IN thick.
 - 1) Refer to ductwork drawings for application.
- P. Kitchen Exhaust Ductwork:
1. Hood Ductwork:
 - a. Serving hoods over appliances producing grease vapors.
 - b. Parts of ducts exposed to view and weather: 18 GA stainless steel, type 302 with No.4 finish; weld seams, grind and polish to match adjacent metal.
 - c. Parts of ducts not exposed to view: 16 GA black steel with welded seams.
 - d. Kitchen hood grease duct access doors:
 - 1) Refer to Part 3 for installation requirements, including location guidelines, of grease duct access doors.
 - 2) Access door construction and assembly: See Section 20 07 00, Pipe Duct and Equipment Insulation.
 - 3) Install in accordance with manufacturer's installation details for fire resistive duct wrap specified in Section 20 07 00.
 2. Kitchen Hood Ductwork:
 - a. Serving hoods over ovens and other hot appliances without grease.
 - b. Ductwork exposed to view: 18 GA stainless steel, type 302, with No.4 finish and welded seams.
 - c. Ductwork not exposed to view:
 - 1) 18 GA galvanized sheet steel assembled with flanged duct connection systems.
 - 2) 16 GA black steel with welded seams.
 3. Dishwashing Exhaust System:
 - a. From outlets to above ceiling: 18 GA type 316 stainless steel, welded connections.
 - b. Above ceiling: 18 or 20 GA stainless steel, using duct sealer and tapes as specified for high velocity ducts to make entire duct system watertight.
 - c. Slope ducts to drain back to dishwasher.
 - d. Solder duct joints may be used in lieu of duct sealer and tape.
 - e. Install damper above each dishwasher connection.
 - f. Spiral stainless steel duct is optional for dishwashing exhaust duct provided a sealer is used in joints during fabrication.
- Q. Dampers:
1. Dampers Manual, Rectangular and Square:
 - a. Opposed blade type, fitted with shank bolts, marked for direction (open/closed).
 - b. Provide locking hand quadrant, with 2 IN standoff bracket.

- c. Construction:
 - 1) Greater than 36 x 12 IN :
 - a) Frame: 16 GA galvanized steel formed into structural shape.
 - b) Blades: 16 GA galvanized steel, equipped with brass pin running on stainless steel pivot for vertical axis.
 - c) Axles: Continuous, steel 1/2 IN hex.
 - d) Basis of design: Ruskin MD35.
- R. Fire Dampers:
- 1. UL labeled, 1-1/2 HR rated unless otherwise indicated.
 - 2. Fire dampers shall have 165 degF 74 fusible link.
 - 3. Provide as indicated and as required by NFPA and local regulations.
 - 4. Provide with mounting angles and sleeves.
 - 5. For curtain-type fire dampers, blades must be out of air stream (Type B fire damper), except as follows:
 - a. Fire dampers with blades in the airstream (Type A fire damper): where dampers are installed at a wall mounted grille and ductwork is not installed on both sides of the wall penetration.
 - b. For ducts where the smallest dimension is 8 IN or less : Type C fire dampers shall be 1 IN larger in each dimension and both the frame and the blades must be out of the air stream. This is not required at locations where fire dampers are installed at wall mounted grilles.
 - 6. On round or flat oval ductwork, provide dampers in enclosure with round or oval connections on each side.
 - a. Fire Dampers in Low Pressure Ducts:
 - 1) Provide curtain type damper, Ruskin Model DIBD2.
 - a) Rated up to 2000 FPM at 4 IN WG for vertical mounted applications.
 - b) Rated up to 2000 FPM at 4 IN WG for horizontal mounted applications.
 - b. Fire Dampers in High Pressure Ducts:
 - 1) For vertical mounted applications: curtain type damper, Pottorff Model VFD-10D.
 - a) Rated up to 4000 FPM at 8 IN WG .
 - 2) For horizontal mounted applications: curtain type damper, Pottorff Model VFD-10D
 - a) Rated up to 2000 FPM at 4 IN WG .
 - c. Fire Dampers for Stainless Steel Ductwork Systems:
 - 1) Provide as specified above except with type 304 stainless steel construction.
 - 2) Provide as specified above except with type 316 stainless steel construction.
 - d. Ceiling Fire Dampers:
 - 1) UL listed specifically for floor/ceiling assemblies.
 - 2) Provide Ruskin CFD Series radiation damper suitable for type of diffuser, register, and grille.
 - 3) Provide mineral wool thermal insulating blanket for back side of diffuser, register, or grille as required by the manufacturer to comply with listing of damper.
- S. Smoke Dampers:
- 1. UL classified as a leakage rated damper for use in smoke control systems under UL555S, latest edition, and bear a UL label attesting to same.
 - 2. Suitable for velocity and pressure of system.
 - 3. Jamb seals: Stainless steel flexible metal compression type.
 - 4. Provide in ductwork adjacent to smoke partition (not in wall) with actuator in accessible location and visible for inspection.
 - 5. Provide dampers and actuators as a single entity which meets all applicable UL555 and UL555S qualifications for both dampers and actuators as a rated assembly.
 - 6. Frame: 16 GA galvanized steel, minimum.
 - a. Loss through wide open damper based on AMCA Test Figure 5.3:
 - b. 12 IN x 12 IN duct size: Not more than 1.25 IN WG at 3000 FPM face velocity.
 - c. 24 IN x 24 IN duct size: Not more than 0.45 IN WG at 3000 FPM face velocity.

- d. 36 IN x 36 IN duct size: Not more than 0.3 IN WG at 3000 FPM face velocity.
- 7. Provide factory supplied caulked sleeve.
- 8. Smoke Dampers, Low Pressure:
 - a. Parallel blade type with blades hinged together for operation in unison and bearings arranged for automatic operation.
 - b. UL555S Leakage Rating: Class I (4 CFM/ SF at 1 IN WG).
 - 1) Pottorff Model SD-141
 - c. Blades: Single or double thickness type.
 - 1) Single thickness type: 16 GA steel, minimum.
 - 2) Double thickness type: 18 GA steel.
 - d. Blade width: Not more than 6 IN .
 - e. Single blade dampers may be used for up to 8 IN wide blade, or up to 12 IN round.
- 9. Smoke Dampers, Square or Rectangular, High Pressure:
 - a. Parallel or opposed blade type with linkage for automatic operation.
 - b. UL555S Leakage Rating: Class I (8 CFM/ SF at 4 IN WG).
 - 1) Pottorff Model SD-151.
 - c. On round or flat oval ductwork:
 - 1) Provide dampers in an enclosure with round or oval connections on each side.
- 10. Smoke Dampers, Round or Flat Oval, High Pressure:
 - a. Single blade type with encompassed blade edge seal.
 - b. UL555S Leakage Rating: Class I (8 CFM/ SF at 4 IN WG).
 - 1) Pottorff Model SD-25R.
- 11. Damper actuator:
 - a. Electric type, factory installed.
 - 1) Two-position type.
 - 2) 120 VAC.
 - 3) Spring return fail closed.
 - 4) UL listed at 250 degF.
- T. Combination Fire-Smoke Dampers:
 - 1. Fire-Smoke Dampers, Combination:
 - a. UL classified as a Leakage Rated damper under UL555S, latest edition, bearing a UL label attesting to same.
 - b. UL555 fire rating: 1.5 Hour.
 - c. Suitable for velocity and pressure of system.
 - d. Compressible metal jamb seals.
 - e. Operator installed per UL requirements, in accessible location and visible for inspection.
 - f. Provide dampers and actuators as a single entity which meets all applicable UL555 and UL555S qualifications for both dampers and actuators as a rated assembly.
 - g. Frame: 16 GA galvanized steel, minimum.
 - h. Loss through wide open damper:
 - i. Loss through wide open damper based on AMCA Test Figure 5.3:
 - 1) 12 IN x 12 IN duct size: Not more than 1.25 IN WG at 3000 FPM face velocity.
 - 2) 24 IN x 24 IN duct size: Not more than 0.45 IN WG at 3000 FPM face velocity.
 - 3) 36 IN x 36 IN duct size: Not more than 0.3 IN WG at 3000 FPM face velocity.
 - j. Provide factory supplied caulked sleeve.
 - 2. Fire-Smoke Dampers, Combination, Low Pressure:
 - a. Parallel blade type with blades hinged together for operation in unison and bearings arranged for automatic operation.
 - b. May be used in lieu of separate fire and smoke dampers.
 - c. UL555S Leakage Rating: Class II (10 CFM/ SF at 1 IN WG).
 - 1) Pottorff Model FSD-142.
 - d. Fusible link: 165 degF melting point.
 - 3. Fire-Smoke Damper, Combination, High Pressure:
 - a. Parallel blade type.

- b. May be used in lieu of separate fire and smoke dampers.
 - c. UL555S Leakage Rating: Class I (8 CFM/ SF at 4 IN WG).
 - 1) Pottorff Model FSD-151.
 - d. Fusible link: 165 degF melting point.
 - 4. Actuators, Fire-Smoke Damper:
 - a. Electric type, factory installed.
 - b. Two-position.
 - c. 120 VAC.
 - d. Spring return fail closed.
 - 5. Diffusers:
- U. Diffusers, Registers and Grilles:
- 1. Diffusers, Ceiling:
 - a. Square type.
 - b. Size, type and manufacturer: As scheduled.
 - c. Finish of steel units: Factory applied, baked or electrocoated enamel; color as selected by Architect or as indicated.
 - d. Finish of aluminum units: Satin anodized.
 - e. Provide sponge rubber gasket for ceiling diffusers.
 - f. Provide necessary screws, duct collars, transitions and air pattern deflectors.
 - 2. Air Grilles and Registers:
 - a. Size, type and manufacturer as scheduled.
 - b. Finish of steel units:
 - 1) Factory applied, baked or electrocoated enamel.
 - 2) Color as selected by Architect or as indicated.
 - c. Finish of aluminum units: Satin anodized.
 - d. Provide sponge rubber gasket for ceiling and wall units.
 - e. Provide necessary screws, duct collars and transitions.
 - f. Provide opposed blade dampers in registers where indicated.
 - 3. Diffusers and Grilles, Linear:
 - a. Size, type and manufacturer as scheduled on Drawings.
 - b. Adjustable pattern controller (on supply units only) capable of 180 degree air pattern adjustment and volume control. All adjustments accessible from the face of the diffuser.
 - c. Extruded aluminum or steel ceiling linear diffuser.
- V. Air Blenders:
- 1. Completely fixed devices with no moving parts.
 - 2. Type, size, pressure drop and capacity: As scheduled.
 - 3. Factory built and tested.
 - 4. Fabricated of 14 GA aluminum and welded construction.
 - 5. Capable of providing a minimum mixing effectiveness of 75 percent and plus or minus 6 degF standard deviation when mixing 50 percent outside air with 50 percent return air at 60 degF inlet temperature differential.
- W. Louver Blank Off Panels:
- 1. Provide behind inactive louver sections.
 - 2. Double wall construction with minimum 22 GA galvanized sheet metal.
 - 3. 2 IN thick rigid insulation.
 - 4. Paint side facing louver flat black.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine structure, substrates, and conditions under which work is to be installed.
- B. Correct deficiencies.

- C. Installation constitutes acceptance of responsibility for performance.
- D. Install air flow measuring stations specified in Section 25 50 00 in accordance with manufacturer's installation instructions and as specified.

3.2 INSTALLATION OF DUCTWORK

- A. Ductwork Cleanliness:
 - 1. Reference Standard:
 - a. SMACNA – Duct Cleanliness for New Construction.
 - 2. Basic Level:
 - a. Under this level of ductwork cleanliness it is acknowledged that ductwork leaving the premises of the manufacturer will include some or all of the following:
 - 1) Internal and/or external self-adhesive labels or marking for parts identification.
 - 2) Exposed mastic sealant.
 - 3) Sealant shall have a VOC content no greater than 420 g/L.
 - 4) Light zinc oxide coating on the metal surface.
 - 5) A light coating of oil on machine formed ductwork.
 - 6) Minor protrusions into the airway of rivets, screws, bolts and other jointing devices.
 - 7) Internal insulation and associated fasteners.
 - 8) Discoloration marks from plasma cutting process.
 - b. The internal surfaces of ductwork shall be wiped to remove excess dust immediately prior to installation.
 - 3. Intermediate Level:
 - a. Under this level of ductwork cleanliness it is acknowledged that ductwork leaving the premises of the manufacturer will include some or all of the following:
 - 1) Internal and/or external self-adhesive labels or marking for part(s) identification.
 - 2) Exposed mastic sealant.
 - 3) Light zinc oxide coating on the metal surface.
 - 4) A light coating of oil on machine formed ductwork.
 - 5) Minor protrusions into the airway of rivets, screws, bolts and other jointing devices.
 - 6) Internal insulation and associated fasteners.
 - 7) Discoloration marks from plasma cutting process.
 - b. Site storage: The area provided for storage shall be clean, dry and exposure to dust minimized.
 - c. The working area should be clean and dry and protected from the elements.
 - d. The internal surfaces of ductwork shall be wiped to remove excess dust immediately prior to installation.
 - e. Open ends on completed ductwork and overnight work-in-progress shall be sealed.
 - 4. Advanced Level:
 - a. In addition to the provisions of the Intermediate level the following requirements apply:
 - 1) All self-adhesive labels for part identification are to be applied to external surfaces only.
 - 2) To maintain cleanliness during transportation, all ductwork shall be sealed either by blanking or capping duct ends, bagging small fittings, surface wrapping or shrink wrapping.
 - b. Site Storage:
 - 1) A clean and dry environment where the ductwork is protected from dust must be provided for the storage of ductwork prior to installation.
 - 2) All sealed ends shall be visually examined and if damaged resealed with an appropriate material.
 - c. The working area shall be clean, dry and the ductwork protected from dust. Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary.
 - 5. Duct Cleanliness levels by space type:

- a. Basic Level:
 - 1) Ductwork systems serving mechanical or electrical equipment rooms.
- b. Advanced Level:
 - 1) Computer, telephone equipment rooms, Data Centers and similar areas housing high tech equipment or fabrication processes.
- c. Intermediate Level:
 - 1) All building areas not covered under Advanced or Basic Level duct cleanliness (i.e. general office and administration areas, cafeterias, meeting rooms, etc.)
- B. Install generally as indicated.
- C. Conceal ductwork in finished spaces unless indicated otherwise.
- D. Do not install ductwork in or allow to enter or pass through electrical rooms, elevator machine rooms, or spaces housing switchboards, panelboards or distribution boards, except ductwork that serves electrical rooms, elevator machine rooms, or spaces.
- E. Exercise special care to provide tight fitting well fabricated, well braced ductwork systems.
- F. Field assemble rectangular, round or flat oval ductwork as follows:
 - 1. Use duct joint sealer applied slip joints.
 - 2. Use Ductmate Spiralmate or Ovalmate systems.
 - 3. Isolate dissimilar metals with elastomeric sealant tape or fiber gaskets, and gaskets and washers for bolts.
 - 4. Install TDC flanged duct connection systems in accordance with SMACNA construction standards.
- G. In high pressure ductwork, do not use 2 piece mitered 90 degree elbows with or without vanes unless approved by Engineer.
- H. Kitchen Exhaust Systems:
 - 1. Install ductwork for kitchen exhaust systems in accordance with NFPA-96 and applicable state and local codes.
 - 2. In addition to the locations and intervals required by NFPA-96 and local and state codes, the following additional requirements for grease duct access doors apply:
 - a. Vertical installations: install one access door at every floor.
 - b. Horizontal installations: install access doors at intervals no greater than 20 feet on center.
 - c. Where plans call for intervals less than the above requirements the plan intervals supercede.
- I. Where ducts pass thru fire rated and smoke rated construction, maintain rating indicated.
 - 1. Where fire dampers are not used, seal around duct with firestopping.
 - 2. See Section 07 84 00 for materials.
- J. Do not kink, bend or otherwise restrict the free area of flexible ductwork.
- K. Ductwork Hangers:
 - 1. Install per SMACNA Duct Construction Standards but in no case shall ductwork hangers or ductwork be directly supported to or supported off of other ductwork.

3.3 INSTALLATION OF MANUAL DAMPERS

- A. Provide volume dampers, to facilitate air balancing, in the following locations whether shown on the plans or not:
 - 1. Run-outs to individual room terminal devices (i.e. supply grilles and diffusers, return and exhaust grilles). Locate damper as close to the run-out take off as possible.
 - 2. Lateral duct take-offs from a return or exhaust main riser for systems serving multiple floors.
- B. Provide additional branch main volume dampers required by the balancing contractor, refer to Section 20 08 00.

3.4 INSTALLATION OF FIRE AND SMOKE DAMPERS

- A. Install in accordance with manufacturer's instructions and UL requirements.
 - 1. See Section 07 84 00.
- B. Floor mounted dampers may be installed in a concrete floor curb.

3.5 PERFORMANCE TESTS

- A. Test high pressure air ductwork with air pressure not less than 4 IN WG pressure before external insulation is applied.
 - 1. As required, test portions of system to permit finish work.
 - 2. Leakage not to exceed maximum values identified by SMACNA HVAC Air Duct Leakage Test Manual.
 - 3. Testing procedures shall be as described by SMACNA HVAC Air Duct Leakage Test Manual.
 - 4. Test all high pressure ductwork systems.
 - 5. Test 25percent of the high pressure ductwork systems. The Engineer reserves the right to designate which sections are to be tested.
- B. Use a pressure blower with volume control and orifice flow meter to provide supply air for test.
- C. Submit reports to Architect.

3.6 APPLICATION OF ACOUSTICAL DUCT LINER

- A. Apply duct liner to clean, dry surfaces with duct surfaces at room temperature.
- B. Apply duct liner in accordance with duct liner installation standards of SMACNA HVAC Construction Standards - Metal and Flexible.
- C. Calk joints with fire retardant mastic and point up to smooth surface.
- D. Apply adhesives and mastics per manufacturer's recommendations.
- E. When duct width exceeds 8 IN, provide additional securement with mechanical fastening devices that are spaced in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- F. Butt edges tightly and secure to metal surface with adhesive covering 100 percent of duct surface.
 - 1. Spacing at edges, joints and corner breaks per manufacturer's recommendations.
- G. Install metal nosing at upstream transverse edges for velocities over 4000 FT/MIN.

3.7 CLEANING

- A. At substantial completion, clean work installed under this section.

3.8 EQUIPMENT DEMONSTRATION

- A. At substantial completion, inspect and test, and operate satisfactorily, in presence of Engineer and representative of Owner, operation of each piece of equipment and its accessories.
- B. If inspection or test indicates defects, replace defective work or material.
- C. Repeat inspections and tests until defects are eliminated.

END OF SECTION

SECTION 23 35 00
EXHAUST AND VENTILATING FANS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Air Terminal Units and Induction Units, as indicated, in accordance with provisions of Contract Documents.
- B. Systems Included:
 - 1. Gravity roof ventilators.
 - 2. Power roof and wall ventilators.
- C. Abbreviations:
 - 1. AMCA: Air Movement and Control Association.
 - 2. ADC: Air Diffusion Council.
 - 3. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.
- D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Standards:
 - 1. ADC Standard 1062R2, Air Diffusing Equipment Test Code.
 - 2. AMCA Standard 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - 3. AMCA Standard 204, Balance Quality and Vibration Levels for Fans.
 - 4. ASHRAE Standard 70, Method of Testing for Rating the Performance of Air Outlets and Inlets.
 - 5. NFPA-90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 6. ASTM B117-03: Standard Practice for Operating Salt Spray(Fog) Apparatus.
 - 7. ABMA : American Bearing Manufacturers Association.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Performance data.
 - 2. Physical dimensions.
 - 3. Fan curves.
 - 4. Sound data.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - 2. Owner instruction report.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. General Fans:
 - 1. Base:
 - a. Members of AMCA.
- B. Gravity Roof Ventilators:
 - 1. Base:
 - 2. Optional:
 - a. Carnes.
 - b. Aerovent, TCF.

- c. Acme Engineering and Manufacturing.
 - d. Cesco Products.
 - e. Jenn Industries.
 - f. Cook, Loren.
 - g. PennBarry.
 - h. Greenheck.
- C. Power Roof and Wall Ventilators:
- 1. Base:
 - 2. Optional:
 - a. Carnes.
 - b. Acme Engineering and Manufacturing.
 - c. Cook, Loren.
 - d. Jenn Industries.
 - e. PennBarry.
 - f. Greenheck.
- D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Fans - General:
- 1. Performance ratings: Based on laboratory tests conducted in accordance with latest edition of ASHRAE/AMCA Standard Test Codes.
 - 2. UL 705 listed.
 - 3. Capacity and ratings: As indicated.
 - 4. Arrangement and drive: As indicated.
 - 5. Provide removable belt guard.
 - 6. Fan drive sheaves for belt driven fans over 5 HP:
 - a. Cast iron, split tapered bushings dynamically balanced at factory.
 - b. Provide initial fixed pitch sheave based upon design conditions.
 - c. Provide final fixed pitch drive sheaves for proper RPM determined during balancing process.
 - 7. Belt driven fans 5 HP and less: Provide with adjustable sheaves.
 - 8. Fan wheels shall be statically and dynamically balanced per AMCA Standard 204.
 - 9. Finish:
 - a. Steel fan components: Finished with paint system exceeding 1000 HR salt spray under ASTM B117 test method, minimum 2 MIL thick.
 - b. Aluminum, galvanized, and stainless steel fan components: Unfinished.
- B. Special Applications.
- 1. Kitchen exhaust, grease laden:
 - a. Fans shall have UL 762 listing for restaurant exhaust applications.
 - b. Disconnect shall be mounted on exterior of unit.
 - 2. Smoke control:
 - a. Fans shall be UL listed for smoke control systems.
- C. Motors and Control:
- 1. See Section 20 05 00.
 - 2. Provide TEFC motor for outdoor installations exposed to weather.
 - 3. For direct drive fans, provide TEFC motors when motor is located in the airstream.
- D. Belt Drives:
- 1. Single or multiple belts as required to develop full horsepower of driving motor with service factor of not less than 1.50.
 - 2. Where more than one belt is used for drive, provide "matched" sets.
 - a. Use new belts on final fixed pitch drive sheaves.
 - 3. Motors on fan drive: Provide with adjustable rail motor mounts of type using screws for tightening of belts.

4. Bolt motor mounts to fan bases or frames.
 5. For fans suspended from ceilings, belt tightening device may be pivoted type.
- E. Belt Guards:
1. See Section 20 05 00.
- F. Control Dampers:
1. Control dampers shall be as specified in Section 23 31 13.
 2. Actuator for control dampers shall be as specified in Section 25 50 00.

2.3 GRAVITY ROOF VENTILATORS

- A. Gravity Roof Ventilators:
1. Size and type: As indicated.
 2. Housings:
 - a. Aluminum or galvanized steel.
 - b. Capable of withstanding 30 LB/SF snow load and 100 MPH wind.
 3. Hoods:
 - a. Easily removable for access to throat area.
 - b. Provide with bird screens.
 4. Provide factory prefabricated, insulated roof curbs.

2.4 POWER ROOF AND WALL VENTILATORS

- A. Power Roof and Wall Ventilators:
1. Centrifugal, direct or belt driven as scheduled, wall or curb mounted type as scheduled
 2. Capacity: As scheduled.
 3. Housing: Extruded or heavy gauge sheet aluminum mounted on rigid support structure.
 - a. Hooded dome type.
 - b. Square base to match roof curb.
 4. Motor and drive: Isolated from exhaust air stream.
 - a. Provide overload protection.
 - b. Isolate each fan motor and drive from enclosure with internal vibration isolators.
 - c. Resiliently mounted motors may be used for direct drive fans.
 5. Fan wheel: Backward inclined, dynamically and statically balanced.
 6. Bearings:
 - a. Bearings shall be fixed to the fan shaft using concentric mounting locking collars. Set screws will not be allowed.
 - b. Self aligning, extra heavy duty type, ball or roller bearings with regreasable lubrication.
 - c. Select for minimum average bearing life L-50 rating of 200 000 HRS operation at maximum cataloged operating speed.
 7. Provide factory prefabricated, insulated roof curbs.
 8. Provide 1/2 IN mesh birdscreen on outlet.
 9. Provide factory wired NEMA 1 disconnect under cover.
 10. Provide factory wired, solid state speed controller, on direct drive 120 volt, single phase fans.

2.5 PREFABRICATED INSULATED ROOF CURBS

- A. Construction:
1. Curb height: 8 IN, above finished roof.
 2. 300 MM12 IN00 MM24 INStyle: Straight sides (without cants) to accommodate tapered roof insulation. Roof curbs shall be approved by roofing manufacturer and compatible with roofing system.
 3. Shell, liner, and base: G90 galvanized steel with fully mitered and welded corners, integral base plates.
 4. Insulation: Factory applied, 1-1/2 IN thick, 3 PCF density fiberglass insulation.
 5. Nailers: Factory installed pressure treated wood.
 6. Provide level installation, regardless of roof slope.

2.6 VIBRATION ISOLATION

- A. Vibration isolation: Section 20 05 50.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's recommendations and as specified.
- B. Caulk roof curbs for watertight installation.
- C. Coordinate placement of equipment on roof with other trades.

3.2 VIBRATION ISOLATION

- A. Vibration isolation: Section 20 05 50.

3.3 FAN DYNAMIC BALANCING

- A. Experienced, trained mechanics from factory shall dynamically balance centrifugal fans 7-1.2 HP and above. Balancing shall include the following:
 - 1. Inspection of fans to determine if damage has occurred during storage or installation and coordinate repair of damages.
 - 2. Inspection of fan drives including bearing and motor mounts.
 - 3. Inspection of tensioning of drive belts on adjustable and fixed pitch sheaves.
 - 4. X-Y dynamic vibration plot on each fan resulting in a properly balanced installation within factory specifications, performed after system has been balanced and final fixed pitch drive sheaves installed.

END OF SECTION

SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Air Terminal, as indicated, in accordance with provisions of Contract Documents.
- B. Systems Included:
 - 1. Air terminal units
- C. Operators and controllers:
 - 1. Operators and controllers for air terminal units: Provided in Section 25 50 00.
- D. Definitions:
 - 1. Low pressure ductwork:
 - 2. High pressure ductwork: refer to section 23 31 13.
- E. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Design and installation standards:
 - 1. ASHRAE Guide and Data Book – Systems and Equipment, current chapter on duct construction
 - 2. Air Diffusion Council, ADC Standard 1062R2, Air Diffusing Equipment Test Code.
 - 3. Air Moving and Conditioning Association, AMCA Standard 210, Test Code for Air Moving Devices.
 - 4. ASHRAE Standard 70-72, Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
 - 5. NFPA-90A, Standard for the Installation of Air Conditioning and Ventilating Systems, current edition
 - 6. SMACNA HVAC Duct Construction Standard - Metal and Flexible current edition.
 - 7. UL Publication No.181, Erosion Test Methods
 - 8. ARI 885-98: Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Air Terminal units
- B. Contract Closeout Information:
 - 1. Operating and maintenance data
 - 2. Owner instruction report

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Air terminal units:
 - 1. Base:
 - a. Titus
 - 2. Optional:
 - a. Anemostat Air Products.
 - b. Tuttle and Bailey.
 - c. Krueger.
 - d. Price.
 - e. Metalaire.
 - f. Trane.
- B. Other manufacturers desiring approval comply with Section 01 25 13.

2.2 MATERIALS

- A. Air Terminal Units
 - 1. Air terminal units - general: Factory assembled.
 - a. Configured for pressure independent control.
 - b. Capacity: As indicated.
 - c. Noise level: Based on ARI 885-98. Refer to plans for scheduled values.
 - d. Operators: Furnished in Section 25 50 00.
 - 1) Factory or field installed on units.
 - 2) Provide two operators per air terminal unit for dual duct applications.
 - e. Acoustical fiberglass liner:
 - 1) Comply with NFPA-90A for fire resistivity and UL Standard 181 for erosion.
 - 2) Insulation shall consist of 1 IN thick non-porous foil faced rigid fiberglass insulation secured by full length galvanized steel z-strips which enclose and seal all edges, eliminating tape and adhesives.
 - f. Provide multi-point velocity pressure sensors with external pressure taps.
 - g. Provide static pressure tube(s).
 - h. Valve adjustment: Field adjustable.
 - i. Set air terminal units to air flow rates indicated.
 - j. Casing leakage: 5 percent, maximum, of nominal rated capacity at 3.0 IN WG internal pressure.
 - 2. Electric heating coils for air terminal units:
 - a. Shall be supplied and installed on the terminal unit by the terminal manufacturer.
 - b. Capacity: As indicated on schedule.
 - c. Heating elements shall be derated nickel chrome, supported by ceramic isolators staggered for maximum thermal transfer and element life, and balanced to ensure equal output per step.
 - d. Primary automatic reset thermal cutout per coil.
 - e. Secondary thermal cutout per element.
 - f. Air flow proving switch.
 - g. Magnetic or safety contactors as required.
 - h. Line terminal block.
 - i. Control terminal block.
 - j. Door interlock disconnect switch.
 - k. UL listed.

3. Inlet air valves for air terminal units: Corrosion resistant, self-seating type.
 - a. Frame, links and levers may be of zinc coated steel or aluminum.
 - b. Vanes, pivots, hinged or knuckle joints: Aluminum or other non-ferrous metal.
 - c. Leakage: Not greater than 3 percent of maximum rated capacity when closed against inlet static pressure of 4.0 IN WG.
 - d. Equip with suitable linkage and motor mounting platform to accommodate control operators.
 - e. Use resilient sealing members to prevent leakage.
 - f. Provide direct reading air flow rate scale and external adjustment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units as indicated and in accordance with manufacturer's recommendations and instructions and as specified.

END OF SECTION

SECTION 23 73 14
KITCHEN MAKE UP AIR UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Abbreviations:
1. ADC: Air Diffusion Council.
 2. AMCA: Air Moving and Conditioning Association.
 3. ANSI: American National Standards Institute.
 4. ARI: Air-Conditioning and Refrigeration Institute.
 5. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.
 6. IES: Institute of Environmental Sciences.
 7. ETL: Edison Testing Laboratories.

1.2 QUALITY ASSURANCE

- A. Standards:
1. AMCA 99 - Standard Handbook.
 2. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
 3. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
 4. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
 5. AMCA 500 - Test Methods for Louver, Dampers and Shutters.
 6. ANSI/AFBMA-9 - Load Ratings and Fatigue Life for Ball Bearings.
 7. ANSI/UL-900 - Test Performance of Air Filter Units.
 8. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
 9. ARI 430 - Standard for Central-Station Air-Handling Units.
 10. ARI 435 - Standard for Application of Central-Station Air Handling Units.
 11. NFPA-90A - Installation of Air Conditioning and Ventilation Systems.
 12. SMACNA - Low Pressure Duct Construction Standards.
 13. UL – 705.
 14. CSA STD. - C22.2, NO. 113.
 15. ETL
 16. Air Handling Units: Product of manufacturer regularly engaged in production of components who issues complete catalog data on total product.

1.3 SUBMITTALS

- A. Product Data:
1. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details and field connection details.
 2. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics and gauges and finishes of materials.
 3. Fan curves:
 - a. Provide fan curves reflecting the following conditions:
 - 1) Scheduled operating point clearly plotted.
 - 2) 50 percent air flow condition (Used to evaluate potential surge conditions).
 4. Submit product data of filter media, filter performance data, filter assembly and filter frames.
- B. Contract Closeout Information:
1. Submit operation and maintenance data.
 2. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists and wiring diagrams.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures and finish.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, all filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include but are not limited to:
 - 1. Greenheck Fan Corporation

2.2 PACKAGED ROOFTOP VENTILATORS WITH INDIRECT GAS-FIRED FURNACE AND PACKAGED DX COOLING

- A. This section includes units with integral heating and cooling for outdoor installation. Integral heat source shall be Indirect Gas-Fired furnace. Integral cooling source shall be packaged DX. Airflow arrangement shall be Outdoor Air only. Unit shall be constructed in a horizontal configuration and shall incorporate additional product requirements as listed in Section 2 of this specification.

B. MANUFACTURED UNITS

- 1. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, downturn outdoor air intake with 2" aluminum mesh filter assembly, condensate drain pan, P trap, indirect gas furnace, packaged DX system, motorized dampers, sensors, curb assembly, service receptacle, filter assembly for intake air, supply air blower assembly and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection except with electric post heat and exhaust fan only power which have dual point power.

C. CABINET

- 1. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
 - a. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Unit's exterior shall be supplied from the manufacturer using G60 galvaneal steel with proprietary pre-painted material in the following finish color; Concrete Gray-RAL 70023. This has been subjected to a salt spray test per ASTM-B117 and evaluated using ASTM-D714 and ASTM-D610 showing no observable signs of rust or blistering until reaching 2,500 hours.
 - b. Internal assemblies: 22 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.
- 2. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
 - a. Materials: Rigid urethane foam
 - 1) Thickness: 2 inch (50.8 mm)
 - 2) Thermal Resistance: R13
 - 3) Meets UL94HF-1 flame requirements
 - 4) Location and application: Full coverage of entire exterior to include walls, roof of unit, unit base and doors
- 3. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 18 gauge galvanized G90 steel or painted galvanized steel.

4. Supply Air blower assemblies: Blower assembly shall consist of an electric motor as specified by A / E and direct-drive fan(s). Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor(s) shall be capable of continuous speed modulation and controlled by a VFD.
5. Evaporator Coil: Evaporator coil shall be AHRI Certified and shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of “interlaced” configuration, permitting independent operation of either compressor without conflict with the other compressor.
6. Control panel / connections: Rooftop Ventilator units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch.
7. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.
8. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.
9. Indirect gas furnace:
 - a. Shall be ETL Certified as a component of the unit.
 - b. Shall have an integral combustion gas blower.
 - c. Shall be ETL Certified for installation downstream of a cooling coil.
 - d. Shall have fault sensors to provide fault conditions to optional digital controller or building controls.
 - e. Shall have 4-pass tubular heat exchangers, constructed of type 409 stainless steel. Heat exchanger tubes shall be installed on the vest plate by means of swaged assembly, welded connections are not acceptable. Heat exchanger tubes shall be supported and also permit expansion and contraction of the tubes.
 - f. Heat exchanger shall have a 5 year extended warranty.
 - g. Furnace control shall be 16:1 Modulating
 - h. Shall be encased in a weather-tight metal housing with intake air vents. Large, metal door shall provide easy access to the enclosed vest plate, control circuitry, gas train, burner assembly, and exhaust blower.
 - i. Shall have solid state controls permitting stand-alone operation or control by building controllers.
10. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Unit condenser fans shall feature swept blade design resulting in reduced sound levels. Condenser fan motors shall be three phase, external rotor, type 56 frame, open air over and shaft up. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector. Lead condenser fan will have an electronically commutated (EC) motor that will modulate to maintain a head pressure set point. Motors shall be UL Recognized and CSA Certified. The refrigerant compressor(s) shall be digital hermetic scroll-type and shall be equipped with liquid line filter drier, thermostatic expansion valves (TXV)(s), manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with R-410A refrigerant. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.

11. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:
 - a. Global alarm condition (active when there is at least one alarm)
 - b. Supply Air Proving alarm
 - c. Dirty Filter alarm
 - d. Compressor Trip alarm
 - e. Compressor Locked Out alarm
 - f. Supply Air Temperature Low Limit alarm
 - 1) Sensor #1 Out of Range (outside air temperature)
 - 2) Sensor #2 Out of Range (supply air temperature)
 - 3) Sensor #3 Out of Range (cold coil leaving air temperature)
12. Phase and brownout protection: RTU shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.
13. Motorized dampers / Outdoor Air: AMCA Class 1A certified motorized damper of insulated low leakage type and a leakage rate of 3 CFM/ft² @ 1 in. wg. shall be factory installed].
14. [AMCA Class 1A motorized recirculating air damper designed to permit 100% maximum recirculation of return air shall be factory installed].
15. Sensors are considered to be part of various optional operational modes or device controllers and are to be factory supplied and installed as specified by the A/E.
16. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly. The curb shall be the height of 18.
17. Service receptacle: 120 VAC GFCI service outlet shall be factory-provided and installed [by this contractor in a location designated by the A/E. Unit contains a 120 VAC transformer to provide power to service outlet.
18. Hail guards: Protects the condensing unit from damage due to extreme weather conditions such as hail and flying debris.
19. Vapor Tight Lights: Provide service lights mounted in the unit to be used during times of routine maintenance. The lights must be wired by others on the jobsite as they will not be wired through the unit control center]. If vapor tight lights are selected with a factory mounted and wired service outlet, the lights will be factory mounted and wired as well.
20. 24V/120V Smoke detector – Duct smoke detector is shipped loose for field mounting and wiring in the supply or return air duct. The air duct smoke detector housing shall be UL listed per UL 268A specifically for use in air handling systems. The air duct smoke detector housing shall be suitable for mounting indoors. The detector shall operate at air velocities of 100 feet per minute to 4000 feet per minute (0.5 to 20.32 meters/second). The power supply voltage shall be 20-29 VDC, 24 VAC 50-60 Hz, and 120 VAC 50-60 Hz. The detector shall consist of an alarm initiation contact & two DPDT auxiliary contact closures.

D. BLOWER

1. Blower section construction Supply Air: direct drive motor(s) and blower(s) shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.
2. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
3. Fan: Direct drive, airfoil plenum fan with steel wheels statically and dynamically balanced and AMCA certified for air and sound performance.

4. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating."

E. MOTORS

1. General: Blower motors greater than ¾ horsepower shall be "NEMA Premium™" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Motors shall be 60 cycles, 3 phase 460 volt.

F. UNIT CONTROLS

1. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors, or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.
2. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.
3. RTU supply fan shall be configured for network control 0 – 10 VDC by others to DDC.
4. Outside Air / Return Air damper control shall be network control.
5. Dirty filter sensor shall be factory-installed.
6. Operating protocol: The DDC shall be factory-programmed for BACnet IP.
7. Variable Frequency Drive (VFD) unit shall have factory installed variable frequency drive for modulation of the supply air blower assembly(ies). The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.
8. Room thermostat shall be provided as a shipped loose item. The room thermostat shall have an LCD display to adjust the room temperature set point from within the space.

G. FILTERS

1. Unit shall have permanent 2 inch (50.8 mm) aluminum mesh filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the supply air stream.

2.3 PACKAGED MAKE-UP AIR UNITE WITH DIRECT GAS-FIRED FURNANCE

A. SUMMARY

1. This section includes units with integral Direct Gas-Fired heating and cooling for rooftop installation. Integral cooling source shall be packaged DX. Airflow arrangement shall be Outdoor Air only. Each unit shall be constructed in a horizontal configuration and shall incorporate additional product requirements as listed in Section 2 of this specification.

B. MANUFACTURED UNITS

1. Unit with Integral Heating and cooling shall be fully assembled at the factory and consist of an insulated metal cabinet, outdoor air intake weather hood with aluminum mesh filter with bird screen with combination mesh filter and louver, condensate drain pan, P trap, Packaged DX, motorized intake damper sensors, curb assembly, service receptacle, filter assembly for intake air, supply air blower assembly and an electrical control center. All specified

components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

C. CABINET

1. Materials: Formed, single wall metal cabinet with fiberglass duct liner insulation, fabricated to permit access to internal components for maintenance. Underside of unit shall have formed metal panels covering base panel insulation.
 - a. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvaneal steel. Base rail is 12 gauge, galvanized (G90) steel.
 - b. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.
2. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
 - a. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
 - 1) Thickness: 1 inch (25 mm)
 - 2) Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
 - 3) Location and application: Floor of each unit shall be insulated with fiberglass insulation. Full interior coverage of entire cabinet to include walls and roof of unit shall be semi-rigid type and installed between inner and outer shells of all cabinet exterior components when double walls are specified.
 - 4) Access panels: Unit shall be equipped with insulated hinged access panels to provide easy access to all major components. Access panels shall be fabricated of 18 gauge galvanized G90 steel.
 - 5) Supply Air blower assembly options:
 - a) Forward curve blower: Blower assembly consists of an electric motor as specified by A/E and a belt driven, double width, and double inlet forward curve blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on [minimum 1.125 inch thick neoprene vibration isolators] [spring isolation devices]. Or
 - b)
 - c) Direct-drive fan(s) Blower assembly shall consist of an electric motor as specified by A / E. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor(s) shall be capable of continuous speed modulation and controlled by a factory supplied VFD.
3. Control center / connections: unit shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit [single-point high voltage power supply connections.
4. Direct Gas-Fired Burner:
 - a. Unit shall be factory assembled, piped and wired. Direct gas-fired system will be 92% efficient while supplying a burner that is capable of providing 25:1 turndown. Unit will utilize a draw through design and incorporate adjustable burner baffles plates for field adjustments. Unit will have a pilot ignition system.
 - b. Burner construction shall consist of a cast aluminum burner manifold and 400 series stainless steel mixing plates. No air from the inside space shall be allowed to pass across the burner at any time. Flame sensing shall be provided by a flame rod. A flame safeguard display shall be included. Burner control shall have a digital coded fault indicator capable of storing the last five faults.
 - c. Shall be equipped for operation on natural gas with a maximum rated inlet gas pressure of 1/2 psi. An External Gas pressure regulator shall be provided by the factory.

- d. Burner control options to include the following discharge temperature with room override.
- e. Shall include the following safety controls:
 - 1) Manual Reset, High Limit Switch: Main gas valve closes if high-limit temperature is exceeded.
 - 2) Dual safety shutoff valves shall be that do not exceed 120 VAC control signals.
 - 3) High and low Gas Pressure Switch(s): Main gas valve closes if high or low pressure switch faults.
 - 4) Visual indication: Clear visual signal demonstrating the position of the main gas safety shutoff valves. Visual indication provides a clear visual signal that demonstrates the position of the main safety shutoff valves.
- 5. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be double pitched, sloped in opposite directions to provide positive draining. Drain connector shall be sealed at penetration through cabinet wall.
- 6. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.
- 7. Packaged DX: Unit shall be equipped with a Packaged DX system to include compressor(s), evaporator and condenser coil(s), condenser fans and all appurtenant controls as specified elsewhere in this section. The Packaged DX system is to be an integral module, incorporated into the unit. Stand-alone Packaged DX systems that are connected to the unit or systems that require hardware or equipment that is not integral to the unit are not acceptable.
- 8. Motorized Inlet Air Damper: to be of low leakage type and shall be factory installed.
- 9. Sensors are considered to be part of various optional operational modes or device controllers and are to be factory supplied and installed as specified by the A/E. **See IOM / Sensors Installed by Factory.**
- 10. Curb Assembly: A curb assembly shall be made of galvanized steel provided by the factory for field assembly and installation as part of this division. [The curb shall include a duct adapter(s) for supply air [and return air]]. The installing contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly.
- 11. Service receptacle: 120 VAC GFCI service outlet shall be factory-provided and installed by this contractor in a location designated by the A/E.

D. BLOWER-DD

- 1. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower and must have neoprene vibration isolation devices, minimum of 1 – 1/8 inches thick.
- 2. Fan: Airfoil plenum fan statically and dynamically balanced. **Airfoil is only available on housing sizes 35 and larger.**
- 3. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, “Laboratory Methods of Testing Fans for Rating.”
- 4. Proceed with installation only after all unsatisfactory conditions have been corrected.

E. MOTORS

- 1. General: Blower motors greater than ¾ horsepower shall be “NEMA Premium™” unless otherwise indicated. Compliance with EPA minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty,

permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.

2. Motors shall be 60 cycles, 3 phase 460 volt.

F. UNIT CONTROLS

1. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied remote panel, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed Network interface controller that is connected to various optional sensors.
2. Sensors to be provided with the unit
 - a. Room / Space Temperature Sensors
 - b. Heating Inlet Air Sensor
 - c. Cooling Inlet Air Sensor
 - d. Dirty Filter Sensor
 - e. Fire Stat Type III
 - f. 120V/24V Smoke Detector

G. FILTERS

1. Unit shall have 2" thick permanent metal filters following the outdoor air intake in a V-bank arrangement and shall be accessible from the exterior of the unit.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
- B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.
- C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

3.3 CONNECTIONS

- A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.
 1. Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.
 2. Duct installation and connection requirements are specified in Division 23 of this document.
 3. Electrical installation requirements are specified in Division 26 of this document.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM. Insert any other requirements here.

3.5 START-UP SERVICE

- A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, and install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6 DEMONSTRATION AND TRAINING

- A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

END OF SECTION

SECTION 23 74 14
PACKAGED ROOFTOP AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Packaged Rooftop Air Handling Units, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ARI standard 210-66.
- B. Factory test coils.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Wiring diagrams.
 - 2. Control diagrams.
- B. Product Data:
 - 1. Packaged rooftop air handling units:
 - a. Certified performance data.
- C. Contract Closeout Information:
 - 1. Operating and maintenance data:
 - 2. Owner instruction report.

PART 2 - PRODUCTS

2.1 PACKAGED ROOFTOP UNIT

- A. Acceptable manufacturers:
 - 1. Packaged rooftop units:
 - a. Base:
 - 1) Aeon.
 - b. Optional:
 - 1) Venmar
 - 2) Daikin
 - 2. Other manufacturers desiring approval comply with Section 01 25 13.
- B. Provide packaged rooftop units, factory assembled, piped, internally wired and fully charged with R-410A.
 - 1. Design to operate at outdoor ambient temperatures as from 0°F to 120°F.
 - 2. Cooling and heating capacities rated in accordance with ARI standards.
 - 3. Design certified by American Gas Association (AGA), specifically for outdoor applications using propane or natural gas.
 - a. Cooling units UL listed.

 - 4. Designed for outdoor rooftop or ground level installation.

5. Exterior surfaces of units phosphatized, galvanized steel with epoxy resin primer and baked enamel finish.
6. Capacity: As scheduled.
7. Casings: Double wall G-90 construction.
 - a. Foam insulation with R-13 and L-240 deflection.
 - b. Integral unit lifting lugs.
 - c. Base pan shall be foam insulated.
 - d. Access doors shall include stainless steel piano hinges.
8. Refrigeration controls:
 - a. Single or dual circuited as required for capacity.
 - b. Include condenser fan, evaporator fan and compressor contactors, and 24 volt transformer.
 - c. Separate set of refrigerant controls for each circuit.
 - d. Safety controls include high and low pressure controls and compressor overloads.
 - e. Refrigeration circuits shall be equipped with thermal expansion valve type refrigerant flow control.
9. Compressors:
 - a. Hot gas bypass shall be provided on VAV units.
 - b. Constant speed scroll compressors
 - c. Equipped with over temperature, over current and high pressure controls.
 - d. Furnish Crankcase heaters.
10. Evaporator coil:
 - a. 1 or 2 independent circuits as required.
 - b. 3/8 IN, OD seamless copper tubing mechanically bonded to aluminum fins (spiral fins are not acceptable).
 - c. Factory pressure and leak tested at 225 PSIG.
 - d. Split or spline aluminum fins not acceptable.
 - e. Coils shall be minimum 3 row.
 - f. Face velocities shall not exceed 550 ft/min, no exceptions.
11. Drain pans:
 - a. Evaporator drain shall be double sloped 304 stainless steel.
 - b. Evaporator pan internally sealed and insulated.
 - c. Threaded drain connection in evaporator section, drain opening in condensing section.
12. Condenser coil:
 - a. Single or dual circuited as required.
 - b. 3/8 IN, OD seamless copper tubing mechanically bonded to aluminum fins.
 - c. Factory pressure and leak tested at 425 PSIG.
13. Indoor air fan:
 - a. Direct drive, un-housed, backward curved, plenum fan.
 - b. Motor thermally overload protected with permanently lubricated fan and motor bearings.
 - c. Motors shall be premium efficiency ODP type.
 - d. Fan drive components mounted on rubber-in-shear isolators.
14. Exhaust air fan:
 - a. Fans shall be capable of 100% exhaust.
 - b. Motors shall be premium efficiency ODP type.
 - c. Required to maintain building pressure.
15. Condenser fans:
 - a. Direct drive, statically and dynamically balanced propeller fans.
 - b. Weatherproofed PSC fan motors UL listed for outdoor use.
 - 1) Built-in thermal overload protection.
16. Gas fired heating section:
 - a. Completely assembled, wired and piped, gas fired heating systems within unit.
 - b. Threaded gas connection on unit.

17. Heat exchanger:
 - a. Embossed, formed and seamed 304 stainless steel
 - b. Factory tested for gas leaks.
 - c. Stress relieved, free floating design.
18. Burners: Stamped and seamed welded 304 stainless steel
19. Force combustion blower:
 - a. Insure flame stability under varying wind conditions.
 - b. Combustion blower motor not in hot air stream.
20. Electronic ignition system:
 - a. Pilot to light each time thermostat calls for heat.
 - b. Flame sensor to prove pilot flame and turn on main burners.
 - 1) Should a loss of pilot flame occur, main valve closes and a spark re-occurs within 0.8 seconds
 - c. When thermostat is satisfied both pilot and main burner are extinguished.
21. Gas valves:
 - a. 2 stage gas valves on CAV units.
 - b. Modulating gas valves on VAV units.
22. Variable Frequency Drives (VFD):
 - a. Supply and exhaust fans shall be equipped with factory-mounted and wired VFD.
23. Anti-short cycle: Lockout timer to provide minimum OFF time of 5 minutes between compressor cycling.
24. Filters:
 - a. 4 IN MERV 8 filters.
25. Supply and return casing:
 - a. Constructed and insulated with same materials as rooftop unit.
 - b. Furnish for horizontal units to provide a complete, watertight down flow configuration.
 - c. Include base pan and attachments for concentric ductwork where required.
26. Roof mounting:
 - a. Vibration isolation roof curb designed to mate with unit and provide complete support and watertight installation.
 - b. 1 IN spring isolators minimum.
 - c. 14 GA galvanized steel with a wood nailer.
 - d. Built in counter-flashing sealed with 3/4 IN x 3 IN neoprene gasketing
 - e. Provide curbs as required for a level installation, regardless of roof slope.
 - f. Roof Curbs: Minimum 18 IN high.
 - g. Manufacturer: Thycurb or equal.
27. Temperature controls:
 - a. Furnish controls, factory or field-mounted, as required for complete operation.
 - b. Enclosure:
 - 1) Unit shall be shipped complete with factory configured, installed, wired and tested single packaged unit controller housed in a rain and dust tight NEMA 3R/12 (IP55) powder painted steel cabinet with hinged, latched, and gasket sealed door.
 - c. Basic Controls:
 - 1) Control shall include automatic start, stop, operating, protection sequences across the range of scheduled conditions and transients. The single packaged unit controller shall provide automatic control of compressor start/stop, energy saver delay and anti-recycle timers, condenser fans, and unit alarms. Automatic reset to normal operation after power failure. Software stored in non-volatile memory, with programmed setpoints retained in lithium battery backed real time clock (RTC) memory for minimum 5 years. LCD, descriptions and numeric data in English (or Metric) units. Sealed keypad with sections for Setpoints, Display, Entry, Unit Options & clock, and an On/Off Switch. Unit shall be capable of being programmed for smoke purge sequences as required.
 - d. Diagnostics:
 - 1) Upon startup of the controller, it shall run through a self-diagnostic check to verify proper operation and sequence loading. The single packaged unit controller shall

- continually monitor all input and output points on the controller to maintain proper operation. The unit shall continue to operate in a trouble mode or shut down as necessary to prevent an unsafe condition for the building occupants, or to prevent damage to the equipment.
- e. BMCS Communications:
 - 1) BACnet MSTP (RS-485) or BACnet IP: The unit shall include BACnet communications directly from the unit controller. Equipment that is not native BACnet at the unit control board shall include any necessary interface or translator device factory-mounted and wired within the unit. A control points list, BIBBs and PICS statement shall be provided by the manufacturer to facilitate communications programming with the building automation system. Programming, establishing communications and commissioning shall be the responsibility of the installing controls contractor. Inputs: supply air reset, duct static pressure reset, building static pressure reset, ventilation override, morning warm-up and demand limiting.
 - 2) Outputs: fault alarms for sensors, cooling or heating failure, supply fan faults, and dirty filter faults
 - 3) Manufacturer shall include 1/2 day per unit to assist in assuring that the BMCS system is communicating properly.
 - f. Furnish a packaged combined status panel and thermostat (installed and wired under Section 25 50 00 work).
 - g. Status panel with following signal lights:
 - 1) Three signal lights to indicate power outage, clogged filters, and reset relay.
 - 2) Power signal shows green indicating power available to unit.
 - 3) Power signal shows red when electrical service is interrupted.
 - 4) Filter signal shows red when filters clog and need replacement.
 - 5) Reset signals show red if system is out on cooling safety controls.
28. Power Exhaust/Relief Fan:
 - a. Provide power exhaust/relief fan with integral speed control.
29. Electrical:
 - a. Provide dual point power connection for all rooftop units.
 - b. Unit-mounted and wired non-fused disconnect switches for each connection.
 - 1) Controls, furnace and fans on one connection
 - 2) Refrigeration: compressors and condenser fan on one connection
30. Warranty:
 - a. Furnish whole unit 12/18 (start-up/shipment) parts warranty.
 - b. Provide additional 4 year non-prorated compressor parts warranty.
 - c. Provide 10 year non-prorated warranty on heat exchanger.
31. Manufacturer's responsibilities/services:
 - a. Unit checkout and start-up
 - b. Controls interface coordination as required.
 - c. 8 hours of Owner training during normal business hours.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accord with manufacturer's instructions and recommendations.

3.2 VIBRATION ISOLATION

- A. Vibration isolation: section 20 05 50.

END OF SECTION

SECTION 23 74 23

PACKAGED OUTDOOR, HEATING - ONLY MAKEUP - AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Packaged Rooftop Air Handling Units, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ARI standard 210-66.
- B. Factory test coils.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Wiring diagrams.
 - 2. Control diagrams.
- B. Product Data:
 - 1. Packaged rooftop air handling units:
 - a. Certified performance data.
- C. Contract Closeout Information:
 - 1. Operating and maintenance data:
 - 2. Owner instruction report.

PART 2 - PRODUCTS

2.1 PACKAGED ROOFTOP UNIT

- A. Acceptable manufacturers:
 - 1. Packaged rooftop units:
 - a. Base:
 - 1) Aeon.
 - b. Optional:
 - 1) Venmar
 - 2) Daikin
 - 2. Other manufacturers desiring approval comply with Section 01 25 13.
- B. Provide packaged rooftop units, factory assembled, piped, internally wired and fully charged with R-410A.
 - 1. Design to operate at outdoor ambient temperatures as from 0°F to 120°F.
 - 2. Heating capacities rated in accordance with ARI standards.
 - 3. Design certified by American Gas Association (AGA), specifically for outdoor applications using propane or natural gas.
 - a. Cooling units UL listed.
 - 4. Designed for outdoor rooftop or ground level installation.
 - 5. Exterior surfaces of units phosphatized, galvanized steel with epoxy resin primer and baked enamel finish.
 - 6. Capacity: As scheduled.
 - 7. Casings: Double wall G-90 construction.

- a. Foam insulation with R-13 and L-240 deflection.
 - b. Integral unit lifting lugs.
 - c. Base pan shall be foam insulated.
 - d. Access doors shall include stainless steel piano hinges.
8. Indoor air fan:
 - a. Direct drive, un-housed, backward curved, plenum fan.
 - b. Motor thermally overload protected with permanently lubricated fan and motor bearings.
 - c. Motors shall be premium efficiency ODP type.
 - d. Fan drive components mounted on rubber-in-shear isolators.
 9. Gas fired heating section:
 - a. Completely assembled, wired and piped, gas fired heating systems within unit.
 - b. Threaded gas connection on unit.
 10. Heat exchanger:
 - a. Embossed, formed and seamed 304 stainless steel
 - b. Factory tested for gas leaks.
 - c. Stress relieved, free floating design.
 11. Burners: Stamped and seamed welded 304 stainless steel
 12. Force combustion blower:
 - a. Insure flame stability under varying wind conditions.
 - b. Combustion blower motor not in hot air stream.
 13. Electronic ignition system:
 - a. Pilot to light each time thermostat calls for heat.
 - b. Flame sensor to prove pilot flame and turn on main burners.
 - 1) Should a loss of pilot flame occur, main valve closes and a spark re-occurs within 0.8 seconds
 - c. When thermostat is satisfied both pilot and main burner are extinguished.
 14. Gas valves:
 - a. 2 stage gas valves on CAV units.
 - b. Modulating gas valves on VAV units.
 15. Variable Frequency Drives (VFD):
 - a. Supply and exhaust fans shall be equipped with factory-mounted and wired VFD.
 16. Anti-short cycle: Lockout timer to provide minimum OFF time of 5 minutes between compressor cycling.
 17. Filters:
 - a. 4 IN MERV 8 filters.
 18. Supply and return casing:
 - a. Constructed and insulated with same materials as rooftop unit.
 - b. Furnish for horizontal units to provide a complete, watertight down flow configuration.
 - c. Include base pan and attachments for concentric ductwork where required.
 19. Roof mounting:
 - a. Vibration isolation roof curb designed to mate with unit and provide complete support and watertight installation.
 - b. 1 IN spring isolators minimum.
 - c. 14 GA galvanized steel with a wood nailer.
 - d. Built in counter-flashing sealed with 3/4 IN x 3 IN neoprene gasketing
 - e. Provide curbs as required for a level installation, regardless of roof slope.
 - f. Roof Curbs: Minimum 18 IN high.
 - g. Manufacturer: Thycurb or equal.
 20. Temperature controls:
 - a. Furnish controls, factory or field-mounted, as required for complete operation.
 - b. Enclosure:
 - 1) Unit shall be shipped complete with factory configured, installed, wired and tested single packaged unit controller housed in a rain and dust tight NEMA 3R/12 (IP55) powder painted steel cabinet with hinged, latched, and gasket sealed door.
 - c. Basic Controls:

- 1) Control shall include automatic start, stop, operating, protection sequences across the range of scheduled conditions and transients. The single packaged unit controller shall provide automatic control of gas furnace and unit alarms. Automatic reset to normal operation after power failure. Software stored in non-volatile memory, with programmed setpoints retained in lithium battery backed real time clock (RTC) memory for minimum 5 years. LCD, descriptions and numeric data in English (or Metric) units. Sealed keypad with sections for Setpoints, Display, Entry, Unit Options & clock, and an On/Off Switch. Unit shall be capable of being programmed for smoke purge sequences as required.
- d. Diagnostics:
 - 1) Upon startup of the controller, it shall run through a self-diagnostic check to verify proper operation and sequence loading. The single packaged unit controller shall continually monitor all input and output points on the controller to maintain proper operation. The unit shall continue to operate in a trouble mode or shut down as necessary to prevent an unsafe condition for the building occupants, or to prevent damage to the equipment.
- e. BMCS Communications:
 - 1) BACnet MSTP (RS-485) or BACnet IP: The unit shall include BACnet communications directly from the unit controller. Equipment that is not native BACnet at the unit control board shall include any necessary interface or translator device factory-mounted and wired within the unit. A control points list, BIBBs and PICS statement shall be provided by the manufacturer to facilitate communications programming with the building automation system. Programming, establishing communications and commissioning shall be the responsibility of the installing controls contractor. Inputs: supply air reset, duct static pressure reset, ventilation override, morning warm-up and demand limiting.
 - 2) Outputs: fault alarms for sensors, cooling or heating failure, supply fan faults, and dirty filter faults
 - 3) Manufacturer shall include 1/2 day per unit to assist in assuring that the BMCS system is communicating properly.
- f. Furnish a packaged combined status panel and thermostat (installed and wired under Section 25 50 00 work).
- g. Status panel with following signal lights:
 - 1) Three signal lights to indicate power outage, clogged filters, and reset relay.
 - 2) Power signal shows green indicating power available to unit.
 - 3) Power signal shows red when electrical service is interrupted.
 - 4) Filter signal shows red when filters clog and need replacement.
 - 5) Reset signals show red if system is out on cooling safety controls.
21. Electrical:
 - a. Provide dual point power connection for all rooftop units.
 - b. Unit-mounted and wired non-fused disconnect switches for each connection.
 - 1) Controls, furnace and fans on one connection
 - 2) Refrigeration: compressors and condenser fan on one connection
22. Warranty:
 - a. Furnish whole unit 12/18 (start-up/shipment) parts warranty.
 - b. Provide additional 4 year non-prorated compressor parts warranty.
 - c. Provide 10 year non-prorated warranty on heat exchanger.
23. Manufacturer's responsibilities/services:
 - a. Unit checkout and start-up
 - b. Controls interface coordination as required.
 - c. 8 hours of Owner training during normal business hours.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accord with manufacturer's instructions and recommendations.

3.2 VIBRATION ISOLATION

A. Vibration isolation: section 20 05 50.

END OF SECTION

SECTION 23 81 29
VARIABLE REFRIGERANT FLOW HVAC SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Unitary Split Air Conditioners, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 WORK INCLUDED

- A. Provide and install a multiple evaporator, direct expansion, variable capacity air conditioning system with simultaneous cooling and heating. System shall consist of multiple fan coil units, branch selector boxes, refrigerant piping joints and headers, control wiring, sensors and matched variable speed outdoor heat recovery condensing units.

1.3 QUALITY ASSURANCE

- A. Units factory tested.
- B. All system wiring, internal and external to components, shall be in accordance with the National Electrical Code.
- C. System shall be safety certified by ETL and be UL listed.
- D. All units shall be certified, for both performance and efficiency, to AHRI 1230 standard.

1.4 PERFORMANCE

- A. Provide performance as scheduled on drawings.
- B. Each fan coil unit or group of fan coil units associated with each individual branch cool/heat selector box shall be independently capable of operating in either heating or cooling mode regardless of the modes of the other zones on the system. The system shall have a five minute maximum cooling/heating changeover time.
- C. Each zone shall be capable of operating separately with individual temperature controls.

1.5 SUBMITTALS

- A. Product Data:
 - 1. Literature shall be provided that indicates dimensions, operating and shipping weights, certified capacities, ratings, factory supplied accessories, electrical characteristics, and connection requirements. Installation, Operation and Maintenance manual with startup requirements shall be provided.
- B. Shop Drawings:
 - 1. Unit drawings shall be provided that indicates assembly, unit dimensions, construction details, service and air flow clearances, and connection details. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

- C. Submit a manufacturer generated detailed refrigerant piping diagram indicating each condensing unit system, each fan coil unit, each branch selector boxes, each line length and each line size.
- D. Submit coordination drawings as specified. Give consideration to adjacent structures as they affect air flow patterns.
- E. Provide a comprehensive list of the total pounds on refrigerant and type of refrigerant required by each variable refrigerant volume system.
- F. Submit sequence of operation in narrative form.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Variable Refrigerant Flow HVAC System:
 - 1. LG.
 - 2. Carrier.
 - 3. Mitsubishi.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Simultaneous Heating and Cooling Outdoor Unit:
 - 1. General:
 - a. The outdoor unit shall be used with only variable refrigerant volume system components of the same manufacturer.
 - b. Unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. Dual and triple frame outdoor units shall be field piped with factory supplied fittings per the manufacturer's instruction.
 - c. The units' onboard controls shall perform all functions required to effectively and efficiently operate the variable refrigerant volume system.
 - d. Each unit shall be run tested at the factory.
 - e. The unit shall incorporate an auto-charging feature and a refrigerant charge check function. If units are provided without the auto-charge feature, a factory service representative must be present at startup.
 - f. The unit shall include an automatic oil recovery cycle which occurs 2 hours after startup and then once every 8 hours of operation.
 - g. The unit shall be provided with a minimum of the following safety devices; high pressure switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal compressor protectors, thermal fan motor protectors, overcurrent protection for the inverter and anti-short cycling timers.
 - h. The system shall store all setting and programs such that reprogramming is not required upon power failure. In addition, the system shall automatically restart operation after a power failure.
 - i. Unit shall be capable of operating in simultaneous cooling and heating mode down to 20°F and up to 85°F ambient dry bulb.
 - j. Unit shall have a tested sound rating no higher than 58 dB throughout the full range of unit capacity modulation.
 - k. System shall be designed for use with R410a refrigerant.
 - 2. Frame and Casing:
 - a. Shall be constructed of galvanized steel and finished with powder coat baked enamel paint.
 - b. Provide with access panels at control boards, fans, motors and expansion valves. Access panels shall not require a unique tool for removal.
 - 3. Compressor:
 - a. Compressors shall be hermetic digitally controlled inverter driven scroll type.

- b. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protection device.
 - c. The compressor inverter shall permit a capacity control range from 10% to 100%.
 - d. Compressors shall be isolated from the frame with the compressor manufacturer's recommended rubber vibration isolators.
 - e. Unit shall utilize a refrigerant not scheduled for phase out during life of the unit.
 - f. In the case of multiple condensing unit modules, the units' internal controls shall contain a duty cycling function to ensure balanced compressor service hours; sequential starting and starting of each module, completion of oil return and completion of defrost cycle.
4. Fan:
- a. Fan shall be direct drive variable speed propeller type.
 - b. Fan shall be configured for vertical discharge airflow.
 - c. Fan motor shall have inherent protection and have permanently lubricated bearings.
 - d. All fans shall be provided with a raised guard to limit contact with moving parts.
 - e. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature.
 - f. Operation sound level shall be selectable from 3 steps as shown below.

Operation Sound (dB)	Night Mode Maximum Sound Pressure Level (dB)
Step 1	55
Step 2	50
Step 3	45

5. Condenser Coil:
- a. Provide copper tubes with mechanically bonded aluminum fins and aluminum end casings.
 - b. Provide factory installed louvered hail / vandalism guards for condenser coils.
 - c. Provide coils with a factory applied corrosion resistant coating.
6. Electrical and Controls:
- a. Unit shall be provided with electrical power characteristics as specified on drawings.
 - b. Unit shall be capable of operation within voltage limits of +/- 10%.
 - c. Low voltage control power shall be factory provided from the units' main power supply. A separate control voltage power supply shall not be required.
 - d. The system shall be controlled by integral microprocessors.
- B. Branch Controllers:
- 1. Branch controllers shall be designed for use with VRF equipment of the same manufacturer. The branch controller casing shall be constructed of galvanized steel and shall be internally insulated so as not to require a condensate drain.
 - 2. The branch controller shall have 2, 3, or 4 ports as required. The unit shall contain piping, valves, and controls to divert refrigerant controlling each port to operate in either a heating or cooling mode. Units shall be completely factory assembled, internally piped and wired.
 - 3. Branch controllers shall have factory installed control boards that interface with the VRF equipment controls and shall perform all functions to effectively and efficiently control simultaneous heat and cooling.
 - 4. Isolation valves shall be field supplied and installed for ease of service to the branch controller without evacuating the entire system refrigerant charge.

- C. Variable Refrigerant Volume Indoor Units:
 - 1. General:
 - a. Unit shall be a simultaneous heating and cooling variable refrigerant volume system of the same manufacturer.
 - b. Equipped with a factory installed electronic expansion valve.
 - c. Each unit shall be factory assembled, wired and run tested.
 - d. Unit shall be equipped with a condensate pan.
 - e. Casing shall be constructed of galvanized steel.
 - f. Provide copper tubes with mechanically bonded aluminum fins and aluminum end casings.
 - g. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with a minimum of three fan speeds.
 - h. Units shall be provided filled with a dry nitrogen charge from the factory.
 - i. Where indicated provide factory installed and wired condensate pump that will be able to lift condensate 27 inches above the drain pan.
 - j. Provide wall mounted programmable thermostat for each unit. Thermostat shall communicate with a master controller.
 - 2. Wall-mounted indoor unit
 - a. Wall-mounted indoor units shall protrude from the wall no more than 7 inches.
 - b. Unit Cabinet:
 - 1) The unit casing shall have a pearl white finish.
 - 2) Multi directional refrigerant piping up to four (4) directions shall be standard.
 - 3) Multi directional drain piping up to two (2) directions shall be standard.
 - 4) The indoor unit shall attach to a separate back plate that secures the unit to the wall.
 - c. Filter:
 - 1) Return air shall be filtered with a factory supplied removable, washable filter.
 - 2) Where indicated furnished as standard with a factory installed plasma filter with no additional external power supply required.
- D. Controls:
 - 1. Unit control boards shall perform all functions required to effectively and efficiently operate the VRF system and communicate in a daisy chain configuration from outdoor unit to indoor units via RS485.
 - 2. Provide system with BACNET control interface module. BMCS shall have the ability to control ON/OFF of individual zone units, adjust operating set points and monitor trouble alarms.
 - 3. Provide each unit with a remote temperature sensor.
 - 4. The control voltage between the indoor and outdoor unit shall be 16VDC non-shielded, stranded 2 conductor cable. A separate control voltage power supply shall not be required. The control power voltage shall be factory provided from the indoor/outdoor unit's main incoming power.
 - 5. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable wire, thus simplifying the wiring operation. Manufacturer shall provide control wiring diagram with equipment submittals.

2.3 REFRIGERANT PIPING AND ELECTRICAL WORK

- A. Piping, refrigerant for quick-connect installations: Pre-charged, factory assembled, in standard lengths.
 - 1. Female couplings.
 - 2. Suction line: Foam plastic insulated.
 - 3. Provide gauge ports at condenser.
- B. Piping, refrigerant, for field assembled piping: See Section 23 23 00.
- C. Control wiring: Provide wiring between components for control functions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be installed by a manufacturer's factory trained and certified contractor. Submit proof of factory certified training with bid package.
- B. Install according to manufacturer's recommendations and as shown on drawings.
- C. Installing contractor shall install field installed components, in accordance with Installation, Operation and Maintenance manual instructions.
- D. Manufacturer shall inspect, test and adjust field assembled components and equipment installation, including connection, and assist in field testing. Report all findings to the architect and engineering in writing.
- E. Manufacturer or factory-authorized representative shall visit the site regularly during the installation process to ensure proper means and methods are being employed. Include a minimum of two (2) such visits.

END OF SECTION

SECTION 23 82 43
ELECTRIC HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Electric Heaters, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Electric heaters.
 - a. Catalog cuts.
 - b. Wiring diagrams.
 - c. Performance data.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - 2. Owner instruction report.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Electric duct heaters:
 - 1. Base:
 - a. Redd-i.
 - 2. Optional:
 - a. Brasch Manufacturing.
 - b. Q-Mark.
 - c. Besco.
 - d. Markel.
 - e. Industrial Engineering & Equipment.
 - f. Indeeco.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Electric duct heaters:
 - 1. Coils of size, type, and capacity as scheduled.
 - 2. Open coil design.
 - 3. Heaters UL listed for zero clearance and meet requirements of 1987 National Electric Code.
 - 4. Furnish each heater with 2 over temperature safety devices.
 - a. Serviceable and replaceable in terminal box without removing heater from duct.
 - b. Primary safety device disc type automatic reset.
 - 1) Cut heater OFF on over temperature.
 - 2) Automatically bring heater back ON when surrounding temperature has cooled.
 - c. Second safety device heat limiters in power lines.
 - 1) Open circuit and de-energize elements if primary safety device should fail.
 - 5. Terminal box and frame:
 - a. 20 GA aluminized steel sufficiently formed and braced to assure structural rigidity of entire heater assembly.
 - b. Terminal box and lid totally enclosed and free from perforations or louvers.

6. Elements:
 - a. High grade nickel.
 - b. Held in place with floating steatite ceramic bushings, held in place by minimum 20 GA brackets.
 - c. Bracket completely surround ceramic bushing.
 - 1) 1/32 IN total clearance between bushing and metal.
 - 2) 1/8 IN stiffening angles on each side of every bushing in direction of air flow.
 - d. Brackets replaceable in field without welding.
 - e. Brackets of sufficient strength so element wire cannot cause brackets to bend.
7. Furnish each heater with exact as is wiring diagram.
 - a. Typical wiring diagrams not acceptable.
8. Heaters slip-in design type.
9. Controls: Furnish factory mounted, as required for complete operation, as follows:
 - a. Air pressure switch.
 - b. 24 V magnetic contactors for _____ stage(s) of heat.
 - c. Overcurrent protection as required by NEC and UL.
 - d. Thermostat, control relays, and transformer furnished under Section _____.
 - 1) Installed and wired under Section 25 50 00.
10. Vapor retarder insulation on terminal box.
11. Provide disconnect switch so designed that power and control lines to heater terminal panel are dead when hinged terminal panel lid is opened.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct heaters as indicated and in accordance with manufacturer's recommendations and instructions.
- B. Provide wiring diagrams and supervise installation, wiring and control wiring of units.

END OF SECTION



DIVISION 25

INTEGRATED AUTOMATION



SECTION 25 50 00
BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Building Management and Control System, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 DESCRIPTION

- A. BMCS system shall be fully integrated with the existing Alerton energy management control system in compliance with the performance requirements set forth in this specification. Equipment provided herein shall be required to communicate through a facility wide BMCS workstation by means of full binary interface to maintain operations for Denton County personnel. Include additional software or hardware required to maintain the integrity of the existing facility wide system. DDC hardware and software introduced as part of this project shall not alter integrity of existing facility wide system.
- B. Building Management and Control System (BMCS) incorporating Direct Digital Control (DDC), energy management and equipment monitoring consisting of the following elements:
 - 1. Microprocessor based remote control panels interfacing directly with sensors, actuators, and environmental delivery systems to provide complete standalone DDC/EMS functionality. (i.e., HVAC equipment, etc.).
 - 2. Communication network to allow data exchange between remote panels and central building management computer.
 - 3. Personal computer (PC) based central and associated operator station(s), and software functioning as the primary operator interface for BMCS. System shall utilize a graphics front end.
 - 4. Electric and electronic control for all items indicated including dampers, valves, panels and pneumatic and electrical installation.
- C. Air terminal unit damper operators and controls: Provide DDC controllers and actuators under this section.
- D. Smoke and fire/smoke dampers and operators are provided under Specification Section 23 31 13. Power connection to smoke and fire/smoke dampers shall be provided under Electrical Specification Divisions. Damper end switches shall be provided and wired under this section.
- E. Control dampers: Control dampers less actuators are provided under Section 23 31 13. Provide actuators for control dampers under this section.
- F. Duct mounted smoke detectors are to be furnished and wired under Electrical Specification Divisions. The detectors shall be mounted in compliance with Section 23 31 13.
- G. Provide submittals, installation, data entry, programming, startup, test and validation of BMCS, instruction of Owner's representative on maintenance and operation of BMCS, as-built documentation, and system warranty.
- H. Completely coordinate with work of other trades.

1.3 QUALITY ASSURANCE

- A. System installed by mechanics with responsibility for operation of BMCS, including debugging and calibration of each component in system.
- B. Codes and Approvals:

1. Complete BMCS installation to be in strict accordance with national and local electrical codes, and Electrical Specification Divisions of these specifications. All devices designed for or used in line voltage applications to be UL listed.
 2. Microprocessor based remote devices: UL916 and UL864 listed.
 3. BMCS central equipment: UL916 listed.
 4. Electrical environmental control and monitoring devices: UL429 and/or UL873 listed.
 5. Electronic equipment: Label and comply with requirements of FCC regulation Part 15, Section 15 governing radio frequency electromagnetic interference for Class A computing devices.
 6. UL standards:
 - a. UL429 Electrically Operated Valves
 - b. UL555 Fire Dampers
 - c. UL873 Temperature Indicating and Regulating Equipment
 - d. UL916 Energy Management Equipment.
 7. NFPA Standards and Guides:
 - a. NFPA-70 National Electric Code
 - b. NFPA-90A Air Conditioning Systems
 - c. NFPA-90B Warm Air Heating, Air Conditioning.
- C. System Components:
1. Fault tolerant.
 2. Provide satisfactory operation without damage at 110 PCT and 85 PCT of rated voltage, and at +/- 3 hertz variation in line frequency.
 3. Provide static, transient, short circuit, and surge protection on all inputs and outputs. Communication lines to be protected against incorrect wiring, static transients, and induced magnetic interference. Bus connected devices to be a.c. coupled, or equivalent so that any single device failure will not disrupt or halt bus communication.
 4. All real time clocks and data file RAM to be battery or capacitor backed.
- D. System Overall Reliability Requirement:
1. Configure system and install to yield a Mean Time Between Failure (MTBF) at least 1000 HRS.
- E. System Accuracy and Display:
1. Maintain system end-to-end accuracy for 1 year from sensor to Operator's console display for applications specified and shall display value as specified.
- F. Rate field equipment for continuous operation under ambient environmental conditions of 35 to 120 DEGF dry bulb and 10 to 95 PCT relative humidity, non-condensing.
1. Rate instrumentation and control elements for continuous operation under ambient environmental temperature, pressure, humidity and vibration conditions specified or normally encountered for installed location.

1.4 SUBMITTALS

- A. Shop Drawings:
1. Complete system design information including:
 - a. Data entry forms for initial parameters. All text and graphics to be approved prior to data entry.
 - b. Valve, and damper schedules showing:
 - 1) Size.
 - 2) Configuration.
 - 3) Capacity.
 - 4) Location.
 - c. Wiring and piping interconnection diagrams, including panel and device power and sources.
 - d. Equipment lists (bill of materials) of all proposed devices and equipment.
 - e. Software design data including:

- 1) Flow chart of each DDC program showing interrelationship between inputs, PID functions, all other functions, outputs, etc.
 - 2) Sequence of operation relating to all flow chart functions.
 - f. Control sequence.
 - g. DDC installation, block diagrams, and wiring diagrams for each piece of equipment.
 - h. DDC panel physical layout and schematics.
 - i. Building level overview of control system architecture.
- B. Product Data:
- 1. Complete list of product data including:
 - a. Data sheets of all products.
 - b. Valve, damper, and well and tap schedules showing size, configuration, capacity, and location of all equipment.
- C. Project Information:
- 1. Certification of installer qualifications.
- D. Contract Closeout Information:
- 1. Operation and Maintenance Data:
 - a. See Section 01 78 23.
 - 2. As Built Instrumentation and Control Diagrams at 1/8 IN scale showing:
 - a. Communication cable circuiting drawing with DDC panels and communication devices labeled.
 - b. Power wiring circuiting drawing showing 120 volt circuit source and low voltage transformer locations, identifications, and circuit roués to each controlled device per transformer for the DDC system.
 - c. See Section 01 78 39.
 - 3. Owner instruction report.
 - a. Certification that Owner Training has been provided by BMCS installer.
 - b. See Section 01 79 00.

1.5 WARRANTY

- A. All components, system software, parts, and assemblies supplied by BMCS manufacturer to be guaranteed against defects in materials and workmanship for one year from acceptance date.
- B. Labor to troubleshoot, repair, reprogram, or replace system components shall be furnished by BMCS installer at no charge to Owner during warranty period.
- C. All corrective software modifications made during warranty service periods to be updated on all user documentation and on user and manufacturer archived software disks.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Temperature Control System:
 - 1. Base:
 - a. Alerton by Climatec
- B. Air Flow Monitoring Stations:
 - 1. Base:
 - a. Air Monitor.
 - 2. Optional:
 - a. Ebtron.
 - b. Tek Air.
 - c. Paragon.
- C. Chilled Water Flow Meters:
 - 1. Base:

- a. Emco.
- 2. Optional:
 - a. Rosemont.
 - b. Onicon.

D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Temperature Control System:

- 1. Include:
 - a. Temperature sensors.
 - b. Humidity sensors.
 - c. Controllers.
 - d. Switches.
 - e. Relays.
 - f. Valves.
 - g. Dampers.
 - h. Damper operators.
 - i. Thermostats.
 - j. Humidistats.
 - k. Hygrometers.
 - l. Other associated controls required to maintain conditions described on drawings, together with thermometers, gauges and other accessory equipment.
- 2. Provide complete system of wiring and air piping as necessary to fill intent of these specifications.
- 3. Control sequences indicated illustrate basic control functions only.
- 4. Provide additional controls required to meet intent of these specifications and make a complete system.
- 5. Space temperature and humidity control.
- 6. Control of air handling units.
- 7. Control of exhaust systems.
- 8. Control of cooling systems.
- 9. Control of heating systems.
- 10. Control panels.

B. Where electronic sensing is used, furnish amplifier relays and transformer complete with overload protection.

C. Electrical drawings indicate type of motor control required by equipment.

2.3 CENTRAL OPERATORS WORK STATION

A. Existing central operators work station shall be reused. All new direct digital controls shall interface with existing work station.

B. Central BMCS Workstations:

- 1. Interface with the existing operators work station located in the Denton County Facilities Department. The existing Alerton front end software will be expanded to the new building.

2.4 WEB BASED SYSTEM

A. BMCS Architecture

- 1. Overall Conceptual Description
 - a. The BMCS shall be designed entirely for use on intranets and internets. All networking technology used at the Tier 1 level shall be off the shelf, industry standard technology fully compatible with other owner provided networks in the facility.
 - b. All aspects of the user interface, whether to servers or to Tier 1 solid state devices, shall be via browsers. Any PCs used as operator interface points shall not require the purchase of any special software from the manufacturer in order to provide the complete user interface as described herein.

- c. The user interface will be complete as described herein, providing complete tool sets, operational features, multi-panel displays, and other display features. Systems which merely provide HTML based web pages as the operator interface will not be acceptable.
 - d. The primary components of the system will be the Primary Application Nodes and Servers located at the highest level of the network architecture. Both will use the same user interface and provide the same level of accessibility via the network. The only distinction between the user interface used on servers as compared to Primary Application Nodes will be select menu items used for accessing long term storage features on the servers or on their respective archive devices (CD/RW, etc.)
2. General
- a. The BMCS shall consist of a number of Nodes and associated equipment connected by industry standard network practices. All communication between Nodes shall be by digital means only.
 - b. The BMCS network shall at minimum comprise of the following:
 - 1) Operator PCs – fixed or portable.
 - 2) Network processing, data storage and communication equipment including file servers.
 - 3) Routers, bridges, switches, hubs, modems and like communications equipment.
 - 4) Active processing Nodes including field panels.
 - 5) Intelligent and addressable elements and end devices.
 - 6) Third-party equipment interfaces.
 - 7) Other components required for a complete and working BMCS.
 - c. All BMCS features shall be accessible via Enterprise Intranet and Internet browser with equivalent BMCS access control for user access.
 - d. The BMCS shall support auto-dial/auto-answer communications to allow BMCS Nodes to communicate with other remote BMCS Nodes via standard telephone lines. Refer to drawings for type of line to be used, DSL or voice grade. Where no preference is indicated, DSL is the preferred grade.
 - e. The PC Workstations, File servers and principal network equipment shall be standard products of recognized major manufacturers available through normal PC vendor channels. “Clones” are not acceptable.
 - f. Provide licenses for all software residing in the BMCS system and transfer these licenses to the Owner prior to completion.
3. Network
- a. The BMCS shall incorporate a primary Tier 1 network. At the installer’s option, the BMCS may also incorporate integrated secondary Tier 2 and tertiary Tier 3 networks.
 - b. The BMCS Network shall utilize an open architecture capable of all of the following:
 - 1) Utilizing standard Ethernet communications and operate at a minimum speed of 10/100 Mb/sec
 - 2) Connecting via BACnet at the Tier 1 level in accordance with as per ANSI/ASHRAE Standard 135-2001.
 - 3) Connecting via the N2 Protocol at the Tier 2 level.
 - 4) Connecting via LonMark as per ANSI/EIA 709 (LonWorks) to LonMark FTT-10 transceivers at the Tier 2 level.
 - c. The BMCS network shall support both copper and optical fiber communication media.
4. Third-Party Interfaces
- a. BMCS installer shall integrate real-time data from systems supplied by other trades as required in Part 3.
 - b. The BMCS system shall include necessary BMCS hardware equipment and software to allow data communications between the BMCS system and systems supplied by other trades.
 - c. The trade installer supplying other systems will provide their necessary hardware and software and will cooperate fully with the BMCS installer in a timely manner at their cost to ensure complete data integration.
5. Uninterruptible Power Supply (UPS)

- a. Where indicated for supporting operator PCs, servers, and other equipment as indicated, provide a UPS.
 - b. UPS shall be sized for 50 PCT spare capacity. The UPS shall be complete with batteries, external bypass and line conditioning.
6. Power Fail / Auto Restart
 - a. Provide for the automatic orderly and predefined shutdown of parts or all of the BMCS following total loss of power to parts or all of the BMCS.
 - b. Provide for the automatic orderly and predefined startup of parts or all of the BMCS following total loss of power to those parts or all of the BMCS. Archive and annunciate time and details of restoration.
 - c. Provide for the orderly and predefined scheduling of controlled return to normal, automatically time scheduled, operation of controlled equipment as a result of the auto restart processes.
 - d. Maintain the BMCS real-time clock operation during periods of power outage for a minimum of 72 HRS.
 7. Downloading and Uploading
 - a. Provide the capability to generate BMCS software-based sequences, database items and associated operational definition information and user-required revisions to same at any Operator PC, and the means to download same to the associated Application Node.
 - b. Application software tool used for the generation of custom logic sequences shall be resident in both the application node and the server(s) where indicated on the drawings.
 - c. Provide the capability to upload BMCS operating software information, database items, sequences and alarms to the designated server(s).
 - d. The functions of this Part shall be governed by the codes, approvals and regulations applying to each individual BMCS application.
- B. Operator Workstations
1. The operator workstation PCs shall provide the primary means of communication with the BMCS and shall be used for operations, engineering, management, audit, reporting and other related functions.
 2. All PCs shall operate independently and concurrently without interference and under individual user password protection.
 3. PCs functionality shall be individually definable by software means such that PC may be designated for specific limited users and may also be readily re-designated to provide operator workstation back-up to other operator workstations in the BMCS.
 4. Portable operator terminals shall operate identically to the fixed operator workstation PC.
 5. Fixed or portable operator PCs shall not require any special software to be purchased from the BMCS manufacturer. All actions required for the complete operator interface as described herein shall be accomplished through a common browser.
- C. Servers
1. Where communication rooms are shown on the drawings, provide servers that will provide archive locations for all historical data such as trends, alarm and event histories, and transaction logs.
 2. Equip servers with the same tool set that is located in the primary application nodes for the system configuration and custom logic definition.
 3. Equip servers with the same tool set that is located in the primary application nodes for graphic configuration.
 4. Access to all information on the server will be through the same user interface used to access individual nodes. When logged onto a server the operator will be able to also interact with any of the primary nodes in the facility.
 5. The hardware platform for servers will, at minimum, consist of:
 - a. PC processor with minimum 64-bit word structure.
 - b. Minimum 2 GHz processor speed.
 - c. Minimum 1 gigabyte on board ram
 - d. Hard drive or equal high-speed data storage, minimum 50 gigabytes.
 - e. OS shall be Windows 2000 Professional or Windows XP Professional

- f. Removable high-speed data storage and export device(s) such as Read/Write CD ROM or approved equal.
- g. Full ASCII keyboard and digital Mouse or equal pointing device.
- h. Full color, flat screen VDU display unit, minimum 17 IN diagonal screen, minimum 1280 x 1024 resolution, 0.26 or better dot pitch and minimum 72 Hz refresh rate.

D. Operator Interface

1. General

- a. The BMCS Operator Interface shall be user friendly, readily understood and shall make maximum use of colors, graphics, icons, embedded images, animation, text based information and data visualization techniques to enhance and simplify the use and understanding of the BMCS by authorized users at the OWS.
- b. It shall be possible to designate any PC on the Tier 1 network as an Operator Interface point. No special software will need to be purchased from the BMCS manufacturer for any such PC.
- c. User access to the BMCS shall be protected by a flexible and Owner redefinable software-based password access protection. Password protection shall be multi-level and partitionable to accommodate the varied access requirements of the different user groups. Provide the means to define unique access privileges for each individual authorized user. Also provide the means to establish general password groups to which an individual will then be assigned. Once assigned to the group each individual will assume all the capabilities and restrictions of that group. Provide the means to on-line manage password access control under the control of a Master Password.
- d. The user interface shall be able to combine data from any and all of the system components in a single browser window. This shall include historical data stored on a server.
- e. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:
 - 1) User access for selective information retrieval and control command execution
 - 2) Monitoring and reporting
 - 3) Alarm, non-normal, and return to normal condition annunciation
 - 4) Selective operator override and other control actions
 - 5) Information archiving, manipulation, formatting, display and reporting
 - 6) BMCS internal performance supervision and diagnostics
 - 7) On-line access to user HELP menus
 - 8) On-line access to current BMCS as-built records and documentation
 - 9) Means for the controlled re-programming, re-configuration of BMCS operation and for the manipulation of BMCS database information in compliance with the prevailing codes, approvals and regulations for individual BMCS applications.
- f. Provide BMCS reports and displays making maximized use of simple English language descriptions and readily understood acronyms, abbreviations and the like to assist user understanding and interpretation. All text naming conventions shall be consistent in their use and application throughout the BMCS.
- g. All PC-based configurations shall operate on Microsoft® Windows 2000 or Windows XP.
- h. Each fixed and portable PC shall be on-line configurable for specific applications, functions and groups of BMCS points.

2. Navigation Trees

- a. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.
- b. Provide the ability for the operator add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.

- c. The navigation trees shall be “dockable” to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.
- 3. Dividable display panels
 - a. It shall be possible for the operator to divide the display area within a single browser window into multiple display panels. The content of each display panel can be any of the standard summaries and graphics provided by the system.
 - b. Provide each display panel with minimize, maximize, and close icons.
- 4. Alarms
 - a. Alarms shall be routed directly from primary application nodes to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the OWS software shall, at the minimum, provide the following functions
 - 1) Log date and time of alarm occurrence.
 - 2) Generate a “Pop-Up” window, with audible alarm, informing a user that an alarm has been received.
 - 3) Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
 - 4) Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.
 - 5) Provide the ability to direct alarms to an e-mail address or alpha-numeric pager. This must be provided in addition to the pop up window described above. Systems which use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
 - 6) Any attribute of any object in the system may be designated to report an alarm.
 - b. The BMCS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions
 - c. The BMCS shall annunciate application alarms at minimum, as required by Part 3.
- 5. Reports
 - a. Reports shall be generated and directed to one or more of the following: User interface displays, printers, or archive at the user’s option. As a minimum , the system shall provide the following reports:
 - 1) All points in the BMCS.
 - 2) All points in each BMCS application.
 - 3) All points in a specific AN.
 - 4) All points in a user-defined group of points.
 - 5) All points currently in alarm in an BMCS application.
 - 6) All points locked out in an BMCS application.
 - 7) All BMCS schedules.
 - 8) All user defined and adjustable variables, schedules, interlocks and the like.
 - 9) BMCS diagnostic and system status reports.
 - b. Provide all applicable standard reports of the BMCS manufacturer.
 - c. Provide for the generation by the user of custom reports as specified in Part 3.
- 6. Dynamic Color Graphics
 - a. An unlimited number of graphic displays shall be able to be generated and executed.
 - b. Graphics shall be based on Scalar Vector Graphic (SVG) technology.
 - c. Values of real time attributes displayed on the graphics shall be dynamic and updated on the displays.
 - d. The graphic displays shall be able to display and provide animation based on real-time BMCS data that is acquired, derived, or entered.
 - e. The user shall be able to change values (setpoints) and states in system controlled equipment directly from the graphic display.

- f. Provide a graphic editing tool that allows for the creation and editing of graphic files. It shall be possible to edit the graphics directly while they are on line, or at an off line location for later downloading to the AN.
 - g. BMCS system shall be provided with a complete user expandable symbol library containing all of the basic symbols used to represent components of a typical BMCS system. Implementing these symbols in a graphic shall involve dragging and dropping them from the library to the graphic.
7. Schedules
- a. The system shall provide multiple schedule input forms for automatic BMCS time-of-day scheduling and override scheduling of BMCS operations. At a minimum, the following spreadsheet types shall be accommodated:
 - 1) Weekly schedules.
 - 2) Temporary override schedules.
 - 3) Special “Only Active If Today Is A Holiday” schedules.
 - 4) Monthly schedules.
 - b. Schedules shall be provided for each system or sub-system in the BMCS. Each schedule shall include all commandable points residing within the system. Each point may have a unique schedule of operation relative to the system use schedule, allowing for sequential starting and control of equipment within the system. Scheduling and rescheduling of points shall be accomplished easily via the system schedule spreadsheets.
 - c. Monthly calendars for a 12-month period shall be provided that allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the weekly schedules.
8. Historical trending and data collection
- a. Trend and store point history data for all BMCS points and values as selected by the user.
 - b. The trend data shall be stored in a manner that allows custom queries and reports using industry-standard software tools.
 - c. At a minimum, provide the capability to perform statistical functions on the historical database:
 - 1) Average.
 - 2) Arithmetic mean.
 - 3) Maximum/minimum values.
 - 4) Range – difference between minimum and maximum values.
 - 5) Standard deviation.
 - 6) Sum of all values.
 - 7) Variance.
- E. Application Nodes (AN)
1. Primary Application Nodes
- a. The primary application node shall perform the function of monitoring all system variables, both from real hardware points, software variables, and controller parameters such as setpoints.
 - b. Application nodes shall be entirely solid state devices. No rigid disk drives will be permitted in the equipment rooms.
 - c. The primary application nodes shall manage and direct all information traffic on the Tier 1 network, between the Tier 1 and Tier2 networks, and to servers.
 - d. Any node on the Tier 1 network shall be equipped with all software necessary to drive the complete user interface including graphics on a browser connected to the node via the network or directly via a local port on the node.
 - e. The operating system of the application node shall support multi-user access. At minimum four users shall be able to access the same application node simultaneously.
 - f. Communication between nodes shall be per-to-peer via 10/100 Ethernet using the BACnet protocol.

- g. The AN shall be capable of direct connection to multiple field busses using different protocols simultaneously as indicated below. Should the controller not support multiple field busses, install two primary nodes side by side.
 - 1) An RS-485 serial field bus such as MSTP or the manufacturer's proprietary field bus.
 - 2) a LON field bus for supervision and control of LON based controllers that conform to the Lon Talk standard.
 - h. The primary nodes will integrate data from both field busses into a common object structure. Data from both field busses will appear in common displays throughout the user interface in exactly the same format. It shall not be possible to determine which field buss the data originated on without reviewing the system configuration data.
 - i. AN shall be programmable and governed by the requirements of their applicable codes, approvals and regulations.
 - j. The AN shall be designed, packaged, installed, programmed and commissioned in consideration of their specific service and prevailing operating conditions. They shall be proven standard product of their original manufacturer and not a custom product for this Project.
 - k. A failure at an AN shall not cause failures or non-normal operation at any other system AN other than the possible loss of active real-time information from the failed AN.
 - l. Ancillary AN equipment, including interfaces and power supplies, shall not be operated at more than 80 PCT of their rated service capacity.
 - m. AN shall comply with FCC Part 15 subpart J class A emission requirements.
 - n. Each primary node shall be equipped with the necessary un-interruptible power such that it will not cease operation during minor power outages, including those that occur upon transfer to emergency generator or other local power source not provided by the utility.
2. HVAC Node
- a. HVAC Node shall provide both standalone and networked direct digital control of HVAC systems.
 - b. A dedicated HVAC Node shall be configured and provided for each primary HVAC system (air handler, chiller, boiler) and each terminal HVAC system (VAV Box, Unit Heater, Fan Coil Unit, Cabinet Heater, Heat Pump, Fan Powered Box, CV Box)
 - c. Each HVAC Node shall retain program, control algorithms, and setpoint information in non-volatile memory in the event of a power failure, and shall return to normal operation upon restoration of power.
 - d. Each HVAC Node shall report its communication status to the BMCS. The BMCS shall provide a system advisory upon communication failure and restoration.
 - e. For each primary HVAC system, provide means of indication of system performance and setpoints at, or adjacent to the HVAC Node.
 - f. For each primary HVAC system, provide a means to adjust setpoints and start/stop equipment at, or adjacent to the HVAC Node.
 - g. Provide a means to prevent unauthorized personnel from accessing setpoint adjustments and equipment control functions.
 - h. The HVAC Node shall provide the ability to download and upload configuration data, both locally at the Node and via the BMCS communications network.
 - i. The HVAC Node shall be provided with a permanently-mounted local graphic terminal where required in the sequences of this specification. The local graphic terminal shall provide dynamic graphical representation of the associated system status, with the ability for the operator to enter commands with proper password protection.

F. Application Software

1. HVAC Application Software

- a. Event Messaging: Provide for the automatic execution of user-defined messages on the occurrence of each predefined BMCS real-time event including equipment/point status change, approaching limit or alarm, time of day and the like. Direct messages to any number of operator PCs, e-mail destinations, and pagers.

- b. Indoor Air Quality: Provide monitoring of outside air, return air and supply air CO₂ concentration, calculate and maintain fresh air requirements. Adjust outdoor air intake to ensure return air CO₂ high level limit is not exceeded.
- c. Optimum Start/Stop: Provide software to start equipment on a sliding schedule based upon indoor and outdoor conditions, to determine the minimum time of HVAC system operation needed to satisfy the space environmental requirements. The program shall also determine the earliest possible time to stop the mechanical systems. The optimum start/stop program shall operate in conjunction with, and be coordinated with, the scheduled start/stop and night setback programs.
- d. Auto Alarm Lockout: Provide for scheduled and automatic lockout of alarm annunciation from equipment during non-normal operating conditions including shutdown, emergency power operation, fire alarm and the like.
- e. Energy monitoring: Provide software to monitor and totalize consumption as measured by pulse meters.
- f. Event Initiated Programs and custom logic: Provide software to define custom logic sequences that will reside in the nodes. The definition software will also reside in the node and be accessible via the standard user interface via a browser.
- g. System Restart: Upon restoration of the AC power to an HVAC Node, automatically restart all equipment and restore all loads to the state as required by the BMCS. Provide appropriate time delays to prevent demand surges or overload trips.
- h. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
- i. Runtime Totalization: Automatically sample, calculate and store runtime hours for binary input and output points as listed in the point schedule of this specification.
- j. Analog/Pulse Totalization: Sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.

2.5 ELECTRICAL SYSTEM AND DEVICES

- A. All electric switch devices to be selected for applied and UL listed for application. All water thermostats provided with separable copper, monel, or stainless steel well.
- B. Miscellaneous, electric and mechanical devices to include:
 - 1. Control dampers less actuators shall be provided under Section 23 31 13. Actuators shall be provided by controls installer.
 - 2. Smoke dampers and actuators indicated on plans provided by Section 23 31 13. Actuator to be factory installed, coordinate type required.
 - 3. Automatic control valves:
 - a. Chilled water system control valves for new air handling units shall be provided as follows:
 - 1) Pressure independent valves with 100:1 turndown designed to maintain constant flow rate proportional to valve position regardless of inlet pressure.
 - 2) 5 PCT accuracy through selected operating pressure range calibrated per ANSI/NCSL Z540-1-1994.
 - 3) Control valve bodies shall be cast iron, steel, or bronze rated at 150 PSIG. All internal parts shall be stainless steel, steel, Teflon, brass, or bronze. Plastic internal parts are not acceptable.
 - 4) Use of valves shall eliminate need for manually balancing flow rate at each location. Valves shall have pressure ports to verify proper operation.
 - 5) End type:
 - a) 2-1/2 IN and smaller: screwed type.
 - b) 3 IN and larger: flanged.
 - 6) Manufacturer: Delta P.
 - 7) Valves for fan coil units may be conventional type as specified for other systems.
 - b. Other systems:
 - 1) Materials:

- a) Stems: Stainless steel.
 - b) Packing: Spring loaded Teflon with replaceable discs.
 - c) Body: Bronze.
- 2) End type:
- a) 2-1/2 IN and smaller: screwed type.
 - b) 3 IN and larger: flanged.
- 3) Water control valves, 4 IN size and larger: butterfly type.
- 4) Valves ANSI rated to withstand pressures and temperatures encountered.
- 5) Modulating straight through water valves provided with equal percentage contoured throttling plugs. All three way valves provided with linear throttling plugs so total flow through valve remains constant regardless of valve's position. Valves sized for pressure drop equal to coil they serve, but not to exceed 5 PSI. Size two way valve operators to close valves against pump shut off head.
- c. Terminal equipment valves to be straight through or three way type as indicated. Stems polished stainless steel and packing ethylene-propylene suitable for both chilled water and 250 degree hot water service. Pressure ratings as required for intended service.
4. Firestats: 130 DEGF manual reset type.
5. Safety low limits: Snap acting, single pole, single or double throw, manual reset switch which trips if temperature sensed across any 12 IN of bulb length is equal to or below setpoint, requiring minimum 20 FT length of bulb. Provide one thermostat for every 20 square feet of coil surface. Mount freeze protection thermostats using flanges and element holders. Low limit thermostats shall have multiple contacts or shall be installed with relay loop to allow low limit thermostats to be directly connected to the motor starter/VFD and to the BMCS.
6. Electric thermostats: Line voltage or low voltage type suitable for application. Low voltage type heating thermostats to have adjustable heat anticipation.
7. Instrument Pressure Gages: Black letters on white background, 1-1/2 IN diameter, stem mounted with suitable dial range. Install pressure gages on main and branch lines at each receiver controller, at input to each actuator, at inputs and outputs from each relay and switch, and signal lines at each transmitter.
8. Electric Damper Actuators.
- a. Rating: NEMA 1 Enclosure
 - b. Mounting: Direct mount
 - c. Stroke: 90 seconds end to end full stroke, 15 seconds return to normal for spring return
 - d. Protection: Electronic stall protection
 - e. Control Input: 0-10 VDC or 0-20 mADC
 - f. Power: Nominal 24 VAC
 - g. Torque: Size for minimum 150 PCT of required duty
 - h. Duty cycle: rated for 65,000 cycles
 - i. Special:
 - 1) Modulating actuators: Output position feedback.
 - 2) Two position actuators: Two auxiliary contacts for actuator position.
 - 3) Manual override
 - 4) Field selectable rotational / spring return direction
 - 5) Field adjustable zero and span.
9. Electric Valve Actuators.
- a. Rating: NEMA 1 Enclosure
 - b. Mounting: Direct mount
 - c. Control Input: Continuous 0-10 VDC or 0-20 mADC
 - d. Power: Nominal 24 VAC
 - e. Protection: Stall protection
 - f. Torque: Size for minimum 150 PCT of required duty
 - g. Special:
 - 1) Modulating actuators: Output position feedback.
 - 2) Two position actuators: Two auxiliary contacts for actuator position.
 - 3) Manual override.

- 4) Field selectable direction.
- 5) Field adjustable zero and span.
- 6) For spring return, provide field selectable spring return direction.

2.6 ELECTRONIC DATA INPUTS AND OUTPUTS

- A. Input/output sensors and devices matched to requirements of remote panel for accurate, responsive, noise free signal output/input. Control input to be highly sensitive and matched to loop gain requirements for precise and responsive control.
 1. In no case shall computer inputs be derived from pneumatic sensors.
- B. Temperature sensors:
 1. Except as indicated below, all Alerton Microset 4 combination space temp/humidity sensors shall be provided with touch screen setpoint adjustment, temperature and humidity display, and unoccupied mode override button. The following are exceptions to this:
 - a. The following locations shall have sensor without setpoint adjustment:
 - 1) All electrical and communication rooms.
 - 2) All mechanical rooms.
 - 3) All unit heaters.
 - 4) All public elevator lobbies and entrance vestibules.
 - 5) Elevator equipment rooms.
 2. Duct temperature sensors to be averaging type. Averaging sensors shall be of sufficient length (a maximum of 1.8 sqft of cross sectional area per 1 lineal foot of sensing element) to insure that the resistance represents an average over the cross section in which it is installed. The sensor shall have a bendable copper sheath. Water sensors provided with separable copper, monel or stainless steel well. Outside air wall mounted sensors provided with sun shield.
 3. Outside air, return air, discharge air, return air, space, and well sensors to be linear with +/- .7 DEGF between 32 DEGF and 212 DEGF.
- C. Relative humidity sensors to be capacitance type with 10 PCT to 90 PCT range with an accuracy of plus or minus 2 PCT of full scale. Duct mounted humidity sensors provided with sampling chamber.
- D. Differential and static pressure sensors and switches:
 1. The pressure transducer shall withstand up to 150 % of rated pressure with and accuracy of plus or minus 1 PCT of full scale. The sensing element shall be either capsule, diaphragm, bellows, bourbon tube, or solid state. Pressure sensors (all types) installed on liquid lines shall have drains. Pressure sensors installed on steam lines shall have drains and siphons. All pressure sensors shall have valves for isolation, venting and taps for calibration. Pressure sensors shall be verified by calibration. Differential pressure sensors shall have nulling valves.
 2. Pressure switches shall have a repetitive accuracy of plus or minus 2 PCT of their operating range and shall withstand up to 150 PCT of rated pressure. Switch shall have a snap acting form C contact rated for the application. Provide Dwyer 3000 series photohelic gauges with isolation valves and calibration taps, required power supply, and manual reset push button. Pressure switches (all types installed on liquid lines shall have drains. Pressure sensors installed on steam lines shall have drains and siphons. All pressure switches shall have valves for isolation, venting and taps for calibration. Pressure switches shall be adjusted to the proper set point and shall be verified by calibration. Pressure switches shall be mounted higher than the process connection. Differential pressure switches shall have nulling valves. Switch contact ratings and duty shall be selected in accordance with NEMA ICS 1.
 3. Fan proof-of-flow sensor to be current switch.
 4. Pump proof-of-flow sensor to be current switch.
 5. Provide differential pressure gauges for air handling unit filters in pressure ranges to match full loaded filter pressure drop plus 50 PCT with manual reset and set point indication. Provide with isolation valves and calibration taps.
- E. Flow measurement devices:

1. Airflow measuring stations:
 - a. Fan inlet airflow measuring stations: Use airflow traverse probes mounted in the specified centrifugal fan inlets to continuously measure the airflow rate of the fan. DWDI fans shall have probes in each inlet. Probes shall accurately and instantaneously measure fan capacity to within 3 PCT of actual air volume. The probes shall also have the following features:
 - 1) Multiple total and static pressure sensing points for averaging.
 - 2) Unaffected by normal building particulate contamination.
 - 3) Aluminum construction with hard anodized finish.
 - 4) Dual end support swivel mounting brackets for each probe.
 - 5) Probes shall not produce a measurable pressure drop or increase sound levels by its presence in the fan inlet.
 - 6) Model: Air Monitor VOLU-probe/FI.
 - b. Transmitter for airflow stations: Provide solid-state ultralow span transmitter to produce signals of 0-10 VDC or 4-20 MA for use in control of HVAC system. These signal outputs to be linear and proportional to airflow. The transmitter shall also have the following features:
 - 1) Automatic zeroing circuit within 0.1 PCT of operating span.
 - 2) Accuracy: within 0.25 PCT of natural span.
 - 3) 12 adjustable calibrated spans.
 - 4) Digital display indicating CFM and FPM.
 - 5) Maximum Over-pressurization: 20 PSIG.
 - 6) Velocity turndown: 10 to 1.
 - 7) NEMA 1 enclosure with view window.
 - 8) 24 volt power requirement.
 - 9) Model: Air Monitor VELTRON II, Model 7000.
 - c. Outside Air Flow Monitor: The monitor/transmitter shall measure outside air quantity and produce signal of 0-10 VDC or 4-20 MA for use in control of HVAC systems. The output signal shall be linear and proportional airflow. The monitor/transmitter shall have following features:
 - 1) Outside and inlet reference sensors that are not affected by changing wind, ambient temperature, or atmospheric pressure.
 - 2) Accuracy: Within 5 PCT of reading over a range of 150-600 FPM.
 - 3) Digital display indicating CFM, FPM, and temperature.
 - 4) Construct of chemical and weather resistant materials. All surfaces shall be painted or exposed stainless steel.
 - 5) NEMA 1 enclosure.
 - 6) Model: Air Monitor VOLU-flo/OAM.
 - d. The flow station manufacturer's representative shall review all mechanical drawings during the bidding period and verify the acceptability of the proposed location of the air flow measuring stations and inform the Engineer of any problems before bids are due.
 - e. The manufacturer's representative shall visit the site as required during installation and for system start-up.
 - f. The temperature control installer shall be required to calibrate the airflow sensors with input from the air balancing provider. Air flow readings shall be taken for at least five air flows through the range of operation and fit to a linear equation and programmed into the software.
 - g. At installer's option, electronic airflow measuring stations which meet or exceed accuracy and performance of base manufacturer may be used.
2. Electronic Airflow Stations
 - a. Air Flow and Temperature Measurement:
 - 1) Thermal dispersion technology anemometer using instrument grade self-heated thermistor sensors with thermistor temperature sensors.
 - 2) Factory tested prior to shipment and shall not require calibration or adjustment over the life of the equipment when installed in accordance to manufacturer's guidelines.

- 3) Manufacturer shall provide test data for accuracy performance prior to bid date. Vortex shedding arrays are not acceptable. Pitot tube and differential pressure sensing arrays are not acceptable. Auto zeroing sensors are not acceptable.
- b. Flow Station Construction
 - 1) Duct or fan inlet mounted as indicated.
 - 2) Sensors: Two glass-encapsulated thermistors at each measuring point - self heated thermistor and temperature sensor.
 - a) Glass-filled polypropylene housing.
 - b) Factory-calibrated at 16 airflow rates and 3 temperatures to NIST-traceable standards for both airflow and temperature.
 - 3) Duct mounted probe construction:
 - a) Gold anodized aluminum alloy tube
 - b) 304 stainless steel mounting brackets.
 - c) Constructed as insertion, internal, or standoff mounting, depending on installation requirements.
 - d) Probe sensor density:

Area (sq.ft.)	Sensors
<= 1	2
>1 to < 4	4
4 to < 8	6
8 to < 12	8
12 to < 16	12
>= 16	16

- e) Probe operating ranges:
 - (1) Airflow: 0 to 5000 FPM.
 - (2) Temperature: -20 to 160 °F, ±0.15 °F.
 - (3) Relative Humidity: 0 to 99 PCT non-condensing.
- f) Installed accuracy of ±3 PCT of reading or better.
- 4) Fan inlet mounted probe construction:
 - a) Gold anodized aluminum alloy tube
 - b) 304 stainless steel mounting brackets.
 - c) Probe operating ranges:
 - (1) Airflow: 0 to 10,000 FPM.
 - (2) Temperature: -20 to 160 °F, ±0.15 °F
 - (3) Relative Humidity: 0 to 99 PCT non-condensing.
 - d) Installed accuracy of ±10 PCT of reading or better.
- c. Transmitter:
 - 1) Type: Microprocessor Based, totally solid state.
 - 2) Power Requirement: 24 VAC, isolated from other devices and not grounded. AFMS manufacturer shall furnish a 1:1 isolation transformer for each duct location.
 - 3) Capable of processing up to 16 independent sensing points per location.
 - 4) Output signal offset/gain adjustment.
 - 5) Adjustable digital filter to stabilize airflow output.
 - 6) Field configurable for either I.P. or S.I. units.
 - 7) Local digital display on face of cabinet for indicating individual sensor airflow and temperature readings.
 - 8) Wall-mounted NEMA 1 enclosure.
- d. The temperature control installer shall be required to calibrate the airflow sensors with input from the air balancing provider. Air flow readings shall be taken for at least five air flows through the range of operation and fit to a linear equation and programmed into the software.
- e. Performance:

- 1) Electronics temperature range: 30 to 120 DEGF.
- 2) Flow station pressure drop: less than 0.005 IN WC at 2000 FT./min.
- f. Analog output signals: 0-10 VDC or 4-20 ma:
 - 1) Type: linear.
- g. Ebtron Gold Series or approved equal.
- 3. Water flow meters
 - a. Turbine flow meters:
 - 1) Water flow meters:
 - a) Type: Insertion turbine type with retractable probe assembly and 2 IN full port gate valve.
 - b) Pipe size: 3 to 24 IN.
 - c) Retractor: ASME threaded, non-rising stem type with hand wheel.
 - d) Mounting connection: 2 IN 150 PSI flange.
 - e) Rotor assembly: Design for expected water flow and pipe size.
 - f) Seal: Teflon (PTFE).
 - g) Controller:
 - (1) Integral to unit.
 - (2) Locally display flow rate and total.
 - (3) Output flow signal to BMCS: Digital pulse type.
 - h) Performance:
 - (1) Accuracy: 1.0 PCT of reading
 - (2) Repeatability: 0.25 PCT of reading
 - (3) Turndown: 30:1
 - i) Power: 24 volt DC
 - j) Manufacturer: Emco TMP-910
 - b. Vortex shedding flow meters:
 - 1) Water flow meters:
 - a) Type: Insertion vortex type with retractable probe assembly and 2 IN full port gate valve.
 - b) Pipe size: 3 to 24 IN.
 - c) Retractor: ASME threaded, non-rising stem type with hand wheel.
 - d) Mounting connection: 2 IN 150 PSI flange.
 - e) Sensor assembly: Design for expected water flow and pipe size.
 - f) Seal: Teflon (PTFE).
 - g) Controller:
 - (1) Integral to unit.
 - (2) Locally display flow rate and total.
 - (3) Output flow signal to BMCS: Digital pulse type.
 - h) Performance:
 - (1) Accuracy: 1.0 PCT of reading
 - (2) Repeatability: 0.15 PCT of reading
 - (3) Turndown: 20:1
 - (4) Response time: Adjustable from 1 to 100 seconds.
 - i) Power: 24 volt DC
 - j) Manufacturer: Emco V-Bar 910
 - c. Install flow meters according to manufacturer's recommendations. Where recommended by manufacturer because of mounting conditions, provide flow rectifier.
 - d. The temperature control installer shall be required to calibrate the flow meter with input from the balancing provider (Section 20 08 00). Flow readings shall be taken for at least five flows through the range of operation and fit to a linear equation and programmed into the software.

F. Carbon Dioxide Sensors:

- 1. Non-dispersive infrared technology.
- 2. Measuring range: 0-5000 ppm.
- 3. Accuracy: ± 5 PCT or reading or ± 100 ppm, whichever is greater.

4. Repeatability: ± 20 ppm.
 5. Maximum Drift per year: ± 100 ppm.
 6. Response Time (@ 500ml/min.): ≤ 1 min.
 7. Dry contact CO₂ alarm threshold adjustable over range of 0 to 5000 ppm.
 8. Analog output 0-5 VDC or 4-20 mA over full sensed range.
 9. Zero and span adjustment.
 10. Provide aspirating box to permit measurement of return air duct carbon dioxide level. Box to be mounted to outside of duct, allowing access to sensor for maintenance.
 11. Telaire Systems, Inc.
- G. Outputs: Control relays and analog output transducers to be compatible with remote panel. Relays suitable for loads encountered. Analog output transducers designed for precision closed loop control with pneumatic repeatability error no greater than 1-1/2 PCT.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Building Management and Control System (BMCS) shall be designed, installed, and commissioned in a turnkey fully implemented and operational manner; including all labor not noted in the Work by Others paragraph of Part I of this section of these specifications, and not noted in other sections of these specifications.

3.2 VARIABLE VOLUME, PACKAGED ROOFTOP UNIT

- A. General: Variable air volume, heating and cooling packaged unit.
- B. Startup: RTU system is manually started and stopped by system on/off autoswitch located on unit control panel.
1. Start variable frequency drives at zero speed and set VFD rampup at 60 sec minimum.
- C. Dampers:
1. When supply fan is "ON":
 - a. Outside air damper is modulated to provide sufficient fresh air (see schedule) as measured by the outside airflow measuring station..
 - b. Relief air damper is modulated to provide scheduled cfm.
 2. Supply fan is "OFF":
 - a. Outside air dampers, "CLOSED".
 - b. Return air damper, "CLOSED".
 3. Unoccupied cycle:
 - a. Fans "OFF".
 - b. Outside air damper "CLOSED".
 - c. Return air damper "CLOSED".
 - d. Exhaust fans "OFF".
 - e. If space temperature falls below 50 degF (adj.):
 - 1) Fans "ON".
 - 2) Outside air damper "CLOSED".
 - 3) Return air damper "OPEN".
 - 4) Exhaust fans "OFF".
 - 5) Heating cycle enabled
 - f. If space temperature is above 85 degF (adj.)
 - 1) Fan "ON".
 - 2) Outside air damper "CLOSED".
 - 3) Return air damper "OPEN".
 - 4) Exhaust fans "OFF".
 - 5) Cooling cycle enabled.
 4. Warm up/cool down cycle:
 - a. Fans "ON".

- b. Outside air damper "CLOSED".
- c. Return air damper "OPEN".
- d. Exhaust fans "OFF".

D. Static pressure control for variable air volume units:

- 1. Provide differential pressure switch in supply fan discharge plenum which measures pressure differential between supply plenum interior and exterior (return air space).
 - a. On overpressure of 6 IN WG (adj.) the fans shall be shut down.
- 2. Furnish and install static pressure sensor installed in the supply ductwork 2/3 of the way to the end of the longest duct run.
- 3. The unit controller (UC) shall sense the static pressure and control the VFD's through a 4-20 ma or a 0-10 volt signal to maintain the duct static pressure setpoint of 1 IN WG (adj).

E. Filters:

- 1. Provide dirty filter alarm at BMCS set at 1 IN WG (adj.).

F. Temperature control:

- 1. Provide unit mounted supply discharge air sensor. Manufacturers controls cycle compressors to maintain 55 degF (adj.) leaving air temperature.
- 2. Reset the supply air temperature based on the average space temperature sensors associated with the VAV terminal units to minimize reheat.
 - a. The return damper shall be fully open, the max. OA damper fully closed, and the min. OA damper and return air damper modulated to maintain the minimum indoor air quality.
- 3. BMCS shall provide night setback (unoccupied cycle) capability for any or all air handlers at Owner's discretion on both a time clock or manually.
- 4. Modulate gas valve and/or bypass damper to maintain leaving air temperature setpoint (adj.).

G. Supply Fan Control:

- a. If safety controls are normal, the VFD(s) for the supply fan(s) shall be enabled by the BMCS and shall run continuously.
- b. The VFD(s) shall vary the speed of the fan motor(s) as required to maintain the supply duct static pressure sensor setting (adj.). Setting shall be coordinated with balancing provider. For dual supply fans, the fans shall operate in unison.
 - 1) Locate supply duct static pressure sensor in the high pressure ductwork downstream of the unit 2/3 of the distance from the unit.
- c. The airflow of the supply fan(s) shall be measured by the inlet airflow stations. The airflow station transmitter provides a linear control signal to the BMCS proportional to airflow.
- d. Provide supply fan(s) with current switch for fan status.

H. Emergency operation:

- 1. Upon signal from the fire alarm shutdown of RTU as follows:
 - a. Supply fan, off; exhaust fan, off.
 - b. Outside air damper, closed; return air damper, closed.
 - c. Manual reset required.

3.3 CONSTANT VOLUME, PACKAGED ROOFTOP UNIT

A. General: Constant air volume, heating and cooling packaged unit.

B. Startup: RTU system is manually started and stopped by system on/off autoswitch located on unit control panel.

- 1. Start supply fan.

C. Dampers:

- 1. When supply fan is "ON":
 - a. Minimum Outside air damper is modulated to provide sufficient fresh air (see schedule).

- b. Relief air damper is modulated to provide scheduled cfm.
- 2. Supply fan is "OFF":
 - a. Outside air dampers, "CLOSED".
 - b. Return air damper, "CLOSED".
- 3. Unoccupied cycle:
 - a. Fans "OFF".
 - b. Outside air damper "CLOSED".
 - c. Return air damper "CLOSED".
 - d. Exhaust fans "OFF".
 - e. If space temperature falls below 50 degF (adj.):
 - 1) Fans "ON".
 - 2) Outside air damper "CLOSED".
 - 3) Return air damper "OPEN".
 - 4) Exhaust fans "OFF".
 - 5) Heating cycle enabled
 - f. If space temperature is above 85 degF (adj.)
 - 1) Fan "ON".
 - 2) Outside air damper "CLOSED".
 - 3) Return air damper "OPEN".
 - 4) Exhaust fans "OFF".
 - 5) Cooling cycle enabled.
- 4. Warm up/cool down cycle:
 - a. Fans "ON".
 - b. Outside air damper "CLOSED".
 - c. Return air damper "OPEN".
 - d. Exhaust fans "OFF".

D. Filters:

- 1. Provide dirty filter alarm at BMCS set at 1 IN WG (adj.).

E. Temperature control:

- 1. Provide unit mounted supply discharge air sensor. Manufacturers controls cycle compressors to maintain 55 degF (adj.) leaving air temperature.
 - 1) When the supply air sensor is satisfied, the maximum OA damper shall modulate closed and the minimum damper shall modulate open to the minimum OA setpoint.
 - b. When the economized cycle is not allowed, the return damper shall be fully open, the max. OA damper fully closed, and the min. OA damper and return air damper modulated to maintain the minimum indoor air quality.
- 2. BMCS shall provide night setback (unoccupied cycle) capability for any or all air handlers at Owner's discretion on both a time clock or manually.
- 3. Modulate gas valve and/or bypass damper to maintain leaving air temperature setpoint (adj.).

F. Supply Fan Control:

- a. If safety controls are normal, the VFD(s) for the supply fan(s) shall be enabled by the BMCS and shall run continuously.
- b. The VFD(s) shall vary the speed of the fan motor(s) as required to maintain the supply duct static pressure sensor setting (adj.). Setting shall be coordinated with balancing provider. For dual supply fans, the fans shall operate in unison.
 - 1) Locate supply duct static pressure sensor in the high pressure ductwork downstream of the unit 2/3 of the distance from the unit.
- c. The airflow of the supply fan(s) shall be measured by the inlet airflow stations. The airflow station transmitter provides a linear control signal to the BMCS proportional to airflow.
- d. Provide supply fan(s) with current switch for fan status.

G. Emergency operation:

- 1. Upon signal from the fire alarm shutdown of RTU as follows:

- a. Supply fan, off; exhaust fan, off.
- b. Outside air damper, closed; return air damper, closed.
- c. Manual reset required.

3.4 HEATING AND VENTILATING, PACKAGED ROOFTOP UNIT

A. General: Constant air volume, heating and ventilating packaged unit.

B. Startup: RTU system is manually started and stopped by system on/off autoswitch located on unit control panel.

- 1. Start supply fan.

C. Dampers:

- 1. When supply fan is "ON":
 - a. Outside air damper is modulated to provide sufficient fresh air (see schedule).
- 2. Supply fan is "OFF":
 - a. Outside air dampers, "CLOSED".

D. Filters:

- 1. Provide dirty filter alarm at BMCS set at 1 IN WG (adj.).

E. Temperature control:

- 1. Provide wall mounted thermostat..
- 2. Modulate gas valve to maintain leaving air temperature setpoint of 55 degF(adj.).

F. Supply Fan Control:

- a. If safety controls are normal, the VFD(s) for the supply fan(s) shall be enabled by the BMCS and shall run continuously.
- b. The VFD(s) shall vary the speed of the fan motor(s) as required to maintain the space static pressure sensor setting (adj.). Setting shall be coordinated with balancing provider.
- c. Provide supply fan(s) with current switch for fan status.
- 2. Provide fan status and fan status alarm.

G. Emergency operation:

- 1. Upon signal from the fire alarm shutdown of RTU as follows:
 - a. Supply fan, off; exhaust fan, off.
 - b. Outside air damper, closed.
 - c. Manual reset required.
- 2.

3.5 KITCHEN MAKEUP-AIR UNITS

A. General: Constant air volume, heating and cooling packaged unit.

B. Startup: RTU system is manually started and stopped by system on/off autoswitch located on unit control panel.

- 1. Start supply fan.

C. Dampers:

- 1. When supply fan is "ON":
 - a. Minimum Outside air damper is modulated to provide sufficient fresh air (see schedule).
 - b. Relief air damper is modulated to provide scheduled cfm.
- 2. Supply fan is "OFF":
 - a. Outside air dampers, "CLOSED".
 - b. Return air damper, "CLOSED".

D. Filters:

- 1. Provide dirty filter alarm at BMCS set at 1 IN WG (adj.).

E. Temperature control:

1. Provide unit mounted supply discharge air sensor. Manufacturers controls cycle compressors and/or modulate hot gas bypass to maintain 55 degF (adj.) leaving air temperature.
2. Modulate gas valve and/or bypass damper to maintain leaving air temperature setpoint (adj.).
 - a. Reset discharge setpoint to minimize electric reheat.

F. Supply Fan Control:

- a. If safety controls are normal, the VFD(s) for the supply fan(s) shall be enabled by the BMCS and shall run continuously.
- b. Provide supply fan(s) with current switch for fan status.

G. Emergency operation:

1. Upon signal from the fire alarm shutdown of RTU as follows:
 - a. Supply fan, off; exhaust fan, off.
 - b. Outside air damper, closed; return air damper, closed.
 - c. Manual reset required.

3.6 AIR TERMINAL UNITS

A. General

1. Minimum Airflow Rates for Variable Volume Air Terminal Units
 - a. As indicate don Air Terminal Unit Schedule
2. Space Temperature Set Points
 - a. Cooling Mode:75 Deg F +/- 2 Deg F (Adjustable)
 - b. Heating Mode:70 Deg F +/- 2 Deg F (Adjustable)
3. BMCS VAV Air Terminal Unit Control
 - a. The BMCS shall command the VAV Air Terminal Unit into the Heating or Cooling Mode as required based upon the Heating/Cooling Mode Transition Sequence of Operation.
 - b. The BMCS shall limit and control the respective maximum Heating and Cooling supply air temperatures as sensed by the units supply air temperature sensor.
 - c. The BMCS shall control the unit's VAV damper and heating control valve in response to the space temperature set-point according to the Heating or Cooling Sequence of Operation.
 - d. Refer to the VAV Terminal Unit Schedule for all Maximum and Minimum Air Flow and Temperature Limits for both Heating and Cooling modes.

B. Single duct, variable volume unit cooling only (VV-#), direct digital controls

a. Cooling Mode:

During the Cooling Mode the VV damper shall modulate proportionately to maintain the space temperature set-point via BMCS control. As the space temperature rises above its set-point, the VV damper shall modulate open proportionately towards its Maximum Cooling Mode Supply Air Flow Rate to maintain set-point. As the space temperature decreases below its set-point, the VV damper shall modulate closed proportionately towards its Minimum Cooling Mode Supply Air Flow Rate.

C. Single duct, variable volume unit with electric reheat(VVR-#), direct digital controls

a. Heating Mode, VVR - Transition from Cooling Mode:

While in the Cooling Mode and maintaining the Maximum Cooling Mode Reheat Supply Air Temperature limit at minimum supply air flow rate and the space temperature falls 5 Deg F below set-point for five (5) minutes, the BMS shall command the VVR Air Terminal Unit to enter into the Heating Mode.

b. Heating Mode – VVR:

The VVR Air Terminal Unit shall enter into the Heating Mode by command from the BMCS. Upon command to enter into the Heating Mode, the VVR damper shall open to provide the scheduled Heating Mode Supply Air Flow Rate and the SCR controller shall modulate the heat to provide the scheduled Maximum Heating Mode Supply Air Temperature. When the space temperature set-point has been achieved, the SCR controller shall modulate the heat as required to maintain the space temperature set-point limited by the Maximum Heating Supply Air Temperature as sensed by the unit's supply air temperature sensor.

c. Cooling Mode, VVR – Transition from Heating Mode:

While in the Heating Mode and the SCR controller has modulated the heat to maintain a Minimum Heating Mode Supply Air Temperature equal to the space temperature set-point and the space temperature continues to rise above set-point:

1. The BMCS shall command the VVR damper to reduce the air flow rate proportionately in response to the space temperature while the SCR controller modulates the heat down proportionately to main the minimum Heating Mode Supply Air Temperature.
2. When the VVR damper has modulated down to the Minimum Cooling Mode Supply Air Flow Rate and the SCR controller is maintaining the Minimum Heating Mode Supply Air Temperature and the space temperature rises 5 Deg F above the Heating Mode Temperature Set-Point, the BMCS shall command the VVR Air Terminal Unit into the Cooling Mode.

d. Cooling Mode – VVR:

The VVR Air Terminal Unit shall enter into the Cooling Mode by command from the BMCS. During the Cooling Mode the VVR damper shall modulate proportionately to maintain the space temperature set-point via BMS control. As the space temperature rises above its set-point, the VVR damper shall modulate open proportionately towards its Maximum Cooling Mode Supply Air Flow Rate to maintain set-point. As the space temperature decreases below its set-point, the VVR damper shall modulate closed proportionately towards its Minimum Cooling Mode Supply Air Flow Rate. When the unit is supplying its minimum air flow rate and there is a further decrease in space temperature, the SCR controller shall modulate the heat to maintain the Maximum Cooling Mode Reheat Supply Air Temperature as sensed by the unit's supply air temperature sensor via BMS control. Upon satisfying the space temperature set-point, the SCR controller shall modulate the heat to maintain space temperature set-point while being limited by the Cooling Mode Supply Air Temperature until the SCR controller is off. When the SCR controller is off and the space temperature rises, the BMCS shall command the VVR damper to modulate open proportionately to maintain the space temperature set-point.

D. Single duct, constant volume unit with electric reheat(CVR-#), direct digital controls

a. Heating Mode, CVR - Transition from Cooling Mode:

While in the Cooling Mode and maintaining the Maximum Cooling Mode Reheat Supply Air Temperature limit and the space temperature falls 5 Deg F below set-point for five (5) minutes, the BMCS shall command the CVR Air Terminal Unit to enter into the Heating Mode.

b. Heating Mode- CVR:

The CVR Air Terminal Unit shall enter into the Heating Mode by command from the BMCS. Upon command to enter into the Heating Mode, the SCR controller shall modulate the heat to provide the scheduled Maximum Heating Mode Supply Air

Temperature. When the space temperature set-point has been achieved, the SCR controller shall modulate the heat as required to maintain the space temperature set-point limited by the Maximum Heating Supply Air Temperature as sensed by the unit's supply air temperature sensor.

- c. Cooling Mode, CVR – Transition from Heating Mode:
While in the Heating Mode and the SCR controller has modulated the heat to maintain a Minimum Heating Mode Supply Air Temperature equal to the space temperature set-point and the space temperature rises 5 Deg F above the Heating Mode Temperature Set-Point, the BMCS shall command the CVR Air Terminal Unit into the Cooling Mode.
- d. Cooling Mode – CVR:
The CVR Air Terminal Unit shall enter into the Cooling Mode by command from the BMCS. As the space temperature decreases below set-point, the SCR controller shall modulate the heat to maintain the Maximum Cooling Mode Reheat Supply Air Temperature as sensed by the unit's supply air temperature sensor via BMCS control. Upon satisfying the space temperature set-point, the SCR controller shall modulate the heat to maintain space temperature set-point while being limited by the Cooling Mode Maximum Supply Air Temperature.

3.7 MISCELLANEOUS FANS

- A. All exhaust fans with constant speed starters shall be controlled as follows (unless indicated otherwise).
 - 1. Fans shall be manually enabled/disabled remotely through the BMCS.
 - 2. Provide each fan with current switch for fan status.
- B. Dishwasher exhaust fan :
 - 1. Provide wall switch is dishwashing area to control fan. The wall switch shall be wired directly to the fan motor starter independent of the BMCS.
 - 2. Provide fan with current switch for fan status.
- C. Kitchen exhaust fans (KEF-all):
 - 1. Provide temperature switch in each kitchen/server exhaust hood. Coordinate location with the kitchen/server exhaust hood supplier.
 - 2. When the exhaust temperature within the exhaust hood rises above the exhaust temperature set point of 85 degrees F then the temperature switch closes and sends a signal to the BMCS. The BMCS energizes the exhaust fan and associated kitchen makeup air unit (where applicable).
 - 3. When any one kitchen/servery hood exhaust fan is energized then the BMCS energizes all of the kitchen/servery exhaust fans.
 - 4. Provide each fan with current switch for fan status.
- D. Where an exhaust fan is shown or specified with a control damper, the fan shall not be allowed to operate unless associated normally closed, two position control damper with electric actuator is proven open by end switch. If fan is off, the associated control damper shall be closed.

3.8 DUCTLESS SPLIT SYSTEMS

- A. Ductless split systems (all):
 - 1. Ductless split system is stand alone.
 - 2. Provide room high temperature alarm.
 - 3.

3.9 UNIT HEATERS AND DUCT HEATERS

- A. Electric cabinet unit heaters (EUH-#):
 - 1. Unit mounted thermostat cycles fan and stages of electric heat as required to maintain space sensor set point of 65 DEG F(adj.).
 - 2. BMCS monitors status.
- B. Electric duct heater (EDH-#):
 - 1. Wall mounted thermostat senses space temperature and sends a signal to the unit mounted controls to energize electric duct heater when the space temperature falls below the space temperature set point of 70 DEG F (adj.).
 - 2. Upon a fall in space temperature below the space temperature set point, then the wall mounted thermostat sends a signal to the BMCS. Once flow is proven then the BMCS stages the duct heater to maintain the space temperature set point.
 - 3. BMCS monitors status.

3.10 MISCELLANEOUS CONTROLS

- A. For each domestic hot water system, provide temperature sensor at the outlet of the water heaters.

3.11 DATA CONTROL (D/C) AND GRAPHICS

- A. Provide all programming required to accomplish sequence of operations, including all data and control points not listed on input/output points summary shown on plans.
- B. In addition to graphics of building systems with dynamic data points as noted in following data and control and graphic summary, and graphics required under digital system management sections, following additional graphics shall be provided:
 - 1. Building layouts (floor plans).
 - 2. Any other graphics necessary for logical penetration.
 - 3. Sequence of operation (window split screen view).
 - 4. Flow charts for critical DDC loops and existing building.
 - 5. Supervisor graphics.
 - 6. System configuration.
 - 7. Display VVR and CVR boxes, and reheat coil locations on building floor plans. This applies only to boxes specified with DDC control.
 - 8. Display duct mounted humidifier locations on building floor plans.
 - 9. Display air handling unit locations and configuration (flow diagram, DDC Logic Diagram and control sequence).
 - 10. Flow diagram of steam system for new building showing PRVs, and display all points indicated on I/O summary.
 - 11. Flow diagram of chilled water system for new building showing variable speed pumps and locations of differential pressure switches, and display all points indicated on I/O summary.
 - 12. Display all pneumatic and DDC sensors, thermostats, and humidistats on floor plan corresponding to air terminal or other controlled device locations.
 - 13. Display all DDC panels, indexed to correspond with system configuration.
- C. Include Pseudo points for display in logical groups and graphics. Command pseudo points to be command directly from displays.
- D. Each analog point to have unique remote panel resident dual high, and dual low limit alarm threshold engineering units. Where specified, provide floating (band above and below setpoint) alarm limits.
- E. Each digital output to have software-associated monitored input. Anytime monitored input does not track its associated command output within programmable time interval, "command failed" alarm shall be reported.

- F. Where calculated points (such as CFM) are shown, they shall appear in their respective logical groups. Respective unconditioned raw data (such as logarithmic differential pressure) points to also be grouped in special group for display and observation independent of logical groups.
- G. Where data or control points are required to accomplish digital control or energy management sequences specified, but not listed in I/O summary, installer shall provide the points necessary to accomplish the specified sequence.
- H. Primary analog input and analog output of each DDC loop to be resident in single remote panel containing DDC algorithm, and shall function independent of any peer or mux communication links. Secondary (reset type) analog inputs may be received from the peer network, but approved default values and/or procedures shall be substituted in DDC algorithm for this secondary input in network communications fail or if secondary input becomes erroneous or invalid.

3.12 INSTALLATION

- A. All wiring and tubing to be properly supported, and run in neat and workmanlike manner. All wiring and tubing shall run parallel to or at right angles to building structure. All piping and wiring within enclosures to be neatly bundled, and anchored to prevent obstruction to devices and terminals.
- B. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and pilot lights, push buttons and switches flush on cabinet panel face. ANSI/NEMA 250, general purpose utility enclosures with enameled finished face panel. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved nameplate on cabinet face.
- C. Electrical wiring:
 - 1. BMCS installer: responsible for all electrical installation required for fully functional system, and not shown on electrical plans or required by electrical specifications.
 - 2. Code compliance: all local and national codes.
 - 3. Wiring size: #18 AWG minimum THHN, shielded where required by manufacturer or installation.
 - 4. Line voltage and low voltage control wiring installation: in conduit.
 - 5. Power supply:
 - a. Coordinate with electrical engineer and electrical installer.
 - b. BMCS installer: responsible for costs associated with installation of power supply from electrical panel to control device(s).
- D. Identification:
 - 1. Provide laminated plastic nameplates for control panels. Other equipment devices furnished, including sensors, switches, valves, gages, actuators and all other item furnished under this section shall be identified with plastic embossed labels adhered to the device. Each nameplate shall identify the function, such as "mixed air low limit" or "cold deck temperature sensor" Laminated plastic shall be one-eighth inch thick whiter with black center core. Nameplates shall be a minimum of 1 IN by 3 IN with minimum one quarter inch high engraved block lettering. Nameplates for devices smaller than 1 IN by 3 IN shall be attached by a nonferrous metal chain. Submit proposed wording of each nameplate with hardware submittal.
 - 2. Instrumentation and Control Diagrams: Provide framed drawings including the sequence of controls and verbal description in laminated plastic showing complete diagrams for all equipment furnished and interfaces to all existing equipment, at each respective equipment location. Condensed operating instructions explaining preventive maintenance procedures methods of checking the system for normal safe operation and procedures for safely starting and stopping the system manually shall be prepared in typed form, framed as specified for

the diagrams and posted beside the diagrams. Proposed diagrams, instructions and other sheets shall be submitted prior to posting.

- E. BMCS installer to enter all computer programs and data files into related computers, including all control programs, initial approved parameters and settings, English descriptors, and colorgraphics complete with dynamic dispersed data. In addition, following to be user implemented, shall have samples installed for training and validation:
 - 1. Trend log.
 - 2. Alarm message (action taking message).
 - 3. Run time maintenance message.
 - 4. Trouble action message.
 - 5. Dynamic trend plot (6 points).
- F. BMCS installer to maintain diskette copies of all data file, and application software for reload use in event of system crash or memory failure. One copy to be delivered to Owner during training session, and one copy archived at local software vault provided by BMCS manufacturer within 10 miles of OS.
- G. Mount local control panels at convenient location adjacent to equipment served.
 - 1. Mount relays, PE switches, pressure switches, etc., on rear of temperature control panels. Tag each instrument by using "Dymo" tape corresponding to symbols used on control diagrams.
- H. Locate panels so visual observation and adjustment can be accomplished from floor level.
- I. Room sensors:
 - 1. Unless indicated otherwise, locate thermostats, humidistats and sensor for room control, and monitoring immediately inside of door adjacent to light switch.
 - a. Where light switch is in an entry way to room, locate on wall within room so it is capable of sensing true space conditions.
 - b. Prior to installation, coordinate locations with Architect/Engineer.
 - c. Mount at 48 IN above finished floor.
 - 2. All room temperature and humidity sensors indicated in the control sequences shall be provided whether or not a location is indicated on the plans. If a location is not shown, allow for a maximum of 100 FT of wiring between the sensor and terminal unit or equipment. Submit Request for Information (RFI) to confirm sensor location with Architect.

3.13 VALIDATION

- A. Submit test plan and test procedures for the performance verification tests for approval. Explain in detail actions and expected results to demonstrate compliance with the requirements of this specification and the method for simulating the necessary conditions of operation to demonstrate performance of the system. Deliver Test Plans documentation for the performance verification tests to the owners representative 30 days prior to the performance verification tests. Provide draft copy of operation and maintenance manual with performance verification test.
- B. BMCS installer shall completely checkout, calibrate, and test all connected hardware and software to insure that system performs in accordance with approved specifications and sequences of operation submitted. Calibration to be demonstrated by the BMCS installer in the presence of the Architect or Owner's representative, as dictated by the Owner. representative. Should random sampling indicate improper commissioning, the owner reserves the right to subsequently witness complete calibration of the system at no addition cost to the owner.
- C. Demonstrate to authorities that all required safeties and life safety functions are fully functional and complete.
- D. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.

- E. After completion of validation procedures, installer shall perform validation demonstration in the presence of the Architect or Owner's representative, as dictated by the Owner. Record the outcome of each test noting actual outcomes and discrepancies. Submit detailed report of outcomes. Witnessed validation demonstration and associated report shall consist of:
1. Running each specified report and recording outcomes.
 2. Display and demonstrate each data entry to show site specific customizing capability. Demonstrate parameter changes.
 3. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
 4. Execute digital and analog commands in graphic mode.
 5. Demonstrate DDC loop precision and stability via trend logs of inputs and outputs (6 loops minimum).
 6. Demonstrate EMS performance via trend logs and command trace.
 7. Demonstrate scan, update, and alarm responsiveness.
 8. Demonstrate spreadsheet/curve plot software, and its integration with database.
 9. Demonstrate on-line user guide, and help function and mail facility.
 10. Demonstrate digital system configuration graphics with interactive upline and downline load, and demonstrate specified diagnostics.
 11. Demonstrate multi-tasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
 12. Demonstrate class programming with point options of beep duration, beep rate, alarm archiving, and color banding.

3.14 MANUALS (FOLLOWING MANUALS TO BE PROVIDED)

- A. Functional design manual: The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be provided for all system operating modes.
- B. Hardware manual: Furnish a hardware manual describing all equipment provided including a general description and specification, installation and checkout procedures, equipment electrical schematics and layout drawings, system schematics and I/O wiring lists, and alignment and calibration procedures.
- C. Software manual: The software manual shall describe all furnished software, starting with a system overview and proceeding to a detailed description of each software module. The manual shall be oriented to enable proper integration, loading, testing and program execution. Provide flow charts or diagrams or equivalent documentation, as approved in advance by owners representative, in hard copy enabling the logical step by step analysis of the program listings. Substitutions of different format are not acceptable.
- D. Maintenance Manual: The maintenance manual shall provide descriptions of maintenance for all equipment including inspection, periodic preventative maintenance, fault diagnosis and repair or replacement of defective components.

3.15 TRAINING

- A. All training to be by BMCS manufacturer and utilize specified manuals, as built documentation, and on-line help utility.
1. Provide classroom instruction course at Climatec's local Training Center in Irving, TX.
 - a. Minimum 2 day for 3 individuals
 - b. Travel, room and board at Owner's expense.
- B. Operator training to include one initial on-site eight hour sessions encompassing:
1. Sequence of operation review.
 2. Sign on-sign off.
 3. Selection of all displays and reports.
 4. Commanding of points, keyboard, and mouse mode.
 5. Modifying English text.

6. Use of all dialog boxes and menus.
 7. Modifying warning limits, alarm limits, and start-stop times.
 8. System initialization.
 9. Download and initialization of remote panels.
 10. Purge and/or dump of historical data.
 11. Use of portable operator's terminal.
 12. Troubleshooting of sensors (determining bad sensors).
 13. Password modification.
- C. After initial training, BMCS manufacturer shall include 8 additional hours of training for miscellaneous instruction requested by the Owner.
- D. Supervisor training shall include additional eight hour session encompassing:
1. Password assignment/modification.
 2. Operator assignment/modification.
 3. Operator authority assignment/modification.
 4. Point disable/enable.
 5. Terminal and data segregation/modification.
 6. Use of portable operator terminal.
 7. Use of spreadsheet package with system data.
- E. Programmer training shall include two additional eight hour sessions encompassing:
1. Software review of sequence of operation and flow charts.
 2. Modification of control programs.
 3. Add/delete/modify data points.
 4. Use of diagnostics.
 5. System maintenance procedures.
 6. Review of initialization.
 7. Upload/download and off-line archiving of all system software. Programmer training shall be for two Owner personnel, and shall be scheduled by Owner with two week notice anytime during warranty period.
 8. Graphic creation.

END OF SECTION



DIVISION 26

ELECTRICAL



SECTION 26 00 10
ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Drawings use and interpretation:
 - 1. Drawings are diagrammatic and indicate general arrangement of systems and equipment, except:
 - a. Specific installation details.
 - b. When specific dimensions are indicated for electrical equipment it is intended that these be limiting dimensions. When proposed equipment exceeds these limiting dimensions, advise Architect. Features and functions of specified equipment shall not be superseded by these limiting dimensions.
 - 2. For exact locations of building elements, refer to dimensioned architectural/structural drawings.
 - 3. Field measurements take precedence over dimensioned drawings.
 - 4. Intention is to indicate size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement.
 - 5. Field verify locations and arrangement of all existing systems and equipment.
- B. Installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.
- C. Description of systems:
 - 1. Provide materials to provide functioning systems in compliance with performance requirements specified.
 - 2. Provide modifications required by reviewed shop drawings and field coordinated drawings.

1.2 QUALITY ASSURANCE

- A. Perform all work in accordance with but not limited to:
 - 1. Federal, state and local codes, regulations and ordinances.
 - 2. Underwriters Laboratories, Inc. (UL) requirements.
 - 3. NFPA-70 National Electrical Code (NEC).
 - 4. Occupational Safety and Health Act (OSHA).
 - 5. All authorities having jurisdiction.
 - 6. Factory Mutual System (FM) requirements.
 - 7. International Building Code (IBC).
 - 8. NFPA-101: Life safety code.
 - 9. NFPA-110: Emergency and standby power systems.

1.3 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Final performance test reports.

1.4 DEFINITIONS

- A. Weatherproof (WP): Indicates rating suitable for wet or damp location.

1.5 PROTECTION

- A. Provide covering and shielding for all equipment to protect from damage.

- B. Protect nameplates on motors and similar equipment, to prevent defacing.
- C. Repair, restore or replace damaged, corroded and rejected items.

1.6 JOB CONDITIONS

- A. Examine Contract Documents to determine how other work will affect execution of electrical work.
- B. Make arrangements for and pay for necessary permits, licenses, and inspections.
- C. Cause as little interference or interruption of existing utilities and services as possible.
 - 1. Schedule work which will cause interference or interruption in advance with Owner, Architect, authorities having jurisdiction and all affected trades.
- D. Determine and verify locations of all existing utilities on or near site.
- E. Temporary construction power and communications (See Division 01)
- F. Record drawings:
 - 1. Keep a complete set of all electrical drawings in job site office for indicating actual installation of electrical systems and equipment.
 - 2. Use this set of drawings for no other purpose.
 - 3. Where any material, equipment, or system components are installed differently from that indicated, indicate differences clearly and neatly using ink or indelible pencil.
 - 4. At project completion, submit record set of drawings. Refer to Section 01 78 39 for specific requirements.

1.7 ENVIRONMENTAL CONDITIONS

- A. General:
 - 1. Provide NEMA 1 enclosures for electrical equipment unless otherwise indicated.
- B. Conduit: See Section 26 05 33.
- C. Cable: See Section 26 05 19.
- D. Boxes and Fittings: See Section 26 05 34.
- E. Damp and wet locations:
 - 1. Exterior applications:
 - a. Provide NEMA 3R enclosures for electrical equipment.
 - 2. Dietary applications:
 - a. Provide NEMA 4 enclosures for electrical equipment in kitchen production, dishwashing and servery areas.
- F. Corrosive environments:
 - 1. Use NEMA 4X reinforced fiberglass watertight enclosures in areas with corrosive atmospheres.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use only prime quality, new materials, apparatus and equipment.
- B. Material and equipment: Current and standard design of manufacturers regularly engaged in their production.
- C. Where UL approval or listing is required in electrical specifications, suitable approval or listing from other nationally recognized testing laboratory (NRTL) is acceptable.

- D. Use UL labeled electrical materials and fabricated assemblies.
- E. Structural steel for supports: ASTM-A36.
 - 1. Galvanize members installed in areas of high humidity or condensation.
 - 2. Furnish other members with shop coat of rust inhibiting primer.
 - 3. Shop fabricate for field assembly using bolts.
 - 4. Minimize field welding.
 - 5. Retouch primer and galvanizing after field welding.
 - 6. Unless support is otherwise indicated where weight of equipment exceeds 400 pounds, submit engineering design and calculations signed and sealed by a registered Engineer licensed to practice Structural Engineering in the state in which the project is located.
- F. Rain hoods and counter flashings not exposed to view:
 - 1. Stainless steel: Minimum 20 GA.
 - 2. Sheet copper: Minimum 24 OZ.
- G. Rain hoods and counter flashings exposed to view: As specified in Section 07 62 00.
- H. Access doors, panels and frames: See Section 08 31 16.
 - 1. Provide where indicated on Drawings.
 - 2. Where not indicated on Drawings, provide access panels and/or doors at walls, and inaccessible ceilings as required to permit access to equipment, devices and piping requiring service, adjustment, or inspection.
 - 3. Size:
 - a. As required to allow access, inspection, service, and removal of items served.
 - b. Minimum 18 x 18 IN.

2.2 FIRESTOPPING

- A. Firestop all penetrations of fire rated walls, floors and assemblies.
 - 1. Penetrations shall comply with UL listing for construction or assembly.
- B. Use materials and methods as specified in Section 07 84 00.

PART 3 - EXECUTION

3.1 GENERAL

- A. Use only thorough, highly skilled, and experienced personnel.
- B. When changes in location of any work are required, obtain approval of Architect before making change.
- C. Do not change indicated sizes without written approval of Architect.
- D. Provide all necessary offsets and crossovers in conduits, raceways, cabletrays and ducts.
- E. Where electrical items penetrate fire and/or smoke rated walls, ceilings and floors, comply with Section 07 84 00.

3.2 CUTTING AND PATCHING

- A. Provide cutting, fitting, repairing, patching and finishing of installed work.
 - 1. Include installed work of other sections where it is necessary to disturb such work to permit installation of electrical work.
 - 2. Repair or replace existing or new work disturbed.
- B. Avoid cutting, where possible, by setting sleeves or frames, and by requesting openings in advance.

- C. Before cutting, obtain approval of Structural Engineer.
 - 1. Use only approved methods.
 - 2. Cut all holes neatly and as approved by engineer possible to admit work.
 - 3. Do not weaken walls or floors; locate holes in concrete to avoid structural members.
- D. Locate openings and sleeves to permit neat installation of conduits and equipment.
- E. Do not remove or damage fireproofing materials.
 - 1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
 - 2. Repair or replace fireproofing removed or damaged, at no extra cost.
- F. See Section 01 73 29.

3.3 EXCAVATING AND BACKFILLING

- A. Excavating, trenching, and backfilling:
 - 1. See Section 31 23 33.
 - 2. See Section 31 23 00.

3.4 INSTALLATION OF EQUIPMENT

- A. Install all equipment in accordance with manufacturer's recommendations.
- B. Provide all necessary anchoring devices and supports.
 - 1. Use structural supports suitable for equipment.
 - 2. Check loadings and dimensions of equipment with shop drawings.
 - 3. Do not cut, or weld to, building structural members.
 - 4. Provide equipment supports even though not detailed on architectural and structural drawings.
- C. Arrange for necessary openings to allow entry of equipment.
 - 1. Where equipment cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves or other devices to allow later installation.
- D. Make all penetrations through roofs prior to installation of roofing. For penetrations required after installation of roofing:
 - 1. In built-up roofing (BUR), provide all curbs, cants and base flashings.
 - 2. In elastic sheet roofing (ESR), arrange and pay for flashing work by authorized roofer.
- E. Install rain hoods and metal counter flashings as indicated and make all penetrations of electrical work through walls and roofs water and weathertight.
 - 1. Furnish all clamps, waterproofing material and labor necessary.
 - 2. Where metal flashings are applied over concrete, paint concrete with 1/8 IN of mastic cement first.
 - 3. Set flashing in mastic cement, watertight.
- F. Have repair and replacement of roof construction, damaged by this work, done in manner which will not nullify roof warranty.
- G. Install equipment to permit easy access for normal maintenance.
 - 1. Maintain easy access to switches, motors, drives, pull boxes, receptacles, etc.
 - 2. Relocate items which interfere with access.
- H. Provide concrete foundations (isolation pads) or housekeeping pads for floor mounted electrical equipment as follows unless otherwise indicated:
 - 1. Install nominal 4 IN high concrete housekeeping pads. Outside dimension of pad shall be at least 4 IN larger in all directions than base of equipment or 228 mm 9 IN from center of anchor, whichever is greater.
 - 2. Use 3,000 PSI concrete.
 - 3. Reinforce with No.4 12 IN OC each way, with short No.4 dowels into floor at 24 IN OC each way.

4. Chamfer top edges 3/4 IN.
 5. Make faces smooth.
 6. Set anchor bolts for equipment.
- I. Provide security fasteners on all light fixtures, device plates, etc., in inmate areas within secure perimeter.
 1. "Torx" drive with center pin, hardened steel.
 2. Provide 10 fastening tools.

3.5 PAINTING

- A. See Section 09 91 13, and Section 09 91 23.

3.6 REMODELING

- A. Field verify locations and arrangement of all existing systems and equipment.
- B. Where relocation of existing equipment and piping systems is necessary in areas providing services that must remain in operation, schedule work for minimal down time during slack period.
 1. Anticipate scheduling work during premium time and include cost in proposal.
- C. Do not cut into existing services without first verifying with Owner that service has been correctly identified.
 1. Perform work that interrupts any service during premium time.
 - a. Include cutting into existing lines for new connection.
 - b. Cause least interference to normal operation of building.
 2. Inform building engineering staff in advance of any shut off that will occur and give estimate of duration.
 3. Begin work only after engineering staff is fully informed and has agreed to schedule of shut offs.
- D. Fabricate and install interconnecting portions of these systems prior to shut down for final connections.
- E. Maintain all existing services and equipment unless indicated to be removed.
- F. Perform demolition as directed by Contractor.
 1. Remove all equipment indicated.
 2. Relocate items indicated after thorough cleaning.
 3. Remove all existing wiring serving abandoned circuits.
 4. Remove all non-embedded conduit serving abandoned circuits.
- G. Salvage items in accordance with Section 02 41 00.
- H. Existing conduit and wire of proper sizes may be spliced and extended from appropriate points, but do not reuse after removal.
- I. Existing equipment and materials removed from existing construction and not indicated or required to be reused shall become the property of the Owner, if they so elect.
 1. Present equipment and materials removed to Owner's representative, who shall select equipment and materials to retain.
 2. Equipment and materials not retained shall become property of Contractor and shall be removed from site.

3.7 FIELD QUALITY CONTROL

- A. Perform indicated tests to demonstrate workmanship, operation, and performance.
 1. Conduct tests in presence of Architect and, if required inspectors of agencies having jurisdiction.
 2. Arrange date of tests in advance with Architect, manufacturer and installer.
 3. Give minimum of 24 hours notice to all inspectors.

4. Furnish or arrange for use of electrical energy, steam, water, diesel fuel, or gas required for tests.
 5. Furnish all lubricating materials required for test.
- B. Repair or replace equipment and systems found inoperative or defective and retest.
1. If equipment or system fails retest, replace it with products conforming with Contract Documents.
 2. Continue remedial measures and retests until satisfactory results are obtained.
- C. Test equipment and systems as indicated for each item, unless otherwise recommended by manufacturer.

3.8 FINAL PERFORMANCE TEST

- A. Perform panel load balance, short circuit, and freedom from ground, and ground test (including ground fault protection where provided).
1. As part of putting systems in operation, provide tabulated results of load balance and voltage at each switchboard, panelboard and motor control center. Use true RMS measuring metering devices.
 2. Provide written report that all circuits have been energized and no short circuits exist.
 3. Provide neutral to ground resistance tests to prove neutral is grounded in only one location.
 4. Provide ground test at service entrance and provide report on resistance to earth of the grounding electrode system.

3.9 ADJUST AND CLEAN

- A. Inspect all equipment and put in good working order.
- B. Clean all exposed and concealed items.
- C. Where new work occurs in existing areas where no other work has been done, clean area and restore to original condition.

3.10 PUTTING SYSTEMS IN OPERATION - START UP

- A. Put all systems into satisfactory operation prior to final acceptance, at time agreed to by Contractor, Owner and Architect.
- B. Operate all systems in good working order for period of 5 working days.

3.11 DEVICE MOUNTING

- A. See symbol legend for device mounting heights unless otherwise noted.
- B. Dimensions are to center of device unless otherwise indicated.
- C. Coordinate device locations with all equipment/furnishings abutting walls such as, but not limited to, architectural millwork, casework, lockers, mirrors, and equipment. Refer to architectural and casework/equipment elevations to facilitate coordination of device placement. Devices shall be relocated at Contractor's expense if conflict exists after installation.
- D. Coordinate device mounting height with wainscoting where provided. Where top of wainscot and device mounting height overlaps, shift device down to provide 2 IN gap between top of device and top of wainscot.

3.12 IDENTIFICATION AND LABELING

- A. Nameplates: Provide engraved laminated nameplates with white lettering for electrical equipment.
1. Provide black nameplate(s) for equipment fed by normal distribution system.
 2. Coordinate color(s) of emergency system name plates with painting paragraph below.
 3. Letters:
 - a. 1/4 IN high for equipment with cover plate under 12 IN wide.

- b. 1/2 IN high for equipment with cover plate over 12 IN wide:
 - 4. Attach with stainless steel screws.
 - 5. Switchgear, switchboard, distribution panel and motor control center nameplates:
 - a. Center nameplate near top of first section. Label text to include:
 - 1) Equipment name and branch, i.e., "Panel XXXX - Emergency Branch".
 - 2) Source, i.e., "Source - Switchboard XXXX".
 - b. Provide similar nameplates for each main and feeder device. Mount label adjacent to or on cover of device. Label text to include:
 - 1) Description of load, i.e., "Load - Panelboard XXX".
 - 6. Panelboard nameplates:
 - a. Center nameplate near top of each section. Label text to include:
 - 1) Equipment name and branch, i.e., "Panel XXXX - Emergency Branch".
 - 2) Source, i.e., "Source - Switchboard XXXX".
 - 7. Disconnect switches, transformers, contactors, thermal element switches, starters, capacitors, etc. nameplates:
 - a. Center nameplate near top of face plate or cover. Label text to include:
 - 1) Description of load, i.e., "Load - AHU-XXX".
 - 2) Source, i.e., "Source - MCC-XXXX".
 - 8. Transfer switches:
 - a. Center nameplate near top of cover. Label text to include:
 - 1) Description of load, i.e., "Distribution Board XXXX – Emergency Branch".
 - 2) Normal source, i.e., "Normal Source - Switchboard XXXX".
 - 3) Emergency source, i.e., "Emergency Source - Switchboard XXXX".
 - 9. Fire alarm, public address and other system control cabinet nameplates:
 - a. Center nameplate near top of cover. Label text to include:
 - 1) Description of system, i.e., "Fire Alarm System Control Panel".
 - 10. Relays and relay cabinet nameplates:
 - a. Center nameplate near top of cover. Label text to include:
 - 1) Description of item controlled, applicable system or function and type of device, i.e., "AHU-XXX FA Shut Down Relay" or "Exterior Lighting Circuit XX-X Control Relay".
- B. Flash hazard warning signs: Provide for all switchboards, panelboards, and motor control centers per NEC Article 110.
- C. Device plates: See Section 26 27 26.
- D. Paint outlet boxes, junction boxes and enclosures, except switchboard and panelboard enclosures, and for emergency circuits as follows:
 - 1. Fire Alarm System: Red.
 - 2. Emergency System: Yellow.
 - 3. Normal System: No color.
 - 4. Datacom System: White.
 - 5. Security System: Blue.
 - 6. Access Control System: Green.
- E. Paint all emergency system feeder conduits with 2 IN wide band 10 FT on center as scheduled in paragraph(s) above.
 - 1. Pressure-sensitive, color-impregnated tape will be acceptable.
- F. High voltage signs:
 - 1. All distribution equipment rated over 600 volts and/or pull and junction boxes containing conductors rated over 600 volts shall have a sign posted on the front and rear as applicable:
 - a. 1 to 1-1/2 IN high red letters stenciled on a 3 IN high white background.
 - b. Sign shall read, "DANGER -- HIGH VOLTAGE".

END OF SECTION

SECTION 26 00 11
WIRING EQUIPMENT FURNISHED BY OTHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all conduit, wiring, outlet boxes, receptacles, circuit breakers, fittings, switches, starters, (with overloads) etc., to make final connections to all equipment.
- B. Connect:
 - 1. Heating, ventilation, cooling and plumbing system equipment, (Mechanical Specification Divisions)
 - 2. Automatic door equipment, (Division 08)
 - 3. Projection screens, (Division 11)
 - 4. Fixed and/or movable equipment, (Division 11)
 - 5. Panel folding doors, (Division 08)
 - 6. Electronic security equipment, (Division 13)

PART 2 - PRODUCTS

2.1 MECHANICAL SPECIFICATION DIVISIONS EQUIPMENT

- A. Provide all conduit, wire, and connect all Mechanical Specification Divisions equipment.
- B. Provide all motor starters except in package or prewired units as indicated in Mechanical Equipment Schedule.
 - 1. Connect all motors.
 - 2. Provide starters with thermal overload protection for all motors not having such protection, except as otherwise indicated.
- C. Provide proper thermal overload heater elements in all starters.

2.2 FOOD SERVICE EQUIPMENT

- A. Where equipment items are to be connected using plug and receptacle, provide receptacle compatible with plug.
- B. Where equipment is to be directly connected, use flexible conduit as indicated in Section 26 05 33.
- C. Provide power panels serving electrical cooking equipment with main breaker having 120V shunt trip.
- D. Install 120V relay cabinet furnished by Food Equipment Contractor near cabinet for dry chemical system.
 - 1. Provide 20A, 120V emergency circuit to this relay cabinet.
 - 2. Provide 2 No.14 1/2 IN conduit from this cabinet to shunt trip on main circuit breaker(s) to open when system is pressurized.
 - 3. Provide connection from this cabinet to initiate fire alarm.
- E. Provide manufactured metal sign with 1/2 IN high white letters on black background reading: "After operation and restoration of dry chemical system, close main circuit breaker in power panel to restore electrical power".
- F. Hood fan shutdown system is described in Section 28 31 00.

2.3 AUTOMATIC DOOR EQUIPMENT

- A. Provide all conduit, wiring, outlet boxes, etc., to make final connections to all motors, switches, safety mats, proximity detectors, remote control units, electric dead bolts.
- B. See Section 28 31 00 for connections to fire alarm system.
- C. Switches for control of automatic doors provided by door manufacturer, installed by electrical.

2.4 DIVISION 11 EQUIPMENT

- A. Provide all conduit, wiring, outlet boxes, receptacles, circuit breakers, fittings, switches, etc., to make final connections to all equipment.
- B. Where equipment items are to be connected using plug and receptacle, provide receptacle compatible with plug.
- C. Where equipment is to be directly connected, use flexible conduit as indicated in Section 26 05 33.
- D. See Division 11 and electrical plans for equipment to be connected.

2.5 DIVISION 27 ELECTRONIC SECURITY SYSTEMS

- A. Provide complete raceway system, minimum size conduit 1 IN, from main head end equipment to the end device, including any necessary standard size backboxes, wireways, junction boxes, pullboxes and manholes.
- B. Provide all 120 volt AC power wiring and connections to electronics systems UPS equipment.
- C. Provide heavy duty nylon pull string or wire in all conduit suitable for use in pulling in wire.
- D. Division 27 installer: Furnish conduit requirements and special backboxes to the Electrical Specifications Divisions installer.
- E. Division 27 installer: Provide additional conduits required (not shown on drawings) or increase in size of conduit to effect the installation of the Division 27 equipment.
- F. Refer to Division 27 and to electronic security drawings, Series EY.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Perform work in accordance with applicable Electrical Specifications Divisions.
- B. Wire equipment complete properly connected and energized.
- C. Provide conduit and wiring as required for directly-connected switches as indicated or required.

END OF SECTION

SECTION 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Low Voltage Electrical Power Conductors and Cables, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Splices and taps for smaller than No.6 AWG wire:
 - 1. Base:
 - a. 3M.
 - b. Ideal Electric.
 - c. Heyco Molded Products.
 - d. Elastimold.
 - e. Buchanan Construction Products.
 - 2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Wire for 600 volts and below: Single conductor, soft drawn, copper wire with 600 volt insulation, UL listed.
 - 1. For feeders and branch circuits: Type THWN/THHN or XHHW.
 - 2. For exterior feeder and branch circuits: Type XHHW.
 - 3. For branch circuits served by GFCI circuit breakers: Type XHHW.
 - 4. Use no wire smaller than No.12 AWG, except as follows:
 - a. Smaller size wire may be used only where specifically indicated.
 - b. No.14 AWG may be used for pilot control and signal circuits.
 - 5. Size conductors to match over current protective device unless larger conductors are indicated.
 - 6. No.10 and smaller wire: Solid conductor.
 - 7. No. 10 AWG conductor to be used for 20 ampere, 120V circuits exceeding 100 FT.
 - 8. No. 10 AWG conductor to be used for 20 ampere, 277V circuits exceeding 200 FT
- B. Splices and taps for smaller than No.6 AWG wire:
 - 1. 3M, "Scotchlok" or "Hyflex".
 - 2. Ideal "Wingnut" or "Wirenut".
 - 3. Heyco.
 - 4. Elastimold insulated conical spring-type connectors.
- C. Splices and taps for No.6 AWG wire and larger: Use compression connectors with pre-stretched insulation to equal insulation of wire being spliced.
- D. Splices and taps - General: Do not make splices and taps with crimp or indenter-type connectors.
- E. Pulling lubricant: Do not use cable pulling lubrication compound containing petroleum or other products which may deteriorate insulation.

- F. Color coding: Color code all conductors in accordance with NEC as follows:
1. Color code all wiring.
 2. Use following colors in lighting and power wiring:

120/208 VOLT	277/480 VOLT
--------------	--------------

Phase 1	Black	Brown
Phase 2	Red	Orange
Phase 3	Blue	Yellow
Neutrals	White	Gray
Ground	Green	Green

3. Isolated equipment grounding conductor: Green with one or more yellow stripe(s).
4. Color coding of ends only will be acceptable for feeder phase conductors.
5. Color coding of ends only will be acceptable for neutral and grounding conductors number 4 AWG and larger.

- G. Wire and cable for 600 volt and below: (for Feeders Only)

1. Compact stranded AA-8000 series aluminum alloy conductors of equivalent ampacity may be used in lieu of copper conductors of sizes 100 AMPS and larger.
2. If used, comply with Paragraph "Design Criteria for Use of Aluminum Conductors."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting and receptacle home runs indicated are for identification purposes only.
- B. Install all line voltage wiring in conduit unless otherwise indicated.
- C. Install no more than 3 phase conductors in one conduit. This excludes ground wire. The neutral conductor shall be considered as a current carrying conductor.
- D. Provide a separate neutral conductor for each phase conductor in all branch circuits.
- E. Run panelboard and motor feeders in individual conduits.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Grounding and Bonding for Electrical Systems, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Technical data on connectors.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Exothermic weld kits:
 - 1. Base:
 - a. Cadweld.
- B. Compression fittings:
 - 1. Base:
 - a. Burndy.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Wire and cable: See Section 26 05 19.
 - 1. Main ground: Copper conductor, sized as required by appropriate service grounding conductor table of NEC.
 - 2. Grounding copper conductor for non-metallic conduit and ducts: Copper bar or insulated conductor, sized in accordance with NEC or as indicated.
- B. Conduit: See Section 26 05 33.
- C. Grounding clamp connections: Clean contact surfaces, tinned and sweated during bolting.
- D. Grounding type insulated bushings: See Section 26 05 33.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground all neutral conductors, conduit systems, cabinets, equipment, motor frames, etc., in accordance with NEC and applicable codes.
- B. Locate neutral ground disconnecting link or links in main switchboard so that low-voltage neutral bar with all interior secondary neutrals can be isolated from common equipment grounding bus.

3.2 MAIN GROUND

- A. Install main grounding conductor in steel conduit and connect to grounding electrode system using an exothermic weld or UL listed compression fitting.
 - 1. Unless otherwise indicated, install main ground unspliced in exposed conduit.
 - 2. Make connections easily accessible for inspection, not underground or concealed in floors or walls.
 - 3. Provide grounding electrode system in accordance with NEC.
 - 4. Resistance to earth of the grounding electrode system shall not exceed 25 ohms.
- B. Bond grounding conductor to conduit at entrance and exit, of same type and quality as other conductors in building.
- C. Install grounding jumper of same size around water meter using ground clamps.

3.3 DISTRIBUTION

- A. Make all metallic raceway fittings and grounding clamps tight to insure that equipment grounding system will operate continuously at ground potential to provide low impedance current path to insure proper operation of overcurrent devices during possible ground fault currents.
- B. Do not solder grounding circuit connections.
- C. Where metallic conduits terminate without mechanical connection to metallic housing (switchboards, motor control centers, etc.), provide each conduit with grounding type insulated bushing.
 - 1. Connect each bushing to grounding bus in equipment with bare copper conductor.
- D. In nonmetallic conduits or ducts maintain continuity of equipment grounding system by bar or conductor installed and connected by approved method to conductive noncurrent-carrying equipment at both ends.
- E. Ground all conduit, panelboards, receptacles, accessible fixtures, switchgear, transformers, motors and motor equipment.
- F. Make ground continuity positive throughout entire project.
- G. In all branch circuits install separate green grounding conductor with circuit conductors.

END OF SECTION

SECTION 26 05 33
CONDUITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Conduits, as indicated, in accordance with provisions of Contract Documents.
- B. Conduit runs are diagrammatic. Verify and coordinate locations in field.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. System standards:
 - 1. ANSI C80.1 – Rigid Steel Conduit – Zinc Coated (GCR).
 - 2. UL 6 - Electrical Rigid Metal Conduit – Steel.
 - 3. ANSI/NEMA FB-1 – Fittings, Cast metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
 - 4. ANSI C80.3 –Steel Electrical Metal Tubing (EMT).
 - 5. UL 797 - Electrical Metallic Tubing – Steel.
 - 6. ANSI C80.6 –Electrical Intermediate Metal Conduit (EIMC).
 - 7. UL 1242 - Standard for Electrical Intermediate Metal Conduit – Steel.
 - 8. UL 1 – Standard for Flexible Metal Conduit.
 - 9. UI 1660 – Standard for Liquid-Tight Flexible Nonmetallic Conduit.
 - 10. UL 514B - Conduit, Tubing, and Cable Fittings.
 - 11. UL 2239 - Hardware for the Support of Conduit, Tubing, and Cable.
 - 12. UL 651 - Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
 - 13. UL 651A - Type EB and A Rigid PVC Conduit and HDPE Conduit.
 - 14. NEMA TC-2 – Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Expansion joint fittings.
 - 2. Color Coated EMT Conduit

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Expansion joint fittings:
 - 1. Base:
 - a. O-Z Gedney.
 - b. Crouse Hinds.
 - c. Appleton Electric.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Conduit:

HDR Project No. 10105890

Denton County
Kitchen & Laundry Addition
CONDUITS
26 05 33 - 1

June 14, 2019
Bidding Documents

1. Stamp each length with name or trade mark of manufacturer and affix UL label.
 2. Rigid steel conduit (GCR or GRC): Hot dipped galvanized or sherardized including threads.
 3. PVC coated steel conduit: Galvanized rigid steel conduit with 40 mils minimum coating of PVC.
 4. Intermediate metal conduit (IMC): Hot dipped galvanized steel including threads.
 5. Electrical metal tubing (EMT): Galvanized steel. Color coated conduit with colors per 26 00 10 – 3.12 (D). Similar to Allied Tube and Conduit True Color EMT.
 6. Flexible steel conduit:
 - a. Provide continuous copper content or separate grounding conductor.
 - b. Dry locations: Hot dipped galvanized.
 - c. Damp or wet locations: Hot dipped galvanized with PVC jacket, Anaconda Seal-Tite type UA.
 7. Rigid PVC conduit: High impact polyvinyl chloride, meeting minimum requirements of NEC.
 - a. Direct burial type: Carlon Electric Products, Types 40 and 80.
 - b. Concrete encased burial type: Carlon Electric Products, Type EB.
 - c. Mark each length clearly and durably with nominal trade size, type of material, and UL label.
- B. Conduit fittings:
1. EMT fittings:
 - a. Dry locations: Set screw type fitting with steel body and cup type screws.
 - b. Damp and wet locations: Compression-ring type, with cast malleable iron or pressure-cast bodies with tempered steel nuts.
 - c. Do not use indenter type EMT fittings.
 2. Flexible conduit fittings:
 - a. Dry locations: Squeeze type, malleable iron, cadmium plated, straight and angle connectors for all sizes except twist-in connectors for 1/2-inch and 3/4-inch flexible metal conduit.
 - b. Damp or wet locations: Approved liquid-tight connectors.
 3. PVC fittings: Solvent weld type, with connectors and threaded adapters as required.
 4. Expansion joint fitting: Watertight deflection type, O-Z , type "DX".
 5. Bushings:
 - a. Threaded, galvanized, malleable iron.
 - b. Bushings for conductors No.4 and larger: Separate insulated bushings.
 - 1) Use at all points where such conductors enter boxes, raceways, cabinets, auxiliary gutter etc., and all other points required by NEC.
 - 2) Do not use insulated throat connectors.
 - c. Grounding bushings: With screw termination for green grounding wire.
 - 1) Provide for feeders to panelboards serving critical care areas, per NEC.

2.3 SUPPORTS, SLEEVES AND SEALS

- A. Conduit supports:
1. Listed and in compliance with applicable standards.
 2. Designed specifically for electrical installations.
 3. Hangers: Steel cadmium plated threaded rods with straps or clamp conduit holder.
 4. Straps: One-hole and two-hole malleable iron, hot-dipped galvanized or steel, cadmium or zinc plated.
 5. Beam Clamps: Malleable iron, hot-dipped galvanized or cadmium plated.
 6. Channels and Fittings:
 - a. Channels: Hot-dipped galvanized.
 - b. Fittings: Galvanized.
 7. Anchors: Self drilling and expansion bolt types. No wood or fiber plugs or concrete nails are acceptable. Use auger anchors where securing directly to drywall.
 8. Trapeze assemblies: Constructed from channels and supported by at least two (2) threaded rods attached to building structure.

9. Do not use following to support conduit:
 - a. Wire including ceiling support wires.
 - b. Perforated strap hangers.
 - c. Plastic or nylon tie wraps.
- B. Sleeves: Black iron pipe, GCR or IMC sized to accommodate work passing through.
- C. Sealer for sleeves and openings around conduit: UL listed for assembly. See Section 07 84 00.

2.4 SCHEDULE OF CONDUIT APPLICATIONS

- A. Use no conduit smaller than 3/4 IN.
 1. Size conduit in accordance with NEC unless indicated larger.
- B. Unless otherwise noted use rigid steel conduit in following locations:
 1. Underground.
 2. Outdoors.
 3. In concrete.
 4. Under concrete slabs on grade.
 5. In exterior masonry walls.
 6. In wet locations.
 7. For exposed runs below 10 FT above finished floor unless otherwise indicated.
 8. For feeders over 600 volts.
- C. Intermediate metal conduit may be used in lieu of rigid galvanized steel unless otherwise noted.
- D. EMT shall be used for other 600 volt and below dry applications as follows:
 1. Concealed in walls or above finished ceilings.
 2. Exposed EMT may be used below 3050mm 10 FT level in following locations:
 - a. From floor to ceiling in electrical equipment rooms.
 - b. Directly above motor control centers in locations other than electrical equipment rooms.
 - c. Directly above junction boxes or control panels associated with elevators or mechanical equipment with conduit termination point of 6 FT or more above floor.
- E. Flexible steel conduit:
 1. For connection to equipment subject to vibration.
 2. In damp and wet locations use liquid-tight flexible conduit. Damp locations include:
 - a. Dietary production and dishwashing areas.
 - b. Mechanical equipment pumps on or below grade.
 - c. Exterior applications.
 3. For connection to lighting fixtures above suspended ceilings less than 6FT in length.
 4. In listed office furnishings.
 5. In architectural millwork and casework.
- F. PVC conduit may be used subject to the following:
 1. Do not use exposed PVC conduit UON.
 2. Provide a 600 volt, insulated, green grounding conductor in each PVC conduit.
 - a. Power circuits: Proper ampacity per NEC.
 - b. Communications circuits: No.12 AWG minimum.
 3. 45 degree and greater bends in PVC conduit runs shall be made with rigid steel conduit.
 4. Schedule 80 PVC conduit may be used for grounding electrode system runs below grade and stubs through concrete slabs on grade.
5. Direct burial Schedule 40 PVC or concrete encased Type EB may be used as follows:
 - a. Exterior site lighting: See Section 26 56 00.
 - b. Voice and data systems where underground and in or under concrete slabs on grade.
 - c. Underground and concrete encased conduits over 600 volts.

- d. Service entrance conductors.
- e. Underground and concrete encased conduits 600 volt and below feeders and branch circuits.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION

- A. Unless otherwise noted install all conduits concealed within walls and above finished ceilings.
- B. Exposed overhead conduit may be used in mechanical, electrical and other equipment rooms except conduit drops to following:
 - 1. Where finished walls are provided, conduit drops to wiring devices, fire alarm devices, telecommunications outlets and other flush mounted devices shall be concealed within finished walls.
- C. Run exposed conduit in straight lines at right angles to or parallel with walls, beams or columns.
- D. Keep conduit away from uninsulated hot water and steam pipes. Where crossings are unavoidable, leave minimum 6 IN clearance.
- E. Avoid running conduits underneath water lines except for crossings.
- F. Do not cross conduit in front of access door in HVAC duct.
- G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.
- H. Provide inserts or fasteners to attach hangers to structure.
 - 1. Do not use drilled or explosive driven inserts in precast-prestressed concrete construction.
 - 2. Drilled or explosive driven inserts may not extend more than 1 IN into post-tensioned concrete construction.
 - 3. Attachment to metal roof deck may be by means of prepunched tabs, prepunched holes, or with screws in sides of ribs or toggle bolts in bottom of ribs.
 - 4. Do not use concrete nails in masonry walls.
 - 5. Hangers for joint between precast units shall be spaced minimum 4 IN from walls and minimum 2 IN apart.
- I. Protect inside of conduit from dirt and debris during construction by capping all openings with tapered wood plugs or plastic caps intended for purpose. If moisture or debris gets into conduit remove before wire is drawn into place.
- J. Make conduit field cuts square with saw and ream out to full size. Shoulder conduit in couplings.
- K. Use trapeze assemblies to support multiple conduits.
- L. Provide sufficient hangers for support of electrical work and equipment to limit load on single hanger to 25 LB, maximum; space not over 8 FT OC.
- M. Hangers in metal roof deck: Do not extend above tops of ribs, or otherwise interfere with vapor retarder, insulation or roofing.
- N. Support all conduit systems from building structure or walls with approved hangers.
 - 1. Do not support from piping, ducts or support systems for piping or ducts.
 - 2. Do not install to prevent ready removal of equipment, piping, ducts or ceiling tiles.
 - 3. Do not support from ceiling or ceiling support systems.
- O. Do not install conduit under pads for fans, pumps, boilers, or other machinery.
- P. All penetrations of floor slab at mechanical rooms above grade shall be sealed off and waterproofed.

- Q. Conduit shall not be installed in structural elements, i.e. concrete columns, beams, decks, or slabs unless otherwise noted.
- R. Conduit in elevated slabs:
1. Do not install conduit in elevated concrete slabs without the Structural Engineer's approval except as follows:
 - a. The outside diameter of a single conduit or vertical dimension of two or more stacked conduits (including crossovers) shall not exceed 1/6 the thickness of the slab.
 - b. The outside horizontal dimension of two or more adjacent conduits shall not exceed the thickness of the slab and the separation between groups of conduits shall not be less than the thickness of the slab.
 - c. The conduit shall have a minimum concrete cover of 3/4 IN.
- S. Sum of angles in any conduit run shall not exceed 360 degrees. Where more bends are necessary, install conduit body, junction box or pull box.
1. Conduit body, junction box and pull box covers shall be accessible.
 2. Conduit bodies may be used as follows:
 - a. On exposed runs at junctions, bends or offsets where splices are not required.
 - b. Around outside corners of walls and equipment or around beams.
 3. Conduit bends:
 - a. Make field bends with tools designed for conduit bending. Heating of metallic conduit to facilitate bending is not permitted.
 - b. Hand conduit bender may be used on 1/2 IN and 3/4 IN RGS, IMC or EMT conduit and 1 IN EMT conduit. Use conduit bending machine for larger sizes.
 - c. Make no bends with radius less than 12 times diameter of associated cable.
 - d. No conduit bends shall be greater than 90 degrees.
- T. Support suspended conduits within 1 FT of any change of direction of 45 degrees or greater.
- U. Make joints in threaded conduit watertight with white nonleaded compound applied to male threads only.
1. Cut square, ream smooth, and properly thread field joints to receive couplings.
 2. Do not use running threads.
- V. Neatly seal openings around conduits, etc., where they pass through fire rated construction or exterior walls or roof.
- W. Conduit passing through concrete wall or slab penetrations:
1. All core drilling, sleeves, block-outs or other penetrations must be approved by Structural Engineer prior to installation.
 2. Space sleeves and core drills to insure minimum of 3 times nominal trade diameter of largest adjacent conduit between sleeves or core drills.
 3. Use block-outs for concentrations of conduits in a confined area.
- X. Unless specifically indicated otherwise, no exterior horizontal roof supported conduit runs are permitted in lengths exceeding 6 feet.
- Y. Empty conduits:
1. Install a polypropylene or nylon pull-line (3/16-inch minimum diameter) from end to end with tag at each end designating opposite terminus.
 2. Cap conduits indicated to be stubbed out underground with glued-on PVC caps intended for purpose.
- Z. Conduit stub-outs:
1. Extend conduit stub-out to cable tray system.
 2. Terminate conduit with insulating bushing.
- AA. Conduits stubbed into manholes:
1. Terminate metal conduit with insulating bushing.
 2. Terminate non-metallic conduit with bell ends.

3.2 CONNECTIONS AND FITTINGS

- A. Install rigid conduits squarely into boxes. Rigidly clamp to box with locknut on outside and inside and provide bushing on inside.
- B. Fit all conduit ends at switch and outlet boxes with approved lock nuts and bushing forming approved tight bond with box when screwed tightly in place.
- C. Above lay-in tile ceilings, make connections to lay-in type fixtures with flexible steel conduit no longer than 3/8 or 1/2 IN x 6 FT.
 - 1. Include No.18 branch and grounding conductors.
 - 2. Arrange conduit and box systems for easy removal of lay-in ceiling.
- D. Connect switch legs for narrow switches in hollow metal jamb posts using 1/2 IN flexible steel conduit.
- E. Make motor and equipment connections with flexible steel conduit not exceeding 24 IN length.
- F. Provide expansion joint fittings as follows:
 - 1. On conduit at all building expansion joints where conduit is rigidly attached to structure.
 - 2. Where necessary to compensate for thermal expansion and contraction.
- G. Provide sealing fittings on raceways subject to different temperatures including but not limited to:
 - 1. Conduits passing from interior to exterior of structure.
 - 2. Conduits serving cold storage rooms, freezers and refrigeration equipment.
- H. Provide sealing fittings on rigid galvanized conduit in hazardous areas. Install in accordance with NEC.
- I. Install conduit to roof exhaust fans through fan housing with no conduit exposed.

END OF SECTION

SECTION 26 05 34
BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Boxes, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. System standards:
 - 1. UL 514A – Metallic Outlet Boxes
 - 2. ANSI/NEMA FB-1 – Fittings, Cast metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

1.3 SUBMITTALS

- A. Shop Drawings.
- B. Product Data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Galvanized boxes:
 - 1. Base:
 - a. Appleton Electric
 - b. Thomas & Betts
 - c. Raco Manufacturing & Engineering
- B. Corrosion resistant boxes and fittings:
 - 1. Base:
 - a. Crouse-Hinds Lighting
 - b. Appleton Electric
- C. PVC coated boxes:
 - 1. Base:
 - a. Robroy Industries
 - b. Occidental Coating
- D. Box supporting brackets:
 - 1. Base:
 - a. Caddy
- E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Galvanized boxes and fittings shall be galvanized after fabrication.
- B. Lighting outlet boxes: Hot-dip galvanized, 4 IN octagon.
 - 1. Use extension and plaster rings as required.
 - 2. Verify proper depth with partition thickness.

3. Provide with proper fittings to support and attach lighting fixtures.
 4. Support outlet boxes for incandescent fixtures and other ceiling-mounting devices in lay-in acoustical tile ceilings by bar hangers anchored to ceiling construction members which do not interfere with tile removal.
- C. Switch and receptacle boxes for concealed wiring: Hot-dip galvanized.
 1. Narrow switch boxes (for hollow metal jambs): Raco Manufacturing & Engineering 426.
 - D. Exposed switch and receptacle boxes: Corrosion resistant, cast, ferrous metal, with threaded hubs; Crouse-Hinds Type FS
 - E. Concealed gang-switch and junction boxes not dimensioned: 4 IN square, hot-dip galvanized.
 - F. Data Cabling Box Size: 4IN square by 2-1/2 IN deep.
 - G. Access Control Box Size: 3IN x 2IN by 2-1/2 IN deep single gang box.
 - H. Boxes for 277 volt switches on opposite phases: Gang-switch type, with barriers between switches.
 - I. Weatherproof receptacle boxes: Corrosion resistant cast ferrous metal type, with threaded hubs and neoprene gasket; Crouse-Hinds Type FS.
 - J. Pull and junction boxes: Code-sized galvanized steel boxes provided with plain blank removable covers held in place with screws unless otherwise indicated.
 1. Where sizes are not indicated, use 4 IN square or NEC size.
 - K. PVC coated steel boxes: Provide 40 mils minimum coating of PVC.
 - L. Pull and junction boxes in PVC conduit: 4 IN square plastic boxes.
 - M. Conduit bodies: Corrosion resistant conduit fittings, cast ferrous metal type, with sharp clean threads.
 - N. Box supporting brackets: Caddy MEB1 and SGB Series.
 - O. Far side box support: Hubbell/RACO Catalog #978.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mounting of outlet boxes for concealed wiring:
 1. Boxes mounted adjacent to studs shall be attached directly to stud with a minimum of 4 metal screws. Provide far-side box support on all boxes.
 2. Boxes that are not attached directly to studs shall be attached to box support bracket spanning studs. Bracket shall be attached to studs with 2 screws at each end. Attach box to bracket with 2 screws minimum.
- B. Mounting of junction boxes in existing walls:
 1. Where junction boxes or device boxes are to be mounted in existing walls, sufficient drywall shall be removed to allow proper support of box by attaching directly to a stud or bracket spanning 2 studs. Patch drywall and seal as required returning wall to original finish.
- C. When a metallic junction box for electrical receptacles or switches is contained within a 1 or 2-hour rated fire or smoke wall of gypsum drywall construction and an opening is provided for the box in the surface of that wall, the area of the opening may not exceed 16 square inches, unless the junction box is protected by an approved method such as a UL listed "putty pad".
 1. The aggregate area of all such junction boxes in a rated wall not protected by an approved method shall not exceed 100 square inches in 100 square feet of wall area as measured from floor to structural deck or rated membrane.

2. Junction boxes with openings on opposite faces of rated walls shall have a horizontal separation of 24 inches as a minimum, regardless of box size, unless protected by an approved method.
 3. Locations of studs do not have any bearing on the above requirements, nor does the use of mineral wool fire safing alter these requirements.
- D. Fill unused punched-out openings in boxes with proper closures.
 - E. Use outlet boxes sized to accommodate quantity of conductors enclosed.
 - F. Provide pull boxes or junction boxes in conduit runs where indicated or as required to facilitate pulling of wires or making of connections. Make covers of all boxes accessible.
 - G. Spray paint inside and outside of boxes per Section 26 00 10.
 - H. Coordinate all floor boxes with available slab depth to assure that concrete depth is adequate for specified box. Make sure that all boxes are level and set to proper level based on slab depth.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Identification for Electrical Systems, as indicated, in accordance with provisions of Contract Documents.
- B. Provide the following:
 - 1. Identification for raceways.
 - 2. Identification for conductors.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Equipment identification labels.
 - 6. Miscellaneous identification products.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer literature for each electrical identification product indicated.
- B. Project Information:
 - 1. Identification Schedule:
 - a. Index of electrical equipment and system components of identification signs and labels. Include appropriate colors of both lettering and label background.

1.4 COORDINATION

- A. Identification required in this section applies to equipment furnished in other Divisions.
- B. Coordinate identification names and abbreviations with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, operation manuals, maintenance manuals, code requirements, standards, and 29 CFR 1910.145.
 - 1. Use consistent designations throughout Project.
 - 2. Equipment identification shall be same as designation indicated on plans.
- C. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- D. Coordinate installation of identifying devices with location of access panels and doors.
- E. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

HDR Project No. 10105890

Denton County
Kitchen & Laundry Addition
IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 05 53 - 1

June 14, 2019
Bidding Documents

- A. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. As scheduled below.
- B. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 IN wide; compounded for outdoor use.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

- A. Conductor jacketing shall be color-coded as scheduled below.

2.3 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to permanently identify and locate underground electrical and communications utility lines.
 - 2. Tape and ink:
 - a. Chemically inert.
 - b. Unaffected when exposed to acids, alkalis, and other destructive substances found in soil.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes with Black Lettering: ELECTRIC LINE, HIGH VOLTAGE.
 - 3. Inscriptions for Orange-Colored Tapes with Black Lettering: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.
- C. Construction:
 - 1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - 2. Thickness: 4 mils .
 - 3. Weight: 18.5 LB/1000 SQ FT. .
 - 4. 3 IN Tensile According to ASTM D 882: 30 LBF , and 2500 PSI .

2.4 CONCRETE COLORANT

- A. Color Pigment:
 - 1. Add red color pigment to concrete mixture according to manufacturer's written instructions.

2.5 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Arc Flash Warning: "WARNING – ARC FLASH HAZARD."
 - 2. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting.
 - 1. Colors as indicated in Identification Schedule below.
 - 2. Letters:
 - a. 1/4 IN high for equipment with cover plate less than 12 IN wide.
 - b. 1/2 IN high for equipment with cover plate over 12 IN wide:

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.8 FLOOR MARKING TAPE

- A. 2 IN wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
 - 1. Coordinate all signage with Owner's facility-wide standard nomenclature, if applicable.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 12 IN below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 IN overall.
- G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Identify with self-adhesive vinyl label applied in bands. Install labels at 30 FT maximum intervals.
- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, manholes, and handholes, use color-coding conductor tape to identify the phase.
- C. Boxes: Color code the covers of each junction and pull box.
- D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground-line warning tape for both direct-buried conduit as well as conduits in ductbank.
- E. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting:
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

- G. Nameplates: Provide engraved laminated nameplates for electrical equipment.
1. Switchgear, switchboard, distribution panel and motor control center nameplates:
 - a. Center nameplate near top of first section. Label text to include:
 - 1) Equipment name and branch, i.e., "Panel XXXX - Life Safety Branch".
 - 2) Source, i.e., "Source - Switchboard XXXX".
 - b. Provide similar nameplates for each main and feeder device. Mount label adjacent to or on cover of device. Label text to include:
 - 1) Description of load, i.e., "Load - Panelboard XXX".
 2. Panelboard nameplates:
 - a. Center nameplate near top of each section. Label text to include:
 - 1) Equipment name and branch, i.e., "Panel XXXX - Life Safety Branch".
 - 2) Source, i.e., "Source - Switchboard XXXX".
 3. Transformers:
 - a. Center nameplate near top of face plate or cover. Label text to include:
 - 1) Equipment name and branch, i.e., "Transformer XXXX - Life Safety Branch".
 - 2) Description of load, i.e., "Load - Panelboard XXXX".
 - 3) Source, i.e., "Source - Busduct XXXX".
 4. Disconnect switches, contactors, thermal element switches, starters, capacitors, etc. nameplates:
 - a. Center nameplate near top of face plate or cover. Label text to include:
 - 1) Description of load, i.e., "Load - AHU-XXX".
 - 2) Source, i.e., "Source - MCC-XXXX".
 5. Transfer switches:
 - a. Center nameplate near top of cover. Label text to include:
 - 1) Description of load, i.e., "Distribution Board XXXX - Life Safety Branch".
 - 2) Normal source, i.e., "Normal Source - Switchboard XXXX".
 - 3) Emergency source, i.e., "Emergency Source - Switchboard XXXX".
 6. Fire alarm, public address and other system control cabinet nameplates:
 - a. Center nameplate near top of cover. Label text to include:
 - 1) Description of system, i.e., "Fire Alarm System Control Panel".
 7. Relays and relay cabinet nameplates:
 - a. Center nameplate near top of cover. Label text to include:
 - 1) Description of item controlled, applicable system or function and type of device, i.e., "AHU-XXX FA Shutdown Relay" or "Exterior Lighting Circuit XX-X Control Relay".
 8. Lighting Control Panel nameplates:
 - a. Center nameplate near top of cover. Label text to include:
 - 1) Equipment name and branch, i.e., "Lighting Control Panel XXXX - Normal Branch".
 - 2) Control Power Source, i.e., "Control Power - Panel XXXX".
- H. Flash Hazard Warning Signs:
1. Provide for all switchboards, panelboards, and motor control centers per NEC Article 110.
- I. Device Plates:
1. Color as scheduled in table below and label text as required under Section 26 27 26.
- J. Boxes & Enclosures:
1. Paint outlet boxes, junction boxes and enclosures, except switchboard and panelboard enclosures, as scheduled in Table below.
 2. Paint outside of boxes and box cover plates.
 3. Identify circuit numbers on inside of box and cover plate. Identification shall be post-painting of boxes.
- K. Conduit:
1. Provide permanently color-coded conduit, color as indicated in Table below. Conduits sized as follows:
 - a. Minimum of 1 IN and smaller shall be fully factory painted.

- b. Larger than 1 IN shall be fully factory painted, or painted 2 IN wide band 10 FT on center, or provided with 2 IN wide pressure sensitive, color impregnated tape 10 FT on center.

L. Provide color-coding of devices and equipment as indicated in Table below.

Electrical Device and Covers	Normal	Life Safety	Critical	Equipment 1	Equipment 2	UPS
Boxes (Outlet, Junction)	Silver (un-tinted)	Yellow	Orange	Green	Gray	Blue
Conduit/Paint/Taping	Silver (un-tinted)	Yellow	Orange	Green	Gray	Blue
Device Plates	White	SS 304	Red	Brown	Gray	Blue
Labeling - Nameplate and Device Plate Background	White	Yellow	Orange	Green	Gray	Blue
Labeling - Nameplate and Device Plate Lettering	Black	Black	Black	White	White	White
LV Lighting Control Switch	White	N/A	White	White	N/A	N/A
Receptacle	White	Yellow	Red	Brown	Gray	Blue
Toggle-type Switch	White	Red	Red	Brown	Gray	N/A
Wall-box Dimmer	White	N/A	White	N/A	N/A	N/A
Wall-box Occupancy Sensor	White	N/A	White	N/A	N/A	N/A

Electrical Device and Covers	Generator (Upstream of ATS)	Fire Alarm	BMS	Low Voltage Voice/Data
Boxes (Outlet, Junction)	Black	Red	Purple	White
Conduit/Paint/Taping	Black	Red	Purple	White
Labeling - Nameplate and Device Plate Background	Black	Red	Purple	Refer to Section 27 05 32
Labeling - Nameplate and Device Plate Lettering	White	White	White	

Electrical Wiring and Cabling	120/208 Volt	277/480 Volt	Fire Alarm	BMS	Low Voltage Voice/Data	Low Voltage Control
Wire - Ground	Green	Green	Refer to Section 28 31 00 for Wiring Color	Refer to Section 25 50 00 for Wiring Color	Refer to Section 27 05 32 for Cable Color	
Wire - Isolated Ground	Green w/ Yellow Stripes	Green w/ Yellow Stripes				
Wire - Neutral	White	Gray				
Wire - Phase 1	Black	Brown				
Wire - Phase 2	Red	Orange				
Wire - Phase 3	Blue	Yellow				

0-10V Control Wire	N/A	N/A	N/A	N/A	N/A	Gray and Purple
--------------------	-----	-----	-----	-----	-----	-----------------------

END OF SECTION

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

1.1 COMMISSIONING AUTHORITY

The Commissioning Authority (CxA) has been contracted directly with the Architect for this project. Commissioning involves all parties to the design and construction process, including the Division 26 Electrical Contractor, and all Subcontractors within Division 26 as required.

1.2 CONTRACTOR RESPONSIBILITY

The Division 26 Electrical Contractor's responsibilities are defined in Section 01 91 00 of the Specifications. These responsibilities apply to all Subcontractors and vendors within Division 26. Each Contractor and vendor shall review Section 01 91 00, and their proposals shall include for carrying out the work described, as it applies to each Section within the Division 26 specifications, individually and collectively.

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Lighting Control Devices, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Underwriter's Laboratories (UL):
 - 1. UL 20 Standard for Safety for General-Use Snap Switches.
 - 2. UL 514D Cover Plates for Flush-Mounted Wiring Devices.
- B. National Electric Manufacturers Association (NEMA):
 - 1. WD-1 General Color Requirements for Wiring Devices.
 - 2. WD-6 Wiring Devices - Dimensional Requirements.
- C. US Federal Specifications:
 - 1. Federal Specification switches (WS-896E).
 - 2. Federal Specification device plates (W-P-455).

1.3 SUBMITTALS

- A. Product Data:
 - 1. Technical data on each type of device.
 - 2. Manufacturer's wiring and installation information.
- B. Shop Drawings:
 - 1. Occupancy sensor layout.
 - a. Submit a lighting plan clearly marked by manufacturer showing occupancy sensor type, location and proper orientation.
 - b. Submit any applicable interconnection diagrams.
- C. Contract Closeout Information:
 - 1. Warranty.

1.4 WARRANTY

- A. Minimum five (5) year warranty for wall-box dimmer switches.
- B. Minimum five (5) year warranty for occupancy sensors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Standard Toggle Switches:
 - 1. Base:
 - a. Hubbell.
 - 2. Optional:
 - a. Cooper.
 - b. Leviton.
 - c. Pass & Seymour / Legrand.
- B. Line Voltage & Low Voltage Occupancy Sensors:
 - 1. Base:

- a. WattStopper.
- 2. Optional:
 - a. Eaton Greengate.
 - b. Hubbell.
 - c. Leviton.
 - d. Sensor Switch.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Toggle Switches:
 - 1. Toggle switches shall be of the same manufacturer providing receptacles.
 - a. See Section 26 27 26.
 - 2. Lighting switches:
 - a. Specification grade, quiet-operating toggle-type with back and side wiring, 120-277 volts, AC only, 20 amp rated unless otherwise indicated.
 - 1) Switches shall be listed per UL 20 and certified by UL to Federal Specification WS-896E, and shall be visibly marked "Fed Spec WS-896 IN".
 - 2) All switches shall be equipped with a green grounding terminal.
 - 3. Refer to Symbol Legend for types.
 - 4. Use white devices for "normal" circuits.
 - 5. Use red devices for "emergency" circuits.
 - 6. Refer to specification 26 27 26 for device plates.
 - 7. Toggle-type switch:
 - a. Single-pole: Hubbell HBL1221.
 - b. Three-way: Hubbell HBL1223.
 - c. Single-pole key switch: Hubbell 1221-L.
- B. Occupancy Sensors:
 - 1. Refer to Symbol Legend for types.
 - 2. All sensors shall be manufactured by same company and shall be aesthetically compatible with similar models from the same product line or generation of products.
 - 3. Refer to table at end of Section 26 05 53 for device colors of occupancy sensors and wall plates.
 - 4. Line Voltage Dual Technology Wall Switch Sensor:
 - a. Sensor shall be a self-contained control system that replaces a standard toggle switch, and shall detect presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes, and shall utilize dual sensing verification for coordination between both technologies to reduce likelihood of false operations.
 - b. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall automatically adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout the controlled space.
 - c. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.
 - d. Sensor shall have its factory preset in a default mode in which both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain lighting ON, and detection by either technology shall turn lights back ON after lights were turned OFF for 5 seconds or less in automatic mode and 30 seconds or less in manual mode.
 - e. Selection of technologies for initial, maintain, and re-trigger shall be done with DIP switches.
 - f. Sensor shall cover up to 1,050 SQFT for walking motion, with a field view of 180 DEG.
 - g. Sensor shall be able to control incandescent, magnetic low voltage, electronic low voltage, LED and fluorescent loads.

- h. Sensor shall have no minimum load requirement and shall be capable of switching from 0 to 1000 Watt ballast, LED and tungsten or 1/4 HP at 120 VAC, 50/60Hz; and 0 to 1200 Watt ballast and LED or 1/4 HP at 230/277 VAC, 50/60Hz.
 - i. Sensor shall feature a walk-through mode, where lights turn OFF 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds, set by a DIP switch.
 - j. Sensor shall have Automatic-ON (occupancy) or Manual-ON (vacancy) operation adjustable with DIP switch.
 - k. Sensor shall have a time delay adjustable from 5 to 30 minutes, set by DIP switches.
 - l. In automatic mode, sensor shall be capable to automatically return to Automatic-ON after lights are turned off manually.
 - m. Sensor shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled.
 - n. Sensor shall not protrude more than 3/8 IN from the wall.
 - o. Time delay shall be set at 5 minutes and high PIR sensitivity with relay in Manual ON (vacancy) mode.
 - p. Wattstopper model no. DSW-301.
5. Line Voltage Dual Technology 0-10V Dimming Wall Switch Sensor:
- a. Sensor shall be a self-contained control system that replaces a standard toggle switches. Sensor shall detect presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes, and shall utilize dual sensing verification for coordination between both to reduce likelihood of false operations.
 - b. Sensor shall have dimming capabilities to allow the user to increase or decrease the lighting level.
 - c. Sensor shall be compatible with 0-10VDC dimming drivers and ballasts to control lighting loads including LEDs.
 - d. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall automatically adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout the controlled space.
 - e. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.
 - f. Sensor shall have its factory preset in a default mode in which both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain lighting ON, and detection by either technology shall turn lights back ON after lights were turned OFF for 5 seconds or less in automatic mode and 30 seconds or less in manual mode.
 - g. Selection of technologies for initial, maintain, and re-trigger shall be done with DIP switches.
 - h. Sensor shall cover up to 1,050 SQFT for walking motion, with a field view of 110 DEG vertical and 360 DEG horizontal.
 - i. Sensor shall be able to control incandescent, magnetic low voltage, electronic low voltage, LED and fluorescent loads.
 - j. Sensor shall have no minimum load requirement and shall be capable of switching from 0 to 1000 Watt ballast, LED and tungsten or 1/4 HP at 120 VAC, 50/60Hz; and 0 to 1200 Watt ballast and LED or 1/4 HP at 230/277 VAC, 50/60Hz.
 - k. Sensor shall feature a walk-through mode, where lights turn OFF 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds, set by a DIP switch.
 - l. Sensor shall have Automatic-ON (occupancy) or Manual-ON (vacancy) operation adjustable with DIP switch.
 - m. Sensor shall have a time delay adjustable from 5 to 30 minutes, set by DIP switches.
 - n. In automatic mode, sensor shall be capable to automatically return to Automatic-ON after lights are turned off manually.
 - o. Sensor shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled.
 - p. Sensor shall not protrude more than 3/8 IN from the wall.

- q. Time delay shall be set at 5 minutes and high PIR sensitivity with Relay 1 in Automatic ON mode and Relay 2 in Manual ON mode.
 - r. WattStopper model no. DW-311.
6. Low Voltage Dual Technology 360 DEG Ceiling Sensor:
- a. Sensor shall be capable of detecting presence in control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes.
 - b. Ultrasonic sensing shall be volumetric in coverage with frequency of 40 KHz. It shall automatically adjust the detection threshold dynamically to compensate for changing levels of activity and airflow throughout controlled space, and shall provide volumetric coverage without gaps in coverage within controlled areas.
 - c. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.
 - d. Sensor shall coordinate between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting ON.
 - e. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system ON within 5 seconds of being switched OFF.
 - f. Sensors shall be ceiling mounted with a flat, unobtrusive appearance and provide 360 DEG coverage.
 - g. Sensor shall operate at 24 VDC/VAC and utilize a power pack.
 - h. The lens shall cover up to 1000 SQFT of walking motion.
 - i. Sensors shall have a time delay that is adjustable from 5 to 30 minutes, set by DIP switch.
 - j. Sensors shall feature a walk-through mode, where lights turn OFF 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.
 - k. Sensors shall have a built-in light level sensor that works from 10 to 300 foot-candles.
 - l. Sensors shall be able to be wired in parallel to allow for coverage of large areas.
 - m. Sensor shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.
 - n. Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled.
 - o. Time delay shall be set at 5 minutes and high PIR sensitivity with relay in Automatic ON mode.
 - p. Time delay shall be set at 15 minutes and high PIR sensitivity with relay in Automatic ON mode.
 - q. WattStopper model no. DT-300.
7. Low Voltage Momentary Switch:
- a. Low voltage switch shall have a momentary push button.
 - b. Low voltage switch shall be capable of interfacing with low voltage occupancy sensors and power packs to allow for manual ON/OFF control.
 - c. Wattstopper model no. LVSW-101
8. Power Pack:
- a. Power pack shall be a self-contained transformer and relay module measuring 1.75 IN x 2.75 IN x 1.75 IN. Power pack shall have primary dual-voltage inputs of 120/277 VAC.
 - b. Power pack shall have dry contacts capable of switching 20 amp ballast and incandescent load at 120 VAC, 60 Hz, 1 HP at 120-250 VAC, 60 Hz; 20 amp ballast at 277 VAC, 60 Hz.
 - c. Power pack shall provide a 24 VDC, 225 mA output.
 - d. Power packs shall be capable of parallel wiring without regard to AC phases on primary.
 - e. Power pack can be used as a stand-alone, low voltage switch, or can be wired to sensor for auto control.
 - f. Power pack shall have hold-ON and hold-OFF inputs for integration with lighting control panels, BMS and other building systems.

- g. Power pack shall have overcurrent protection if the low voltage current drawn exceeds 225 mA. In the event of an overcurrent, the low voltage output current shuts down and the LED will blink to indicate a fault condition.
- h. Power pack shall be UL 2043 plenum rated and shall have low voltage teflon coated leads, rated for 300 volts.
- i. WattStopper model no. BZ-150.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate devices as indicated and as scheduled in Section 26 00 10.
- B. Center devices with regard to paneling, furring and trim.
- C. Set devices plumb or horizontal and extending to finished surface of wall, ceiling or floor as case may be without projecting beyond same.
- D. Route neutral conductor and grounding wire to every junction box containing a line voltage switch.
- E. Occupancy Sensors:
 - 1. Verify sensor type, quantity, location, aiming and sensitivity with manufacturer's recommendations.
 - a. Set time delays and sensitivities of devices, if applicable, per specifications and as appropriate to usage of room.
 - 2. Test controlled spaces to insure 90 to 100 PCT coverage of controlled space.
 - a. If test fails, adjust sensitivity, re-aim, relocate, and/or add sensors.
 - 3. Exact locations of control unit hardware boxes shall be based on observing good installation practices. Installation shall conform to manufacturer's written installation recommendations.
 - 4. Control unit hardware shall be installed in a manner which minimizes aesthetic impact of hardware on appearance of affected rooms. Control unit hardware shall be completely contained within a suitable NEMA-type enclosure, with no exposed wiring other than low-voltage Class 2 wiring.
 - 5. Size and install system raceways as indicated and in accordance with manufacturer's requirements for installation of system's wiring. Tag conductors at junction and terminal points.
 - 6. Protect exposed wiring above hung ceiling construction from physical damage where necessary by using conduit, pipe, guard strips or other approved means. Install drops to wall devices in conduit. Properly support low-voltage cables off ceiling construction and secure by approved staples, straps or similar approved fittings so designed and installed so as not to injure cable. Secure cable in place at intervals not exceeding 4.5 FT and within 12 IN from every cabinet, box or device.
 - 7. Install low voltage Class 2 wiring within air handling plenum ceiling areas in rigid raceways, EMT minimum, and extend 3 FT beyond and outside of plenum barriers and walls or provide plenum rated cable.
 - 8. Locate sensors minimum of four feet away from supply and return air registers.
 - 9. Mount sensors so they will not receive light directly from a light source or reflecting surface.
 - 10. Provide masking inserts on infrared sensors as required to prevent inadvertent turn-on through doorways.
 - 11. Where bi-level switching or manual on/off switching is indicated, provide sensors and/or power packs suitable for low voltage manual switching or provide line voltage series switching as required.
 - 12. For bi-level occupancy sensors, set the first relay for auto-on/ auto-off and the second relay for manual- on/auto-off operation.
 - 13. Provide training necessary to familiarize Owner's personnel with operation and proper adjustment of occupancy sensing devices and systems.

14. Locate power supplies and slave units above accessible ceilings.

3.2 CLEANING

- A. Remove paint splatters and other spots, dirt and debris from equipment.
- B. Clean equipment and devices internally and externally using methods and materials recommended by manufacturer.
- C. Correct improperly located devices.

END OF SECTION

SECTION 26 22 13
LOW VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Low Voltage Distribution Transformers, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Provide transformers conforming to following standards:
 - 1. NEMA ST20 Dry Type Transformers for General Applications
 - 2. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
 - 3. ANSI/IEEE C57.12.91 Standard Test Code for Dry-Type Distribution and Power Transformers
 - 4. DOE 10 CFR Part 431 (DOE 2016) Energy Efficiency Program for Certain Commercial and Industrial Equipment
 - 5. UL 1561 Standard for Dry-Type General Purpose and Power Transformers

1.3 SUBMITTALS

- A. Product Data:
 - 1. Technical data on each type of transformer.
 - 2. No-load core loss and full-load coil loss data.
 - 3. Percent impedance and X/R ratio data.
 - 4. Load efficiency curve plots for each type of transformer.
 - 5. Absolute Peak Inrush (rms) amps.
 - 6. Practical Max Inrush (rms) amps.
 - 7. All transformers must be clearly identified in submittal by name, i.e., "NT1A".
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Dry-type Transformers:
 - 1. Base:
 - a. Schneider Electric/Square D.
 - b. Eaton.
 - c. General Electric.
 - d. Siemens.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Insulating materials are to exceed NEMA ST20 standards and be rated for 220 DEGC UL component recognized insulation system.
- B. Three phase transformers 15kVA and larger shall be 150 DEGC temperature rise above 40 DEGC ambient.

- C. Transformers shall be supplied with quality, full width electrostatic shields resulting in a maximum effective coupling capacitance between primary and secondary of 33 picofarads. With transformers connected under normal loaded operating conditions, attenuation of line noise and transients shall meet or exceed following limits:
 - 1. Common Mode:
 - a. 0 to 1.5kHz: 120dB.
 - b. 1.5kHz to 10kHz: 90dB.
 - c. 10kHz to 100kHz: 65dB
 - d. 100kHz to 1MHz: 40dB.
 - 2. Transverse Mode:
 - a. 1.5kHz to 10kHz: 52dB.
 - b. 10kHz to 100kHz: 30dB.
 - c. 100kHz to 1MHz: 30dB.
- D. Three phase transformers 15kVA and larger shall have a minimum of 4 - 2.5 PCT FCBN primary taps and 2 – 2.5 PCT FCAN primary taps.
- E. Maximum temperature of top of enclosure shall not exceed 50 DEGC rise above a 40 DEGC ambient.
- F. Transformer efficiencies shall be in accordance with DOE 10 CFR Part 431 defined levels effective January 1, 2016. Older in-stock transformers are unacceptable. Efficiency values shall be determined in accordance with DOE 10 CFR Part 431.

Single Phase		Three Phase	
kVA	Efficiency percent	kVA	Efficiency percent
15	97.70	15	97.89
25	98.00	30	98.23
37.5	98.20	45	98.40
50	98.30	75	98.60
75	98.50	112.5	98.74
100	98.60	150	98.83
167	98.70	225	98.94
250	98.80	300	99.02
333	98.90	500	99.14

2.3 CONSTRUCTION

- A. Transformer coils (except buck/boost type) shall be dual winding of continuous wound construction and shall be impregnated with non-hygroscopic, thermosetting varnish.
- B. Cores to be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below saturation point to prevent core overheating.
- C. Completed core and coil shall be bolted to base of enclosure but isolated by means of rubber vibration-absorbing mounts.
- D. Provide aluminum or copper windings.
- E. There shall be no metal-to-metal contact between core and coil and enclosure except for a flexible safety ground strap.
- F. Sound isolation systems requiring complete removal of all fastening devices will not be acceptable.
- G. Core of transformer shall be visibly grounded to enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.
- H. Transformer enclosures shall be ventilated (30 kva and above) and fabricated of heavy gauge, sheet steel construction.

- I. Provide finish suitable for outdoor applications as applicable.
- J. Provide weather shields for outdoor units.
- K. Sound levels shall be warranted by manufacturer not to exceed following:
 - 1. 15 to 50KVA: 45dB
 - 2. 51 to 150kVA: 50dB
 - 3. 151 to 300kVA: 55dB.
 - 4. 301 to 500kVA: 60dB.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install as indicated and in accordance with manufacturer's recommendations and instructions.
- B. Provide minimum of 2 IN clearance on both sides and rear of all ventilated transformers or greater when required by manufacturer.
- C. External wiring connections: See Section 26 05 33.
- D. Provide wall mounting brackets and/or trapeze mounting supports and bracing as indicated or as required.
- E. Floor-mounted transformers shall be mounted on concrete pads per Section 26 00 10.
- F. Provide labeling per Section 26 05 53.
- G. When stacking transformers, provide sheet metal heat shield between transformers.

END OF SECTION

REVISION LOG		
Point of Contact: Tim Koch (Omaha)		
DATE	NAME	SUMMARY OF CHANGE
1-25-2018	R Niehaus	Updated.
4-18-2017	Samuel Rede	Updated Specifier Note Reminder Text and Standardized all Specifications.
28 Jul 16	Rol Horeis	Section content provided by Travis Kiichler including the following: Incorporated DOE 2016 XFMR requirements. Updated XFMR Efficiency Schedule and Clearance requirements, Revised labeling reference spec. Removed specific ext. wiring connection and now refer to other spec.
05-03-2016	Samuel Rede	Added Specifier Note reminder.
21 Apr 11	ARTaylor	Inserted Summary paragraph, adjusted Submittal paragraph for Project Tracker, clerical adjustments of Part 2.
26 Jan 07	Paul Lage	Eaton Electrical.
14 Feb 06	Paul Lage	Title.
09 Nov 05	Paul Lage	Ratings information per Joe Sather.
19 Aug 05	Paul Lage	Cutler-Hammer.
05 Sep 02	S Miller	Fixed spelling formatting errors.

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide distribution panelboard(s) and lighting and appliance panelboard(s) as specified herein and as indicated on associated schedules and drawings.

1.2 QUALITY ASSURANCE

- A. System standards:
 - 1. NEMA PB-1 – Panelboards.
 - 2. NEMA PB-1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards rated 600 volt or Less.
 - 3. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
 - 4. UL 50 – Enclosures for Electrical Equipment.
 - 5. UL 67 – Panelboards.
 - 6. CSA Standard C22.2 No. 29-M1989 – Panelboards and Enclosed Panelboards.
 - 7. Federal Specification W-P-115C – Type I Class 1.
 - 8. Federal Specification W-P-115C – Type II Class 1.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Identify panelboards by alphanumeric designation with branch circuit breaker sizes and types indicated in panelboard schedules or one-line-diagram.
- B. Product Data:
 - 1. Technical data on each type of panelboard.
- C. Contract Closeout Information:
 - 1. Operating and maintenance data.

1.4 DEFINITIONS

- A. Lighting and and appliance branch circuit: Branch circuit that has a connection to the neutral of the panelboard and that has overcurrent protection of 30 amperes or less in one or more conductors.
- B. Lighting and appliance branch-circuit panel boards: Panelboard having more than 10 percent of its overcurrent devices protecting lighting and appliance branch circuits.
- C. Power Panelboard: Panelboard having 10 percent or fewer of its overcurrent devices protecting lighting and appliance branch circuits. The terms “power panelboard” and “distribution panelboard” will be used interchangeably.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Panelboards:
 - 1. Base:
 - a. Schneider Electric/Square D.
 - b. Eaton Electrical.

- c. Siemens.
 - d. General Electric.
- B. Other manufacturers desiring approval comply with Section 00 26 00.
- 1. Eaton Electrical types listed for quality and performance reference.

2.2 PANELBOARDS

- A. All panelboards: Dead front type.
- 1. Provide with non-insulated equipment grounding terminal strip located in top or bottom gutter including main grounding lug and individual terminals for at least 50 percent of panel circuits including spare circuits and space provisions; increase gutter space accordingly for grounding strip.
 - 2. Provide lighting panelboards with branch circuit connection to main bus arranged for sequence phasing.
 - 3. Provide feed-thru lugs or sub-feed lugs for 2 and 3 section panels.
 - 4. Equip bus bars for panelboard with main lugs, main fused switch or main circuit breaker, capacity as required or indicated.
 - 5. Panelboard busing to be tin-plated aluminum.
 - 6. Provide special features such as split bus, lighting contactors, extra-width gutters as required.
 - 7. Provide panelboard buses fully rated for specified interrupting rating. Series rating of panelboards and overcurrent protective devices is not acceptable.
 - 8. Provide full length busing including areas indicated as space only.
- B. Circuit breaker panelboards:
- 1. Provide bolted-on circuit breaker type. Plug-in circuit breakers not acceptable.
 - 2. Do not install feeder or branch circuit breakers in sub-feed section of panel.
 - 3. Main circuit breaker shall not be located in branch circuit section of panel unless specifically indicated.
 - 4. In power and distribution panelboards, provide main buses and back panels which permit changing of circuit breakers without additional machining, drilling or tapping.
 - 5. All multi-pole breakers provide single handle with common trip.
 - 6. All multi-pole breakers, 100A rated and larger shall include means for padlocking in "OFF" position.
 - 7. Include provisions for locking specific circuit breakers in the "ON" position where indicated.
 - 8. Provide shunt trip mechanism on breakers where indicated.
 - 9. Provide ground fault protection as indicated coordinated with upstream devices.
 - 10. Design so a combination of one, two and three pole circuit breaker can readily be assembled in the same panelboard.
 - 11. Circuit breakers operable in horizontal or vertical position and removable from front of panelboard without disturbing adjacent units.
 - 12. Tandem or half-size circuit breakers not allowed.
 - 13. Panelboard ratings:
 - a. In 120/208 V panelboards: Minimum 10,000 AIC symmetrical, or greater as indicated.
 - b. In 277/480 V panelboards: Minimum 14,000 AIC symmetrical, or greater as indicated.
 - 14. Lighting and appliance branch-circuit panelboards:
 - a. Types NQOD and NE.
 - 15. Distribution panel boards (circuit breaker type):
 - a. Type HCN, HCM, HCP-SUHCP, HCW, HCWM and HCR-U.
- C. Cabinets: Trim, door and box, of galvanized sheet steel, code thickness.
- 1. 5-3/4 IN deep by 20 IN wide minimum.
 - 2. Provide hinged trim with piano hinge down one side with outer door lock for all panels.
 - 3. Provide door in door construction for all panels.

4. Fasten trim to cabinet by means of adjustable clamps.
5. Equip door with chrome-plated combination lock and catch; supply two milled keys with each lock; key locks alike.
6. Provide directory frame on inside of door.
7. Identify all circuit locations in each respective panel with load and location served.
 - a. Directory shall be typed.
 - b. Mechanical equipment identified in directory shall be same as designation indicated on plans.
 - c. Room names and numbers in directory shall be final building room names and numbers as identified by Owner and not name or number indicated on plans.
 - d. Where circuits in existing panels are modified or added a new updated typed directory shall be provided for the existing panel. Update description for all new, modified and spare circuits and spaces only. All descriptions for existing circuits not affected by Contractor's work will be responsibility of Owner unless otherwise indicated. Submit final draft to Owner for comments or changes prior to typing final directory.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install as indicated and in accordance with manufacturer's recommendations and instructions.
- B. Panelboard cabinet supports:
 1. Finished areas: Attach to studs via unistrut cross members or metal backing bolted or welded to studs where not otherwise shown.
 2. Masonry or concrete walls: Attach to wall via unistrut cross members where not otherwise shown.
- C. Wall mounted panelboards shall be installed 6 IN above floor minimum. Large panels that rest on floor shall be mounted on house-keeping pads per Section 26 00 10.
- D. Provide spare conduits into accessible ceiling space from all flush wall mounted panel boards. Provide one spare 3/4 IN conduit for each 3 spare and/or space branch circuit poles or fraction thereof but no less than two spare 3/4 IN conduits.

3.2 LABELING

- A. Provide panelboard labeling as specified in Section 26 00 10.
- B. Permanently post, at each panelboard, the conductor color coding scheme specified in Section 26 05 19.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product data:
 - 1. Technical data on each type of device.
 - 2. Provide drawings indicating quantity, location, and type of occupancy sensors used.
- B. Contract closeout information:
 - 1. Warranty information.

1.2 QUALITY ASSURANCE

- A. Provide wiring devices conforming to the following standards:
 - 1. Underwriter's Laboratories (UL).
 - a. UL 20 – Standard for Safety for General-Use Snap Switches.
 - b. UL 498 – Standard for Attachment Plugs and Receptacles.
 - c. UL 514D – Cover Plates for Flush-Mounted Wiring Devices.
 - d. UL 943 – Standard for Safety for Ground-Fault Circuit-Interrupters.
 - 2. National Electric Manufacturers Association (NEMA).
 - a. WD-1 – General Color Requirements for Wiring Devices.
 - b. WD-6 – Wiring Devices – Dimensional Requirements.
 - 3. US Federal Specifications.
 - a. Fed Spec switches (WS-896E).
 - b. Fed Spec receptacles (WC-596F).
 - c. Fed Spec device plates (W-P-455).

1.3 WARRANTIES

- A. Provide 5-year warranty on following devices:
 - 1. Occupancy sensors.
 - 2. Photo sensors
 - 3. Power supplies

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

- A. Acceptable manufacturers:
 - 1. Wiring devices:
 - a. Base:
 - 1) Leviton
 - Modular:
 - 2) Leviton Lev-Lok M series provided with factory terminated UL-listed connectors keyed to insure proper wiring installation into each Lev-Lok receptacle or switch.
 - b. Optional:
 - 1) Hubbell
 - 2) Pass & Seymour, Pass & Seymour Plugtail series provided with factory terminated UL-listed connectors.
 - 3) Arrow-Hart
 - c. All wiring devices shall be provided by the same manufacturer.

2. Plug-in strip:
 - a. Base:
 - 1) Leviton
 - 2) Wiremold.
3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DUPLEX AND SINGLE RECEPTACLES

- A. Receptacle outlets:
 1. Specification grade.
 2. Specification grade receptacles shall be listed per UL 498 for general use and certified by UL to Fed Spec WC-596F, and shall be visibly marked with the "UL-FS" mark to confirm certification.
 - a. Constructed with impact resistant nylon or polyester face and body.
 - b. 0.050 IN brass nickel-plated back strap with one piece (non-riveted) ground design.
 - c. 0.040 IN brass nickel-plated contacts.
 3. Flush, grounding convenience outlets for side wiring, or side and back wiring.
 4. Use white devices for "normal" circuits.
 5. Use red devices on "emergency" circuits.
 6. Refer to symbol legend.
- B. 20A, 125V, 2 pole, 3-wire grounding, duplex: NEMA 5-20R; Leviton 5362, Hubbell HBL5362, P&S 5362A, Leviton Lev-Lok M5362, P&S PT5362A.
- C. 20A, 125V, 2 pole, 3-wire grounding, single; NEMA 5-20R; Leviton 5361, Hubbell HBL5361, P&S 5361.
- D. Weatherproof receptacles: Type as indicated on drawings.
 1. Mount on "FS" cast metal box.
 2. Suitable for wet location when receptacle is in use.
 - a. Grey metal cover with single gasketed lift cover; NEMA 3R rating while in use; Leviton M5979-GY.
 - 1) P&S WIUCAST1 weatherproof cover with receptacle type as indicated.
- E. GFI type duplex receptacles: With built-in ground fault interruption, 5-mA sensitivity, indicator and reset. UL listed.
 1. 20A, 125V, 3-wire duplex: NEMA 5-20R; Leviton 7899, Hubbell GF5362, P&S 2095, Leviton Lev-Lok M7899, P&S PT2095.

2.3 SPECIAL PURPOSE RECEPTACLES

- A. NEMA 6-20R receptacle: 20A, 250V, 2 pole, 3 wire grounding, side and back wired, single; ivory, Leviton 54621, Hubbell HBL54611, P&S 58621.
- B. NEMA 14-20R receptacle: 20A, 125/250V, 3 pole, 4 wire, 1 phase grounding, single; NEMA 14-20R; black; Leviton 8410, Hubbell HBL8410, P&S 3820.
- C. NEMA 15-20R receptacle: 20A, 250V, 3 pole, 4 wire, 3 phase grounding, single, black; Hubbell HBL8420.
- D. NEMA 5-30R receptacle: 30A, 125V, 2 pole, 3 wire grounding, single, black; Leviton 5371, Hubbell HBL9308, P&S 3802.
- E. NEMA 6-30R receptacle: 30A, 250V, 2 pole, 3 wire grounding, single, black; Leviton 5372, Hubbell HBL9350, P&S 3801.
- F. NEMA 10-30R receptacle: 30A, 125/250V, 3 pole, 3 wire, 1 phase, single, brown; Leviton 5207, Hubbell HBL9350, P&S 3860.
- G. NEMA 14-30R receptacle: 30A, 125/250V, 3 pole, 4 wire, 1 phase grounding, single, black; Leviton 278, Hubbell HBL9430A, P&S 3864..

- H. NEMA 15-30R receptacle: 30A, 250V, 3 pole, 4 wire, 3 phase, grounding, single, black; Leviton 8430A, Hubbell HBL8430A, P&S 5740.
- I. NEMA 6-50R receptacle: 50A, 250V, 2 pole, 3 wire, 1 phase, grounding, single, black; Leviton 5374, Hubbell HBL9367, P&S 3804.
- J. NEMA 10-50R receptacle: 50A, 125/250V, 3 pole, 3 wire, 1 phase; black; Leviton 5206, Hubbell HBL7962, P&S 3890..
- K. NEMA 14-50R receptacle: 50A, 125/250V, 3 pole, 4 wire, 1 phase, grounding, single, black; Leviton 279, Hubbell HBL9450A, P&S 3894.
- L. NEMA 15-50R receptacle: 50A, 250V, 3 pole, 4 wire, 3 phase, grounding, single, black, Leviton 8450, Hubbell HBL8450A, P&S 5750.
- M. NEMA L5-20R receptacle: 20A, 125V, 2 pole, 3 wire, 1 phase, grounding, single, twist-lock; black; Leviton 2310, Hubbell HBL2310, P&S L520R.
- N. NEMA L6-20R receptacle: 20A, 250V, 2 pole, 3 wire, 1 phase, grounding, single, twist-lock; black; Leviton 2320, Hubbell HBL2320, P&S L620R..
- O. NEMA L14-20R receptacle: 20A, 125/250V, 3 pole, 4 wire, 1 phase, grounding, single, twist-lock; black; Leviton 2410, Hubbell HBL2410, P&S L1420R.
- P. NEMA L15-20R receptacle: 20A, 250V, 3 pole, 4 wire, 3 phase, grounding, single, twist-lock; black; Leviton 2420, Hubbell HBL2420, P&S L1520R..
- Q. NEMA L5-30R receptacle: 30A, 125V, 2 pole, 3 wire, 1 phase, grounding, single, twist-lock; black; Leviton 2610, Hubbell HBL2610, P&S L530R.
- R. NEMA L6-30R receptacle: 30A, 250V, 2 pole, 3 wire, 1 phase grounding, single, twist-lock; black; Leviton 2620, Hubbell 2620, P&S L630R..
- S. NEMA L14-30R receptacle: 30A, 125/250V, 3 pole, 4 wire, 1 phase, grounding, single, twist-lock; black; Leviton 2710, Hubbell HBL2710, P&S L1430R..
- T. NEMA L15-30R receptacle: 30A, 250V, 3 pole, 4 wire, 3 phase, grounding, single, twist-lock; black; Leviton 2720, Hubbell HBL2720, P&S L1530R..

2.4 DEVICE PLATES

- A. Device plates for concealed wiring: Same manufacturer as devices to suit device covered; single, or ganged, in one piece with beveled edges that match faces of plates.
 - 1. Flush, brushed-finish, type 304 stainless steel, Torx Head w/center pin hardened security screws.
- B. Labeling:
 - 1. Permanently label device plates for all receptacles to indicate panelboard and circuit number supplying them.
 - 2. Permanently label device plates for all lighting switches to indicate panelboard and circuit number supplying them.
- C. Device plates for surface type cast-metal boxes: Corrosion resistant cast ferrous metal designed for application.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate devices as indicated and as scheduled in Section 26 00 10.
- B. Center outlets with regard to paneling, furring, trim, etc.
- C. Where several outlets occur in a room, symmetrically arrange them.

- D. Any outlet which is improperly located must be corrected at Contractor's expense.
- E. Set outlets plumb or horizontal and extending to finished surface of wall, ceiling or floor as case may be without projecting beyond same.
- F. Install receptacles, switches, etc., indicated on wood trim, cases or other fixtures symmetrically. Where necessary, set with long dimension of plate horizontal, or gang in tandem.
- G. GFCI receptacles shall be connected so that downstream devices are not protected by GFCI receptacle.

END OF SECTION

SECTION 26 28 00
OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Overcurrent Protective Devices, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. System standards:
 - 1. NEMA AB 1 1993 - (National Electrical Manufacturers Association) Molded Case Circuit Breakers and Molded Case Switches
 - 2. UL 489 - (Underwriters Laboratories Inc.) Molded Case Circuit Breakers and Circuit Breaker Enclosures
 - 3. UL 943 - Standard for Ground Fault Circuit Interrupters
 - 4. CSA C22.2 No. 5.1 - M91 - (Canadian Standard Association) Molded Case Circuit Breakers
 - 5. Federal Specification W-C-375B/GEN - Circuit Breakers, Molded Case; Branch Circuit and Service
 - 6. All power circuit breakers shall be constructed and tested in accordance with ANSI C37.13, C37.16, C37.17, C37.50, UL 1066 and NEMA SG-3 standard.
 - 7. IEEE 141(Red Book) – Recommended Practice for Electric Power Distribution for Industrial Plants.
 - 8. IEEE 399 (Brown Book) – Recommended Practice for Industrial and Commercial Power Systems Analysis.
 - 9. IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations.
 - 10. NFPA 70E – Standard for Electrical Safety Requirements for Employee Workplaces.
 - 11. IEEE 519 – Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Power system study:
 - a. Submittal 1:
 - 1) Prior to or at same time as distribution equipment shop drawings and prior to release of equipment for manufacturer. No distribution equipment shall be released for manufacture until Engineer has reviewed and approved power system study submittal 1. Submittal 1 to include preliminary:
 - a) Short circuit study.
 - b) Coordination study.
 - b. Submittal 2:
 - 1) Field verify conductor lengths after installation. Update power system study with actual installed equipment, conductor lengths and any changes in conductor sizes. Submit updated study at least 3 months prior to applying final settings for testing and 6 months prior to substantial completion of project. Include any recommended changes in Submittal 2. Submittal 2 to include final:
 - a) Short circuit study.
 - b) Coordination study.
 - c. To be performed by independent, third party firm or by manufacturer of electrical distribution equipment. Study to be stamped and signed by registered professional

engineer. Submit credentials of individual(s) performing study and background of firm for approval prior to start of work. Minimum of five years experience in high and low voltage power system analysis is required for individual in charge of producing study.

- d. Provide computer generated system one-line diagram clearly identifying individual equipment buses, bus numbers, device numbers and maximum available short-circuit current at each bus.
- e. Use specified conductor sizes and estimated conductor lengths for shop drawing.
- f. Short circuit study:
 - 1) Provide calculation methods and assumptions, base per unit quantities selected, one-line diagrams, source impedance data including utility company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions and recommendations.
 - 2) Notify Engineer in writing of equipment not properly rated for fault conditions. Identify any prohibited operating/switching scenarios that would over-duty certain identified equipment.
- g. Coordination study: Coordination study is only required for the emergency branch.
 - 1) Provide determination of settings, ratings, or types for overcurrent protective devices supplied. Where necessary, appropriate compromise shall be made with system protection and service continuity considered to be of equal importance.
 - 2) Breakers shall be set to trip as quickly as possible without compromising overall coordination to limit arc flash hazard energy to the lowest level possible.
 - 3) Provide sufficient number of log-log plots to indicate degree of system protection and coordination. Log-log plots shall include transformer ANSI withstand points and inrush currents of transformers and motors where appropriate.
 - 4) Computer printouts or equivalent tabular format to accompany log-log plots containing descriptions for all devices indicated on plot, settings of adjustable devices, device numbers to simplify location of devices on system one-line diagram.
 - 5) Provide data in tabular format of suggested settings of adjustable overcurrent protective devices, equipment where each device is located, device number corresponding to device on system one-line diagram, and number of time-current log-log plots where they are illustrated. Similar or like devices may be illustrated by using "typical" plots. Every device need not be separately illustrated.
 - 6) Provide discussion section evaluating degree of system protection and system continuity with overcurrent devices, with recommendations as required for increased protection or coordination.
 - 7) Include complete title and one-line diagram with legend with each curve sheet identifying specific portion of system covered by that particular curve sheet.
 - 8) Include detailed description of each protective device identifying its type, function, manufacturer and time-current characteristics.
 - 9) Tabulate recommended device tap, time dial, pickup, instantaneous and time delay settings.
 - 10) Provide time-current curves graphically indicating coordination proposed for system, centered on 8.5 x 11 IN, log-log forms.
 - 11) Any inadequacies shall be called to attention of Engineer and recommendations shall be made for improvements.

B. Product Data:

1. Technical data on each type of device including:
 - a. Outline drawings with dimensions.
 - b. Ratings for voltage, amperage and maximum interrupting ratings.
 - c. Trip unit functions and adjustments
 - d. Accessories.
 - e. Wiring diagrams.

- f. Manufacturer shall provide hard copy time/current characteristic trip curves (and I_p & I_t let through curves for current limiting circuit breakers) for each type of circuit breaker.
 - 2. Submit with associated switchgear, switchboard, panelboard or other assembly.
- C. Contract Closeout Information:
 - 1. Operating and maintenance data.
 - a. Include instructions for circuit breaker mounting, trip unit functions and adjustments, trouble shooting, accessories and wiring diagrams.
 - 2. Final power system study based on actual installed equipment, field measured conductor lengths and any applicable modifications to contract documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Overcurrent protective devices.
 - 1. Base:
 - a. Schneider Electric/Square D.
 - b. Eaton Electric.
 - c. Siemens.
 - d. General Electric.
- B. Fuses:
 - 1. Base:
 - a. Bussmann.
 - b. Ferraz Shawmut.
 - c. Brush.
 - d. Littelfuse.
- C. Equipment and devices by same manufacturer.

2.2 CIRCUIT BREAKERS

- A. General:
 - 1. Provide circuit breakers as required by other specifications and drawings. Provide special features as indicated including but not limited to:
 - a. Drawout construction.
 - b. Electrical operation.
 - c. Key interlock for main-tie-main arrangements.
 - d. Ground fault protection.
 - 2. Provide lugs rated for 75 degree C wire minimum.
 - 3. Contractor shall review one line diagrams and confirm that circuit breakers have adequate lugs to accommodate size and quantity of conductors indicated on one line diagrams, panel and motor control schedules.
 - 4. Lugs shall be UL Listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors.
 - 5. Circuit breakers shall be capable of accepting bus connections.
 - 6. Overcurrent devices shall be fully rated for available fault current unless otherwise specifically indicated.
- B. Molded case type
 - 1. General:
 - a. Constructed of glass reinforced insulating material. Current carrying components shall be completely isolated from handle and accessory mounting area.
 - b. Provide over center, trip free, toggle operating mechanism which shall provide quick-make, quick-break contact action. Provide common tripping of two and three pole circuit breakers.

- c. Circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breaker escutcheon shall be clearly marked ON and OFF in addition to providing International I/O markings.
 - d. Maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker.
 - e. Provide each circuit breaker with push-to-trip button, located on face of circuit breaker to mechanically operate circuit breaker tripping mechanism for maintenance and testing purposes.
 - f. Provide factory seal with date code on face of circuit breaker.
 - g. Provide circuit breakers equipped with UL Listed electrical accessories as noted on associated schedule or drawing.
 - h. Provide circuit breaker handle accessories with provisions for locking handle in ON and OFF position as noted on associated schedule or drawing.
 - i. Provide circuit breakers UL Listed for reverse connection without restrictive line and load markings and suitable for mounting in any position.
 - j. Provide circuit breakers UL Listed to accept field installable/removable mechanical type or compression type lugs. Provide lug body bolted in place; snap in design not acceptable.
2. Thermal-Magnetic Circuit Breakers:
- a. Used only as follows unless otherwise indicated:
 - 1) Main, feeder and branch circuit breakers in lighting and appliance panelboards as defined in Section 26 24 16.
 - 2) Main, feeder and branch circuit breakers rated 125 amps and less in distribution panel boards as defined in Section 26 24 16.
 - 3) Motor circuit protectors.
 - b. Do not use in switchboards rated over 1200 amps.
 - c. Provide permanent trip unit containing individual thermal and magnetic trip elements in each pole.
 - d. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true rms sensing and thermally responsive to protect circuit conductor(s) in a 40° C ambient temperature.
 - e. Provide circuit breaker frame sizes above 150 amperes with magnetic trip adjustment located on front of circuit breaker.
 - f. Provide UL Listed HACR type for two- and three-pole circuit breakers rated up to 250 amperes at 600 VAC.
 - g. Provide Class A (5 ma) sensitivity breaker where GFCI circuit breakers are indicated.
 - h. Provide equipment ground fault protection where indicated with following provisions:
 - 1) Modified zero sequence sensing system.
 - 2) Ground fault sensing system:
 - a) Requiring no external power to trip circuit breaker.
 - b) Suitable for use on grounded systems and suitable for use on three-phase, three-wire circuits where system neutral is grounded but not carried through system or on three-phase, four-wire systems.
 - c) Include ground fault memory circuit to sum time increments of intermittent arcing ground faults above pickup point.
 - d) Shall not affect interrupting rating of companion circuit breaker.
 - 3) Companion circuit breaker equipped with ground-fault shunt trip and capable of group mounting.
 - 4) Field adjustable Ground fault pickup current setting and time delay with switch for setting ground fault pickup point and means to seal pickup and delay adjustments.
 - 5) Means of testing ground fault system to meet on-site testing requirements of NEC.
 - 6) Local visual ground fault trip indication.

3. Electronic trip circuit breakers with standard function trip system
 - a. Provide standard function trip system on circuit breakers rated less than 400 amps unless otherwise indicated.
 - b. Provide circuit breaker trip system with microprocessor-based true rms sensing design with sensing accuracy through thirteenth (13th) harmonic and sensor ampere ratings as indicated on associated schedules or drawings.
 - c. Provide integral trip system independent of any external power source and with industrial grade electronic components.
 - d. Determine ampere rating of circuit breaker by combination of interchangeable rating plug, sensor size and long-time pickup adjustment on circuit breaker. Clearly mark sensor size, rating plug and adjustment positions on face of circuit breaker.
 - e. Provide circuit breakers UL listed to carry 80 percent of ampere rating continuously.
 - f. Provide circuit breakers UL listed to carry 100 percent of ampere rating continuously.
 - g. Provide following time/current response adjustments, each with discrete settings independent from other adjustments:
 - 1) Instantaneous Pickup.
 - a) Disable at service entrance main breaker only.
 - 2) Long time pickup and delay.
 - 3) Short time pickup.
 - 4) Short time delay (I^2t IN only).
 - 5) Ground fault pickup and delay (I^2t OUT only) where indicated.
 - h. Provide means to seal trip unit adjustments in accordance with NEC..
 - i. Provide local visual trip indication for overload, short circuit and ground fault trip occurrences as applicable.
 - j. Provide ammeter to individually display all phase currents flowing through circuit breaker including indication of inherent ground fault current flowing in system on circuit breakers with integral ground fault protection. Display current values in true rms with 2 percent accuracy.
 - k. Provide Long Time Pickup indication to signal when loading approaches or exceeds adjusted ampere rating of circuit breaker.
 - l. Provide trip system with Long Time memory circuit to sum time increments of intermittent overcurrent conditions above pickup point and means to reset Long Time memory circuit during primary injection testing.
 - m. Provide circuit breakers equipped with thermal protection in trip unit to protect breaker from catastrophic failure and instantaneous magnetic override set at the withstand rating of the circuit breaker.
 - n. Provide trip system equipped with externally accessible test port for use with Universal Test Set. Disassembly of circuit breaker shall not be required for testing. Provide test set capable of verifying operation of trip functions with or without tripping circuit breaker.
 - o. Provide circuit breakers with Zone Selective Interlocking (ZSI) communications capabilities on short time and ground fault functions compatible with other electronic trip circuit breakers and external ground fault sensing systems as noted on schedules or drawings.

2.3 INDIVIDUALLY ENCLOSED CIRCUIT BREAKERS

- A. Provide circuit breakers of types specified herein and mounted in individual listed enclosures.
 1. Rate enclosures NEMA 1 unless otherwise indicated.
 2. Flush mount enclosures located in finished areas unless otherwise indicated. Coordinate depth of enclosure with wall depth. Install enclosure cover flush with finished wall. Advise Engineer if enclosure is too deep for available wall depth prior to installation of enclosure.

2.4 FUSES

- A. UL Class L fuses: Dual-element time-delay and current-limiting type fuses; UL Class L listed for 200,000 rms AIC symmetrical; Bussmann "Low-Peak" 600V, 601-6000A, Type KRP-C.

1. Use for main and main feeder devices over 600A, where fuses are indicated.
- B. UL Class RK-1 dual-element fuses: Dual-element time-delay and current-limiting rejection type fuses; UL Class RK-1 listed for 200,000 rms AIC symmetrical; Bussmann "Low-Peak" 0-600A, 250V Type LPN-RK and 600V Type LPS-RK.
 1. Use for main feeder devices 600A and smaller where fuses are indicated.
- C. UL Class RK-1 single-element fuses: Fast-acting current-limiting rejection type fuses; UL Class RK-1 listed for 200,000 rms AIC symmetrical; Bussmann "Limitron" 1/10-600A, 250V Type KTN-RK and 600V Type KTS-RK.
 1. Use as indicated.
- D. UL Class RK-5 fuses: Dual-element time-delay and current-limiting rejection type fuses; UL Class RK-5 listed for 200,000 rms AIC; Bussmann "Fusetron" 1/10-600A, 250V Type FRN-RK and 600V FRS-RK.
 1. Use for motor feeder and branch circuit devices where fuses are indicated.
- E. Elevator fuses: Type and rating as required by elevator manufacturer. Confirm requirements with elevator manufacturer prior to ordering fuses.

2.5 FUSIBLE SWITCHES

- A. Provide panelboard type suitable for mounting in switchboards or panelboards as indicated.
 1. 200,000 AIC, 30 thru 1200 A, with fuses specified above.
 2. Provide ground fault protection system with current sensor, shunt trip and control power transformer where indicated.
- B. Provide bolted pressure contact switches suitable for mounting in switchboards as indicated.
 1. 200,000 AIC, 800 thru 4000 A, with fuses specified above.
 2. Electrically operated as indicated.
 3. Provide ground fault protection with current sensor, shunt trip and control power transformer where indicated.

2.6 POWER SYSTEM STUDY

- A. Provide computer generated power system study of specified electrical power distribution system in accordance with IEEE 141 and 399.
 1. Include electrical distribution system from main distribution equipment (including utility and generator sources) down to each 208 volt branch circuit panelboard. Study shall include each valid system operating/switching mode under all probable source conditions.
 2. Data collection:
 - a. Provide required data for preparation of studies. Performer of studies shall furnish contractor with listing of required data immediately after award of contract.
 - b. Expedite collection of data to assure completion of studies as required for final approval of equipment shop drawings.
 - c. Input data shall include power company's short circuit contribution as calculated and verified by them.
 - d. Verify characteristics of utility service overcurrent devices with power company.
- B. Analysis shall include:
 1. Short circuit study:
 - a. Scenarios that result in maximum fault conditions shall be adequately covered in study. For example, if closed transition transfer switches are provided or if utility is paralleled with standby generators at any time, combined contribution from utility and generators shall be considered.
 - b. Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors and/or generators.

- c. Calculate 1/2 cycle (or 5 cycle where appropriate for MV equipment) short circuit interrupting and momentary (asymmetrical 'close and latch') duties, when applicable for an assumed 3-phase bolted fault at each load interrupter switchgear, transformer primary and secondary terminals, low-voltage switchgear, switchboard, distribution panelboards, bus duct, automatic transfer switch, motor control center, 480 volt panelboard, 208 volt panelboard and other significant locations throughout system.
 - d. Include equipment/device ratings, X to R ratios and symmetrical fault currents in tabulations. Where actual (calculated) X/R ratio exceeds device test X/R ratio, appropriate fault duty adjustment shall be made in accordance with ANSI/IEEE standards and included in tabulations.
 - e. Base transformer impedance on lowest tolerance limit allowed by ANSI C57.12 (7.5 percent below listed value). Use actual nameplate impedance when available.
 - f. Include fault contribution of all motors.
2. Coordination study:
- a. All potential scenarios shall be considered in study. Scenarios to be considered include but are not limited to:
 - 1) For basic system with single service, study shall show coordination between all emergency system breakers.
 - 2) If main switchgear or switchboard is double-ended with main-tie-main arrangement, study shall show coordination between main, tie, feeders and downstream devices when tie breaker is closed. Where overlap cannot be avoided, tie breaker shall be set to overlap downstream feeder overcurrent devices rather than main devices.
 - 3) If multiple levels of ground fault are provided time current curves shall be provided that indicate coordination of ground fault between main, tie and feeder breakers when tie breaker is closed. Where overlap cannot be avoided, tie breaker shall be set to overlap downstream feeder overcurrent devices rather than main devices.
 - 4) Provide graph to indicate coordination between typical 20 amp, 277 volt, single pole breaker and nearest upstream 480 volt overcurrent device with ground fault protection as applicable.
 - 5) Evaluate proper operation of ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided. Discuss neutral grounds and ground fault current flows during a neutral to ground fault.
 - 6) Include phase and ground coordination of generator protective devices. Indicate generator decrement curve and damage curve along with operating characteristic of protective devices. Obtain information from generator manufacturer and include generator actual impedance value, time constants and current boost data in study. Do not use typical values for generator.
 - 7) For motor control circuits, indicate distribution equipment full-load current plus symmetrical and asymmetrical of largest motor starting current and time to ensure protective devices will not trip during major or group start operation.
 - 8) All emergency system overcurrent protective devices shall fully coordinate per applicable requirements of NEC. Where this is not possible due to pre-determined device types, sizing or trip unit selections, notify Engineer immediately of inadequacies and include recommendations for resolution.
 - b. Graphs shall include as applicable:
 - 1) Utility relay and fuse characteristics.
 - 2) Campus substation relay and fuse characteristics.
 - 3) Medium-voltage equipment relay and fuse characteristics.
 - 4) Low-voltage equipment circuit breaker trip device characteristics.
 - 5) Pertinent transformer characteristics.
 - 6) Pertinent motor and generator characteristics.
 - 7) Characteristics of other system load protective devices.
 - 8) All devices down to and including largest branch circuit overcurrent protective device in each motor control center, distribution panel and branch panelboard.
 - 9) All adjustable settings for ground fault protective devices.

- 10) Manufacturing tolerance and damage bands in plotted fuse characteristics.
- c. Indicate transformer full load and 150, 400 or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters and significant symmetrical and asymmetrical fault currents.
- d. Select each primary protective device required for delta-wye connected transformer so that its characteristic or operating band is within transformer characteristics including point equal to 58 percent of ANSI withstand point to provide secondary line-to-ground fault protection. Where primary device characteristic is not within transformer characteristics, indicate transformer damage curve.
- e. Terminate device characteristic curves at point reflecting maximum symmetrical or asymmetrical fault current to which device could be exposed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide overcurrent protective devices in switchboards, panelboards and motor control centers as indicated in those sections.
- B. Provide individually enclosed overcurrent protective devices:
 1. Wall mounted:
 - a. Finished areas: Attach to studs via unistrut cross members or metal backing bolted or welded to studs where not otherwise shown.
 - b. Masonry or concrete walls: Attach to wall via unistrut cross members where not otherwise shown.
 - c. Mounting height shall be as indicated on symbol legend or elsewhere in this specification but bottom of enclosure shall not be less than 12 IN AFF.
 2. Where floor mounted provide pad per specification 16010.
- C. Field settings:
 1. Perform field adjustments of protective devices as required to place equipment in final operating condition. Settings shall be in accordance with approved power system study.
 2. Provide certified calibration report for each protective device.
- D. Arc flash labels:
 1. Provide Arc flash hazard warning label on each piece of electrical equipment.

END OF SECTION

SECTION 26 28 16
ENCLOSED SAFETY SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Enclosed Safety Switches, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Technical data on each type of disconnect switch.
- B. Contract Closeout Information:
 - 1. Operating and maintenance data.
 - 2. Letter stating extra material has been delivered.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Safety switches:
 - 1. Base:
 - a. Schneider Electric/Square D.
 - b. Eaton Electrical.
 - c. Siemens.
 - d. General Electric.
- B. Other manufacturers desiring approval comply with Section 00 26 00.
 - 1. All fuses in fusible-type devices: Same manufacturer.

2.2 SAFETY SWITCHES

- A. Safety switches: Fusible and non-fusible type, NEMA Type HD Heavy Duty construction, unless otherwise indicated.
 - 1. Enclosure: NEMA 1 unless otherwise indicated.
 - 2. Provide weatherproof disconnect switches as required by Section 26 00 10.
 - 3. Switch blades fully visible in OFF position with door open.
 - 4. Contact operation quick-make and quick-break.
 - 5. Switches for motor circuits to be horsepower rated.
 - 6. Switches for motor circuits controlled by Adjustable Frequency Drives (AFD) shall include one N.O. and one N.C. contact which operates with the initial movements of the switch and prior to the opening of the main switch.
 - 7. Provide padlocking provisions in OFF position.
 - 8. Finish: Baked enamel over rust-inhibiting primer.
 - 9. Fuses for fusible switches: See Section 26 28 00.

2.3 EXTRA MATERIAL

- A. Extra fuses: 10 percent or minimum of 3 of each type and rating of installed fuses.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install as indicated and in accordance with manufacturers instructions and recommendations.
- B. Switches for motor circuits controlled by AFD's shall be electrically interlocked to the controlling AFD via contacts provided in switch.
- C. Provide labeling per Section 26 00 10.

END OF SECTION

SECTION 26 41 13
LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Lightning Protection System, as indicated, in accordance with provisions of Contract Documents.
- B. Scope of work:
 - 1. Provide extension of existing system complying with UL and provide UL Letter of findings. Existing system resistance shall be tested prior to new work, and where inadequate new electrodes installed to meet requirements of this specification.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Certified member of Lightning Protection Institute to install lightning protection systems.
 - 2. UL listed manufacturer and installer.
- B. System Standards:
 - 1. ANSI/UL 96, and NFPA 780.
 - 2. ANSI/UL 96 Standard for Safety for Lightning Protection Components.
 - 3. UL96A Standard for Installation Requirements for Lightning Protection Systems.
 - 4. NFPA 780 Standard for the Installation of Lightning Protection Systems.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Lightning protection system:
 - a. Roof penetration details.
 - b. Complete layout indicating all connections, down conductors and grounding tripads.
- B. Product Data:
 - 1. Technical data on each component.
- C. Contract Closeout Information:
 - 1. UL Letter of Findings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Lightning Protection System:
 - 1. Thompson Lightning Protection.
 - 2. Robbins Lightning Inc.
 - 3. Heary Brothers Lightning Protection.
 - 4. Independent Protection.
 - 5. National Lightning Protection.

2.2 MATERIALS

- A. Lightning Protection System:
 - 1. Lightning protection system: Complete UL96A compliant lightning protection system.
 - 2. Labeled for lightning protection systems by UL.
 - 3. Design components to blend with appearance of building.
 - 4. Maximum concealed, semi-concealed or totally exposed system as required.

- B. Conductors:
 - 1. Copper or aluminum, grade ordinarily used for commercial electric work and of weight required by height of building.
- C. Air Terminals:
 - 1. Solid copper or aluminum rod with tapered point, of height required.
 - 2. Attach rods to building with proper cast bronze or copper base to adapt to building design.
- D. Ground Rods:
 - 1. 3/4 IN x 10 FT copper weld.
- E. Main Ground Connection Fittings:
 - 1. See Section 26 05 26.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not install copper conductors or fastenings in contact with aluminum surfaces.
- B. Structural steel may be used as main conductor in accordance with NFPA 780.
- C. Terminate each downlead cable in grounding arrangement suitable to local soil condition and applicable codes.
 - 1. Maximum ground resistance: 10 ohms.
 - 2. Use tripods each containing three rods, located as required.
 - 3. Make connection to ground rods with Cadweld method or UL listed compression fitting for connections buried in earth.
 - 4. If necessary, drive additional ground rods to obtain 10 ohms.
 - 5. Do not cover or bury ground rods until observed by Architect.
- D. Interconnect metal items on roof such as ventilators, stacks, pipes, gutters, downspouts, ducts, tracks, antennas, water pipes, ladders to main conductor system.
- E. Provide connection to incoming electric and telephone service ground per NEC for common bonding.
- F. Provide roof flashings or other method approved by roof manufacturer for down conductor or fittings passing through roofs.
- G. Remove and replace lightning protection system components found not in compliance with specification requirements.
- H. Installation of protection system to allow free movement of flashing and coping systems.

END OF SECTION

SECTION 26 43 13
SURGE PROTECTIVE DEVICES (SPD)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Surge Suppression Devices, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 DESCRIPTION

- A. This specification includes surge protective devices that clamps transient voltage, diverts surge current and attenuates high-frequency electrical line noise.
- B. Surge protective devices shall be located at service entrance equipment and at downstream switchgear, switchboards, motor control centers, busway, distribution panelboards and/or branch circuit panelboards where indicated on Drawings or Panelboard Schedules.
- C. Surge protective devices shall be internally mounted within the protected equipment enclosure.
- D. Surge protective devices shall be externally mounted in its own separate enclosure adjacent to the enclosure of the protected equipment.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Engaged in design and manufacturer of specified system for a minimum of five (5) years
 - 2. SPD manufacturer shall be same as manufacturer of protected equipment.
- B. Design, manufacture, test, and install SPD equipment in compliance with latest edition of following standards:
 - 1. American National Standards Institute and Institute of Electrical and Electronic Engineers:
 - a. ANSI/IEEE-C62.41.1 Guide on the Surge Environment in Low Voltage AC Power Circuits.
 - b. ANSI/IEEE-C62.41.2 Recommended Practice on Characterization of Surges in Low Voltage AC Power Circuits.
 - c. ANSI/IEEE-C62.45 Recommended Practice on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits.
 - 2. American National Standards Institute and Underwriters Laboratories:
 - a. ANSI/UL-50 Enclosures for Electrical Equipment.
 - b. ANSI/UL-67 Panelboards.
 - c. ANSI/UL-845 Motor Control Centers.
 - d. ANSI/UL-857 Busway.
 - e. ANSI/UL-891 Dead Front Switchboards.
 - f. ANSI/UL-1283 Electromagnetic Interference Filters.
 - g. ANSI/UL 1449 Third Edition, Surge Protective Devices.
 - h. ANSI/UL 1558 Metal Enclosed Low Voltage Power Circuit Breaker Switchgear.
 - 3. National Fire Protection Association:
 - a. NFPA-70 National Electrical Code.
 - b. NFPA-780 Lightning Protection Systems.
 - 4. Military Standards
 - a. MIL STD 220C Method of Insertion Loss Measurement.
 - 5. Underwriters Laboratories:
 - a. UL 96A Lightning Protection Systems.

- C. Internally mounted SPD equipment shall be UL-1449 and UL-1283 Listed or shall be UL-1449 and UL-1283 component recognized as a surge protective device and electromagnetic interference filter. The protected equipment including the SPD shall be fully tested and certified to the applicable switchgear, switchboard, motor control center, busway and/or panelboard UL Standard.
- D. Externally mounted SPD equipment shall be UL-1449 and UL-1283 listed as a surge protective device and electromagnetic interference filter.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit unit dimensions, weights, mounting provisions, connection details and layout diagrams of each SPD application.
 - 2. Indicate location with respect to protected bus and connection characteristics to bus including material type, length and routing.
- B. Product Data:
 - 1. Copy of UL 1449 Certification under Category VZCA or VZCA2 with applicable model numbers highlighted and indicating following information:
 - a. Model number.
 - b. Product Type.
 - c. Voltage.
 - d. Phase.
 - e. Voltage protection rating per mode.
 - f. Nominal discharge current rating per mode.
 - g. Maximum continuous operating voltage rating per mode.
 - 2. Standard catalog data sheets indicating:
 - a. Modes of protection.
 - b. Surge current capacity per mode.
 - c. Surge current capacity per phase.
 - d. Short circuit current rating.
 - e. Filter attenuation.
 - f. Diagnostics and monitoring features.
- C. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - a. See Section 01 78 23.
 - 2. Warranty.

1.5 STORAGE AND HANDLING

- A. SPD equipment shall be shipped, stored and handled in accordance with manufacturer's instruction.

1.6 WARRANTY

- A. Manufacturer's Limited Ten-Year Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Surge Suppression Devices:
 - 1. Base:
 - a. Eaton/Cutler-Hammer – SPD Series.
 - b. Square D/Surgelogic – IMA/EMA Series
 - c. Siemens Energy & Automation/Sentron – TPS3 Series.

- d. General Electric – TR7000 Series.
- 2. Optional:
 - a. Emerson/Liebert/Advanced Protection Technologies.
 - b. Smiths Power/LEA International.
 - c. Surge Suppression Inc.
 - d. Thomas & Betts/Current Technology.
- 3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Environmental Requirements:
 - 1. Operating temperature range shall be minus 40 DEGC to plus 50 DEGC.
 - 2. Relative humidity range shall be 5 PCT to 95 PCT non-condensing.
 - 3. Capable of operation at altitudes up to 16,000 FT above sea level.
 - 4. No audible noise.
 - 5. No appreciable emissions of EMI/RFI fields.
- B. General Electrical Requirements:
 - 1. SPD shall be a combination of a solid state, parallel connected surge suppression device and an electromagnetic interference filter.
 - 2. The surge suppression elements shall be Metal Oxide Varistor (MOV).
 - 3. Each MOV shall be provided with individual over-current and thermal over-temperature protection.
 - 4. Surge current shall be equally distributed to all components to ensure equal stressing and maximum performance.
 - 5. Nominal operating voltage: as indicated on the drawings or panelboard schedules.
 - 6. Nominal operating frequency: 60 Hz.
 - 7. Protection modes: provide directly connected suppression elements between line and neutral (L-N), line and ground (L-G), and neutral and ground (N-G).
 - 8. Maximum Continuous Over Voltage (MCOV) shall equal or exceed the following:
 - a. 208Y/120 volt systems:
 - 1) L-N: 150.
 - 2) L-G: 150.
 - 3) N-G: 150.
 - 4) L-L: 300.
 - b. 480Y/277 volt systems:
 - 1) L-N: 320.
 - 2) L-G: 320.
 - 3) N-G: 320.
 - 4) L-L: 640.
 - 9. Voltage Protection Rating (VPR) shall not exceed the following:
 - a. 208Y/120 volt systems:
 - 1) L-N: 800.
 - 2) L-G: 800.
 - 3) N-G: 800.
 - 4) L-L: 1200.
 - b. 480Y/277 volt systems:
 - 1) L-N: 1200.
 - 2) L-G: 1200.
 - 3) N-G: 1200.
 - 4) L-L: 2000.
 - 10. Nominal discharge current rating: 20kA.
 - 11. Short circuit current rating (SCCR): 200kA.
 - 12. EMI/RFI filter shall provide minimum 50 dB noise attenuation at 100 kHz using MIL-STD-220A insertion loss test method.
 - 13. Diagnostics and monitoring:
 - a. Solid state monitoring of each mode and power loss in any phase.

- b. Externally visible green/red LED operational status indicator lights for each protection mode. Absence of a green light and presence of red light shall indicate which mode(s) or phase(s) have been damaged.
 - c. Audible alarm with silence switch shall sound if any fault condition occurs.
 - d. Form C dry contacts (1 NO/1 NC) for remote status monitoring. Contacts shall change state if any fault condition occurs.
 - e. Test switch shall test SPD's diagnostics and monitoring system.
 - f. Surge counter with LCD display shall indicate the quantity of transients recorded. Count shall be stored in non-volatile memory. Provide reset pushbutton with two second duration to reset.
- C. Specific Electrical Requirements by Application/Location:
1. Internally mounted within service entrance equipment:
 - a. UL Labeled as Type 2, or Type 4 investigated by UL for use in Type 2 applications.
 - b. Tested and suitable for use in ANSI/IEEE C62.41 Category C environments.
 - c. Surge current capacity:
 - 1) Maximum surge current rating per phase shall be minimum 250kA.
 - 2) Maximum surge current rating per mode shall be minimum 125kA.
 - d. Factory installed.
 - 1) SPD equipment shall be located within the service entrance equipment enclosure and installed in the factory by the service entrance equipment manufacturer.
 - 2) SPD equipment shall be connected directly to the protected equipment bus on the load side of the service disconnect. If direct bus connection is not possible, conductor leads may be provided. Conductor leads shall be kept as short and straight as possible. Leads shall be minimum #8 conductors and twisted with a minimum of three twists per foot (ten twists per meter) in the conductors to minimize impedance. Tie wrap twisted conductors at 4 IN 100 MM spacing.
 - 3) Provide a remote diagnostics panel mounted on the cover of the service entrance equipment enclosure and visible from outside the enclosure.
 2. Internally mounted within distribution equipment and/or panelboards serving rooftop equipment:
 - a. UL Labeled as Type 2, or Type 4 investigated by UL for use in Type 2 applications.
 - b. Tested and suitable for use in ANSI/IEEE C62.41 Category C or B environments.
 - c. Surge current capacity:
 - 1) Maximum surge current rating per phase shall be minimum 160kA.
 - 2) Maximum surge current rating per mode shall be minimum 80kA.
 - d. Factory installed.
 - 1) SPD equipment shall be located within the distribution equipment enclosure and installed in the factory of the distribution equipment manufacturer.
 - 2) SPD equipment shall be connected directly to the protected equipment bus on the load side of the main circuit breaker if provided. Neutral and ground leads shall be kept as short and straight as possible. Leads shall be minimum #8 conductors and twisted with a minimum of three twists per foot (ten twists per meter) in the conductors to minimize impedance. Tie wrap twisted conductors at 4 IN 100 MM spacing.
 - 3) Provide a window in the equipment to allow the diagnostics panels to be visible from outside the enclosure. If not, provide a remote diagnostics panel mounted on the cover of the distribution equipment enclosure and visible from outside the enclosure.
 - e. SPD mounting shall not limit the use of through-feed lugs, sub-feed lugs or sub-feed breakers.
 - f. Panelboards shall be capable of being placed back in re-energized service upon removal of the SPD.
 3. Internally mounted within branch circuit panelboards:
 - a. UL Labeled as Type 2, or Type 4 investigated by UL for use in Type 2 applications.
 - b. Tested and suitable for use in ANSI/IEEE C62.41 Category B environments.

- c. Surge current capacity:
 - 1) Maximum surge current rating per phase shall be minimum 100kA.
 - 2) Maximum surge current rating per mode shall be minimum 50kA.
 - d. Factory installed.
 - 1) SPD equipment shall be located within the panelboard enclosure and installed in the factory of the panelboard manufacturer.
 - 2) SPD equipment shall be connected directly to the protected equipment bus on the load side of the main circuit breaker if provided. Neutral and ground leads shall be kept as short and straight as possible. Leads shall be minimum #8 conductors and twisted with a minimum of three twists per foot (ten twists per meter) in the conductors to minimize impedance. Tie wrap twisted conductors at 4 IN 100 MM spacing.
 - 3) Provide a window in the panelboard cover to allow the diagnostics panels to be visible from outside the enclosure.
 - e. SPD mounting shall not limit the use of through-feed lugs, sub-feed lugs or sub-feed breakers.
 - f. Panelboards shall be capable of being placed back in re-energized service upon removal of the SPD.
4. Externally mounted at service entrance equipment:
 - a. UL Labeled as Type 2.
 - b. Tested and suitable for use in ANSI/IEEE C62.41 Category C environments.
 - c. Surge current capacity:
 - 1) Maximum surge current rating per phase shall be minimum 250kA.
 - 2) Maximum surge current rating per mode shall be minimum 125kA.
 - d. Separately mounted in NEMA 1 enclosure. Diagnostics shall be visible from outside the enclosure.
 5. Externally mounted adjacent to distribution equipment and/or panelboards serving rooftop equipment:
 - a. UL Labeled as Type 2.
 - b. Tested and suitable for use in ANSI/IEEE C62.41 Category C or B environments.
 - c. Surge current capacity:
 - 1) Maximum surge current rating per phase shall be minimum 160kA.
 - 2) Maximum surge current rating per mode shall be minimum 80kA.
 - d. Separately mounted in NEMA 1 enclosure. Diagnostics shall be visible from outside the enclosure.
 6. Externally mounted adjacent to branch circuit panelboards:
 - a. UL Labeled as Type 2.
 - b. Tested and suitable for use in ANSI/IEEE C62.41 Category B environments.
 - c. Surge current capacity:
 - 1) Maximum surge current rating per phase shall be minimum 100kA.
 - 2) Maximum surge current rating per mode shall be minimum 50kA.
 - d. Separately mounted in NEMA 1 enclosure. Diagnostics shall be visible from outside the enclosure.
- D. Factory-test SPD equipment prior to shipment, including but not be limited to:
1. Quality assurance checks.
 2. MCOV and let-through voltage verification tests.
 - a. MCOV testing shall consist of units burned-in at applicable MCOV for a minimum of one (1) hour.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install SPD equipment per manufacturer's recommendations.
- B. Externally mounted SPD equipment:

1. Mount as close as practical to the protected bus. For panelboard applications, wall mount the SPD immediately adjacent to the circuit breaker serving it.
 2. Conductors shall be as short and straight as possible between SPD and circuit breaker.
 3. Conductor size shall be minimum #8 IN minimum 1 IN conduit. Provide larger conductors and conduit as recommended by the manufacturer.
 4. Provide a minimum of three twists per foot (ten twists per meter) in the conductors to minimize impedance. Tie wrap twisted conductors at 4 IN spacing.
 5. Seal conduit after placement of conductors.
- C. Do not energize SPD's until distribution system has been energized, stabilized and tested.
- D. Disconnect SPD's during distribution system insulation resistance testing.

END OF SECTION

SECTION 26 51 13
BUILDING LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Building Lighting, as indicated, in accordance with provisions of Contract Documents.
- B. Section includes interior luminaires and accessories, lamps, ballasts and drivers.
- C. See Section 26 53 00 for exterior luminaires not mounted to building.
- D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Where groups of luminaire types on Lighting Equipment Schedule exhibit same manufacturers, final installation shall consist of same manufacturer's equipment across groupings as specified for consistency of optics, color of light, finishes, aesthetics and similarity of maintenance procedures.
 - 1. Mixing/matching across groups is unacceptable except where specified.
 - 2. Mixing/matching across multi-phased projects is unacceptable, except where products have subsequently been discontinued or significantly redesigned in size, appearance, lamping or gear.
 - 3. See Lighting Equipment Schedule for additional information.
- B. Advise Architect of discrepancies between luminaire catalog references shown or specified and actual ceiling construction, prior to submission of shop drawings.
 - 1. Failure to do so will require correction at no additional cost.
- C. Coordinate ballasts/drivers used with lamping/LED modules, lamp sockets, and control devices prior to submitting shop drawings.
- D. Each luminaire shall be listed with nationally recognized testing laboratory including but not limited to, UL, CSA, ETL, under UL 1598 and UL 8750, or an equivalent standard from recognized testing laboratory, and manufactured in accordance with NEC.
- E. Lamps and ballasts shall comply with U.S. Federal Efficiency laws and TCLP compliance Standards.
- F. Materials and installations shall be in accordance with latest revision of National Electrical Code and any applicable Federal, State and local codes and regulations.
- G. Luminaires shall comply with relevant and current ANSI, CBM, ESTA, FCC, IEC, IEEE, IESNA, NEMA, NFPA, and UL standards and practices.
- H. American National Standards Institute (ANSI):
 - 1. ANSI C62.41.2 IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000 V and less) AC Power Circuits.
 - 2. ANSI C78.377: Specifications for the Chromaticity of Solid State Lighting Products.
 - 3. ANSI C82.77: Harmonic Emission Limits - Related Power Quality Requirements for Lighting Equipment.
 - 4. ANSI/IES RP-16-10: Nomenclature and Definitions for Illuminating Engineering.
- I. Federal Communications Commission (FCC):
 - 1. Code of Federal Regulations (CFR), Title 47, Part 18, Industrial, Scientific, and Medical Equipment.
 - 2. Code of Federal Regulations (CFR), Title 47, Part 15 Class B: Radio Frequency Devices, Commercial Rated.

- J. International Electrotechnical Commission (IEC):
 - 1. IEC 61000-3-2: Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
 - 2. IEC 61347-1: General and Safety Requirements for Lamp Control Gear.
 - 3. IEC 61347-2-13: Particular Requirements for DC or AC. Supplied Electronic Control gear for LED Modules.
 - 4. IEC 61547: Equipment for general lighting purposes - EMC Immunity Requirements.
 - 5. IEC 62384: DC or AC Supplied Electronic Control Gear for LED Modules - Performance Requirements.
- K. Institute of Electrical and Electronic Engineers (IEEE):
 - 1. IEEE C62.41-91: Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits.
- L. Illuminating Engineering Society of North America (IESNA):
 - 1. IES LM-15: IESNA Guide for Reporting General Lighting Equipment Engineering Data for Indoor Luminaires.
 - 2. IES LM-28: IES Guide for the Selection, Care and Use of Electrical Instruments in the Photometric Laboratory.
 - 3. IES LM-54: Guide to Lamp Seasoning.
 - 4. IES LM-63: ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information.
 - 5. IES LM-64: Photometric Measurements of Parking Areas.
 - 6. IES LM-72: Directional Positioning of Photometric Data.
 - 7. IES LM-79: Electrical and Photometric Measurements of Solid-State Lighting Products.
 - 8. IES LM-80: Measuring Lumen Maintenance of LED Light Sources.
 - 9. IES LM-82: Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature.
 - 10. IES LM-84: Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines and Luminaires.
 - 11. IES LM-85: Electrical and Photometric Measurements of High-Powered LEDs.
 - 12. IES TM-21: Projecting Long Term Lumen Maintenance of LED Light Sources.
 - 13. IES TM-30: IES Method for Evaluating Light Source Color Rendition.
- M. National Electrical Manufacturer's Association (NEMA):
 - 1. NEMA SSL1: Electronic Drivers for LED Devices, Arrays, or Systems.
 - 2. NEMA SSL3: High-Power White LED Binning for General Illumination.
 - 3. NEMA SSL7A: Phase Cut Dimming for Solid State Lighting: Basic Compatibility.
 - 4. NEMA 410: Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.
- N. National Fire Protection Association (NFPA):
 - 1. NFPA 70: National Electrical Code (NEC)
 - 2. NFPA 101: Life Safety Code.
- O. UL International (UL):
 - 1. UL 1310 Standard for Class 2 Power Units.
 - 2. UL 8750 Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. For continuous pattern luminaires, indicate layout, individual section lengths, and lamp/LED module quantities.
 - a. Show details of connections, emergency ballast/driver and lamp/module placement, corners and extensions, end plates, and mounting. Include pendant or bracket locations and show remote transformers/ballasts/drivers.

- b. Provide field-measured overall dimensions in wall-to-wall and wall-to-corner applications.
 - 2. Details of special construction, accessories, and finishes.
- B. Provide a copy of Building Lighting Specification Section, Lighting Equipment Schedule, Lighting Plans, Lighting Details, and Lighting Controls information to listed and optional manufacturers in addition to manufacturer local representative for use in preparing bid.
- C. Product Data:
 - 1. Submit product data for fixtures indicated on Electrical Drawings, Specifications and Schedules.
 - 2. Identify luminaires by Lighting Equipment Schedule designation.
 - a. For each luminaire, provide cutsheets indicating following information:
 - 1) Name of manufacturer, cutsheet, and complete catalog number.
 - a) Include product data details for catalog number references to explain special construction, accessory or finish, and photometric data.
 - 2) Photometric Data:
 - a) Collected by an independent testing laboratory.
 - b) Indicate optical performance developed using methods of Illuminating Engineering Society of North America (IESNA) as follows:
 - (1) Coefficients of utilization.
 - (2) Candlepower data presented graphically and numerically, in maximum 10 degree increments.
 - (3) Develop data for up and down quadrants that are normal, parallel, and at 45 DEG to lamp if light output is asymmetric.
 - (4) Zonal lumens stated numerically in 10 degree increments as above.
 - (5) Fixture efficiency.
 - 3. Solid state Luminaires:
 - a. LED Luminaires:
 - 1) Total input wattage.
 - 2) Luminaire voltage.
 - 3) Delivered lumens.
 - 4) Color temperature, color rendering index (CRI), and individual R-values, measured in accordance with IESNA standards.
 - 5) Rated life, measured in accordance with IESNA standards.
 - 6) Total harmonic distortion (THD).
 - 7) Submit in tabular format the characteristics of submitted fixture per the technical information categories of the Lighting Equipment Schedule. Deviations from specified criteria shall be identified by a +/- percentage.
 - 8) Submit the rated lumen maintenance life of LED luminaires. Life shall be reported based upon the light source's L70 rating.
 - b. LED Drivers:
 - 1) Driver manufacturer and model number.
 - 2) Driver rated life.
 - 3) Driver dimensions.
 - 4) Driver type (0-10V, constant voltage, constant current).
 - 5) If applicable, include lumen management protocols.
 - 6) Dimming range and control device compatibility list.
 - 7) Wiring Diagrams – as needed for special operation or interaction with other systems.
 - 4. Coordinate ballasts/drivers used with lamping/LED modules, lamp sockets, and control devices prior to submitting Shop Drawings.
 - 5. Upon request, provide calculations performed in AGI32 IN specific spaces as identified by Architect for submitted optional manufacturers or substitutions.
 - 6. Coordinate luminaires with ceiling construction.
 - a. Confirm clearances and fixture flange compatibility with construction.

- D. Project Information:
 - 1. Manufacturer's installation instructions.
- E. Contract Closeout Information:
 - 1. Manufacturer's Warranty shall be from date of Substantial Completion.
 - a. Include labor allowance for full cost of component replacement.
 - b. Provide warranties, as specified, for the following equipment:
 - 1) Finish.
 - 2) Lenses.
 - 3) Housings.
 - 4) Transformers.
 - 5) LED Drivers.
 - 6) LED Luminaires.
 - 2. Warrant LED drivers for a minimum of five years from Date of Substantial Completion.
 - a. Include labor allowance for full cost of driver installation.
 - 3. Warrant the luminaire and all of its components (except the ballast/transformer/driver) to be free from defect in operation or finish for a minimum of five years from the date of Date of Substantial Completion.
 - a. Warrant LED modules during this period for color and lumen maintenance (percent shift +/- degrees Kelvin).
 - b. As long as luminaire has been operated within the rated voltage range, Contractor is responsible for cost of materials and labor necessary to repair or replace luminaire.
 - 4. It is the responsibility of the Contractor to manage all warranty issues that may arise.
 - 5. Inventory of driver/module replacement stocks.
 - 6. At time of Substantial Completion as defined by the Architect, submit all installation and maintenance tools received from various luminaire vendors clearly and permanently tagged with Manufacturer's name and relevant luminaire type(s) to the Owner's Representative.
 - 7. Maintenance and Operating Manuals.
 - a. See Section 01 78 23.
- F. Review of shop drawings and product data does not waive the Contractor of their obligations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Luminaires:
 - 1. Base:
 - a. As indicated on Lighting Equipment Schedule.
 - 2. Optional:
 - a. As indicated on Lighting Equipment Schedule.
 - 3. Use catalog numbers listed as a guide only. Follow modifications and other requirements shown or specified.
- B. Lamps/LED Modules:
 - 1. GE Lighting.
 - 2. Osram Sylvania.
 - 3. Philips Lighting.
 - 4. Cree (LED only).
 - 5. Soraa (LED only)
 - 6. Xicato (LED only).
- C. Drivers:
 - 1. Osram Sylvania.
 - 2. Philips Advance.
 - 3. Mean Well.
 - 4. eldoLED.
 - 5. Hatch.

- 6. Lutron.
- D. Emergency LED Drivers:
 - 1. Philips Bodine.
 - 2. Iota.
- E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Luminaires:
 - 1. Resistant to corrosion and thermal and mechanical stresses encountered in normal application. Provide accessory equipment such as starters, sockets and lampholders, approved by UL and ETL, unless otherwise noted.
 - 2. Electrical components of recessed luminaires shall be accessible and removable through luminaire without having to remove luminaire from ceiling.
 - 3. Housings:
 - a. Troffer luminaires: Minimum 22 GA 0.76 MM sheet steel; integral end plates and trim flanges to suit ceiling construction. Provide wire way covers with captive retainers to allow access to electrical components without use of tools.
 - b. Downlight luminaires: Minimum 22 GA 0.76 MM sheet steel, or minimum 0.0508 IN sheet aluminum, unless noted otherwise. Provide auxiliary junction box secured to mounting frame.
 - c. Extruded aluminum housings, where scheduled, shall be at least 1/8 IN thick.
 - d. Punch and form housings prior to finishing (post-paint).
 - e. Ballast/driver surface shall be in complete contact with housing, having the mounting method designed for efficient conduction of ballast heat.
 - 4. Trim:
 - a. For square and rectangular luminaires, miter and continuously weld corners. Miter perimeter inverted T-Bar angles at corners. Do not butt or overlap squared ends. Finish joints smooth.
 - 5. Castings:
 - a. Uniform quality, free from imperfections affecting strength and appearance. Exterior surfaces, if not receiving a finish coat, shall be smooth and match adjacent surfaces. At least one coat of clear methacrylate lacquer shall be applied unless a painted finish is specified.
 - 6. Fasteners:
 - a. For aluminum or steel luminaires, fastening hardware shall be cadmium-plated or an equivalent. For stainless steel luminaires stainless steel fasteners shall be used. For bronze luminaires, the fastening hardware shall be bronze or stainless steel.
 - 7. Finishes: As selected from manufacturer's standards unless scheduled otherwise:
 - a. Painted surfaces, except as scheduled otherwise:
 - 1) Manufacturer's standard metal pretreatment and baked or air-dried, light-stabilized enamel finish; acrylic, alkyd, epoxy, polyester or polyurethane.
 - 2) White finishes shall have minimum 85 PCT reflectance.
 - b. Unpainted aluminum surfaces:
 - 1) Interior luminaires: Clear anodic coating, satin finish, except as scheduled otherwise.
 - 2) Exterior luminaires: Clear anodic coating.
 - 8. Lens/Louver Frames:
 - a. Extruded aluminum with mitered corners unless scheduled otherwise.
 - b. Hinging or other normal motion shall not cause lens or louver to drop out.
 - c. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
 - 9. Lenses:
 - a. Utilize 100 PCT virgin, UV stabilized acrylic.
 - b. The lenses shall be held securely in place but must also be removable to clean and service the luminaire.

- 1) Luminaires with a spread lens shall also include a lens orientation device to ensure that it is not affected during cleaning or relamping.
 - c. There shall be no light leaks between the lens and the luminaire.
 - d. Acrylic lenses and diffusers shall be properly cast, molded or extruded as necessary to meet the intent of the specified optics, and shall remain free of any dimensional instability, discoloration, embrittlement, or loss of light transmittance at least for the period of the Manufacturer's warranty.
10. Reflectors:
 - a. High-purity No. 12 aluminum reflector sheet, 0.047 IN or heavier if specified, free from fabrication or assembly damages. No exposed rivets, springs or other hardware after installation. Shape reflectors in modified elliptical or parabolic contour to produce no apparent brightness.
 - b. Downlight reflector and baffle finishes: First-quality Alzak anodized specular or semi-specular finish of color as specified, unless otherwise noted in Lighting Fixture Schedule.
 - 1) Downlight reflectors shall be securely fastened but also removable for cleaning and relamping.
 - c. Troffer reflector finish: integral reflectors shall be painted white after fabrication and shall have a minimum reflectance value of 90 PCT.
 11. Gaskets: Provide gaskets at face plates or frames of recessed luminaires which serve as ceiling trim and which allow interior access. Provide moisture seal gaskets at exterior locations and in other areas designated. Secure frames to luminaire bodies with screws or other means, to result in tight installation, without light leaks. See Lighting Equipment Schedule for other types of seals and gaskets.
 12. Ventilation: Provide ventilation openings of adequate size and quantity to permit operation of lamps/LED modules and ballast/driver without affecting rated output or life expectancy.
 13. Lamp Holders:
 - a. Position sockets so that lamps are in optically correct relation to luminaire components.
 - b. Secure sockets by screws to luminaire enclosure. Spring mounted sockets are not approved. Do not use plastic or sheet metal sockets unless specified otherwise.
 - c. Halogen: Porcelain body; nickel plated brass socket, pre-lubricated with silicone compound.
 - d. Fluorescent: White urea plastic body; silver plated phosphor bronze or beryllium copper contacts.
 - e. High Intensity Discharge: Porcelain body; nickel plated brass socket, pre-lubricated with silicone compound. Lamp supplied must be compatible with socket orientation (horizontal, base up or base down).
 - f. Light Emitting Diode (LED): Unless otherwise specified, a dedicated means of connecting light source to power shall be used in luminaires purposely made for use with LEDs unless otherwise specified. LED modules shall be field replaceable.
 14. Wiring:
 - a. Factory wire luminaire to be compatible with project electrical and controls systems.
 - b. Ballasted luminaires shall comply with NEC requirements and be supplied with a disconnecting means accessible to qualified persons before servicing or maintaining ballast.
 - c. Power supplies and LED modules, unless otherwise specified, shall be field replaceable and shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.
 15. Mounting Accessories:
 - a. Provide appropriate mounting accessories for each luminaire, compatible with various structural conditions encountered. Provide fastening clips (seismic clips) for luminaires supported from framing members of suspended ceilings.
 - b. Luminaires with adjustable beam angles shall have a locking device to ensure that the beam distribution is not effected during relamping or cleaning.
 - c. Recessed Luminaires:

- 1) Plaster frames: Provide frames for luminaires installed in gypsum board and concealed suspension system ceiling tile. Make frames of non-ferrous metal or suitably rustproof after fabrication.
 - 2) Baffles and gaskets: As required to prevent light leakage.
 - 3) Flanged luminaires are required in all ceiling systems except exposed grid lay-in panel type.
- d. Luminaire Suspension Material:
- 1) Unfinished spaces: 1/2 IN minimum diameter pendant, unless otherwise noted.
 - 2) Finished spaces: Unless otherwise noted, provide manufactured cable or stem and outlet box canopy; contemporary design with swivel self-aligning features; size canopy to cover outlet box; finished to match luminaire. Coordinate pendant location with ceiling tiles/ceiling grid, and submit coordinated mounting accessories as part of Product Data submission.
 - a) Provide luminaires mounted on suspended ceiling grids with outlet box designed for grid mounting with direct cord entry.
- e. Mechanical Safety: Unless otherwise specified, retain luminaire closures (lens doors, trim frame, hinged housings, etc.) in secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- f. Luminaires in Hazardous Areas: Luminaires shall be suitable for installation in flammable atmospheres (Class and Group) as defined in NFPA 70 and shall comply with UL 844.
- g. LED luminaires shall be manufactured specifically for their respective light source with dedicated electrical connections and with power supplies integral to the fixture, except where remote devices are specified. Assemblies designed to retrofit incandescent luminaires are prohibited except when specifically indicated for renovation of existing luminaires. Luminaires shall be designed for lamps as specified.
- h. The Contractor shall assure that all trims and canopies and escutcheons fit snugly and securely to the ceiling and/or wall so that no light leaks occur and so that no gaps or uneven waves are evident.

B. Lamps:

1. LED's:

- a. Color temperature specified shall be uniform for all LED modules within like luminaire types. Color temperature measurement shall have a maximum MacAdam Ellipse boundary of 3 SDCM unless otherwise specified in the Lighting Equipment Schedule.
- b. Color temperature specified shall be uniform for all LED modules within like luminaire types. Color temperature measurement shall have a maximum MacAdam Ellipse boundary of 3 SDCM unless otherwise specified in the Lighting Equipment Schedule at the end of rated life.
 - 1) Correlated color temperature shall be as defined in the Lighting Equipment Schedule.
- c. Minimum Ra value or color rendering index (CRI) of 80.
 - 1) Minimum color rendering index (CRI) shall be as defined in the Lighting Equipment Schedule.
 - 2) Minimum R9 value of 35
- d. LED light output and efficacy shall be measured in accordance with IES LM-79 standards.
- e. LED life and lumen maintenance shall be measured in accordance with IES LM-80 and TM-21 standards.
 - 1) Rated minimum L70 life of 50,000 HRS at 25 DEG C.
- f. The individual LED's shall be connected such that a catastrophic loss or the failure of one LED will not result in a light output loss of the entire luminaire.

C. Ballasts and Drivers:

1. General:

- a. Comply with UL and ANSI specifications. Enclosure shall display approval label for compliance with UL standards.
 - b. Contractor shall verify required voltage, frequency and power factors.
 - c. Comply with US Federal Efficiency Laws.
 - d. Manufacturing facilities shall maintain ISO 9001 certification.
 - e. Equipment shall not contain PCBs.
 - f. Manufacturer shall have a ten year history of producing electronic ballasts and/or drivers for the North American market.
2. LED Drivers:
- a. LED Dimming Driver.
 - 1) 4-Wire (0-10V DC Voltage Controlled) Dimming Driver.
 - 2) Driver as specified on the Lighting Equipment Schedule.
 - b. General.
 - 1) LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
 - 2) Driver shall operate from 60 Hz input source of 120V through 277V with sustained variations of +/- 10 PCT (voltage and frequency) with no visible change in light output.
 - 3) Total Harmonic Distortion less than 20 PCT and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.
 - 4) Driver shall have a Power Factor greater than 0.90.
 - 5) Driver output shall be regulated to +/- 5 PCT across published load range.
 - 6) Driver shall have a Class A sound rating.
 - 7) Driver shall have a minimum operating temperature of -4 DEGF.
 - 8) Driver shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.
 - 9) Driver output ripple current shall be less than 15 PCT measured peak-to-average, with ripple frequency greater than 100 Hz.
 - 10) Driver must limit inrush current and meet or exceed NEMA 410 driver inrush standard of 430 Amps per 10 Amps load with a maximum of 370 Amps² – seconds.
 - 11) Driver shall withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A for Transient protection.
 - 12) Driver shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
 - 13) Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
 - a) Adjustment of forward LED voltage, supporting 3V through 55V.
 - b) Adjustment of LED current from 200 mA to 1.05A at the 100 PCT control input point in increments of 1 mA.
 - c) Adjustment for operating hours to maintain constant lumens (within 5 PCT) over the 50,000 HR design life of the system, and deliver up to 20 PCT energy savings early in the life cycle.
 - 14) Driver: UL Recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.
 - 15) Drivers shall have a rated life greater than or equal to the stated life of luminaire they control.

- 16) LED engine must be compatible with type of driver and perform within the dimming range specified, and coordinated prior to submission of shop drawings.
 - 17) Coordinate if lighting controls utilize source or sync dimming. Luminaire manufacturer shall provide converter pathway device(s) as required for luminaires to dim and function as specified.
 - 18) Fixture shall be properly heat-sinked to assure LED junction temperature ratings are not exceeded. Manufacturer shall provide ambient operating temperature range for which product is warranted.
 - 19) If driver is remote-mounted, provide maximum allowable distances for secondary wire runs to luminaires. Driver shall be housed in NEMA enclosures so rated for the power supply and located in code-compliant, sound-isolated, well-ventilated, easily accessible areas. Size wire according to run length and LED Manufacturer's size and distance-of-run requirements and in accordance with code requirements.
 - 20) All LED power supplies shall be suitably sized to accommodate the LED array consistent with industry standards, including IEC standard 60929 Annex E.
 - 21) Driver shall be available in an all metal-can construction for optimal thermal performance.
 - 22) Driver shall be provided with integral color-coded connectors.
 - 23) Provide with mounting hardware as required.
- c. Light Quality.
- 1) Over the entire range of available drive currents, driver shall provide step-free, continuous dimming. Driver shall respond similarly when raising.
 - a) The luminaire shall be capable of continuous dimming over a range as specified on the Lighting Equipment Schedule.
 - (1) Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
 - 2) Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels.
 - 3) Drivers to track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.
 - 4) Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 PCT luminaire shall have:
 - a) LED dimming driver shall provide continuous step-free, flicker-free dimming similar to incandescent source.
 - b) Flicker index shall be less than 5 PCT at all frequencies below 800 Hz.
- d. Control Input.
- 1) 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers.
 - a) Must meet IEC 60929 Annex E for General White Lighting LED drivers.
 - b) Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
 - c) Must meet ESTA E1.3 for RGBW LED drivers.
 - d) Driver shall utilize fully isolated 0-10V control inputs. 0-10V input shall be protected from line voltage miswire, and shall be immune and output-unresponsive to induced AC voltage on the control leads.
3. LED emergency back-up driver:
- a. Confirm compatibility with LED lamps utilized.
 - b. Backup driver shall consist of a high temperature, maintenance-free nickel cadmium battery, charger and electronic circuitry.
 - c. A solid state charging indicator light to monitor the charger and battery, a single-pole test switch, and installation hardware shall be provided.
 - d. UL component listed.

- e. The following product family shall be selected based on coordination with LED lamp type:
 - 1) Bodine BSL23C: can operate up to 4.5W at 410mA.
 - 2) Bodine BSL26C: can operate up to 5.1W at 265mA.
 - 3) Bodine BSL722: can operate up to 23W at 770mA.
 - f. Bodine BSL23C: can operate up to 23W at 770mA in operating conditions ranging from -4 DEGF to 140 DEGF.
- D. Emergency Battery Wall Pack Luminaires:
- 1. Transfer Circuit:
 - a. Automatically energize lamps upon failure of normal source; de-energize lamps and activate high-rate charge upon restoration of normal source.
 - 2. Battery Charger:
 - a. Automatic two-rate or acceptable solid-state pulse type capable of replacing maximum charge taken out in 1-1/2 HR emergency discharge period within 12 HRS; manual two-rate charger will not be accepted.
 - 3. Provide visual signal to indicate state of charge.
 - 4. Provide integrally mounted, adjustable emergency lights and status lights.
 - 5. Provide luminaire with self-diagnostics and self-testing.
 - 6. Where shown or specified provide remote sealed beam adjustable lights.
 - 7. Provide white UV stabilized thermoplastic housing in finished areas.
 - 8. Acceptable Manufacturers:
 - a. Dual-Lite.
 - b. EmergiLite.
 - c. Lithonia.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate luminaire mounting and trim type with architectural reflected ceiling plans, suspended ceiling grid and ceiling tile specification, and room finish schedules prior to submission of shop drawings.
 - 1. Advise Architect of any discrepancies.
- B. Coordinate required above-ceiling clearances of recessed luminaires with ductwork and piping.
 - 1. In exposed ceiling areas, coordinate luminaire locations, mounting heights, and supports with other trades.
- C. Coordinate, review and approve fixture locations shown on acoustical ceiling shop drawings prior to submission.
 - 1. Notify Architect of any discrepancies with lighting plans and review coordinated ceiling shop drawing review comments.
- D. Coordinate lighting control devices with fixture ballasts and drivers. Advise Architect of discrepancies prior to submission of shop drawings.

3.2 INSTALLATION

- A. Strictly follow the manufacturer's directions for installation of all lighting equipment. Luminaire installation shall include suitable lamps and required equipment, materials, parts, attachments, devices, hardware, cables, supports, frames and brackets necessary for complete and fully operating installation.
- B. Locate luminaires in accordance with architectural reflected ceiling plans.
 - 1. Where field conflicts exist, coordinate relocation of equipment with Architect.
- C. Mount luminaires at heights indicated in Section 26 00 10 and as indicated on drawings. Where field conflicts exist, or mounting height is not stated, coordinate with Architect.

- D. Verify structural support is adequate to ensure luminaires are supported to maintain level and alignment.
- E. Design support system for custom products and lowering devices by licensed structural engineer based on fixture being installed.
 - 1. Submit installation instructions and details for information only as part of fixture shop drawing review process.
- F. Ground luminaires per NEC Article 410.
- G. Provide exit sign at exit locations, with mounting type, number of single or double faces, and directional arrows (chevrons) as required for exiting.
 - 1. Where exit signs are pendant mounted, provide manufacturers pendant mount stem kit.
 - 2. Do not mount sign housing to junction box suspended by conduit.
- H. Orient horizontally positioned fluorescent lamps or LED circuit boards of luminaires within a single room in same direction unless indicated otherwise.
- I. Seal luminaires for wet locations (i.e. knock-outs, pipe and wire entrances) to prevent water wicking.
- J. Luminaire finishes which are disturbed in any way during construction shall be touched up or refinished in a manner satisfactory to the Architect and which does not void warranty.
- K. Install reflector cones, louvers, baffles, lenses, trims and other decorative elements after completion of ceiling tile installation, plastering, painting and general cleanup.
- L. Recessed Luminaires:
 - 1. Verify mounting details for each space; provide correct luminaire flange mounting accessories for each condition.
 - 2. Coordinate to ascertain luminaires are furnished in sizes, with flange details, and installed with the devices (hangers, clips, trim frames, flanges), to match ceiling system being installed.
 - 3. Acoustical Tile Ceilings:
 - a. Fasten luminaires supported by suspended ceiling systems to ceiling framing system with hold-down clips and to building structure with two No. 12 GA steel hanger wires connected to opposite corners of the luminaire.
 - 1) Each hanger shall have the capacity of 100 PCT of luminaire weight acting in any direction.
 - 2) Locate luminaires in exact center of tile unless indicated otherwise. Relocate misplaced luminaires and replace damaged ceiling materials.
 - b. Support downlights and exit signs with rails spanning between runners of suspension system.
 - 4. Gypsum Wallboard Ceilings:
 - a. Support troffers in gypsum board ceilings from structural framed openings with adjustable lugs on side of luminaire or yoke mounting as recommended by luminaire manufacturer.
 - 1) Where structural framed openings are not provided, fixtures must be independently supported from structure.
 - 2) Suspended grid systems for gypsum board ceilings are not approved structural support systems for luminaires.
 - b. Support downlights and troffers in metal pan and gypsum board ceilings from plaster frames.
 - c. Provide access panels for recessed luminaires that require access for maintenance when such access is not provided for in design of luminaire.
 - 1) See Section 26 00 10.
 - d. Coordinate trimless or flangeless luminaires with other trades to achieve a trimless/flangeless installation.
 - 1) Provide a level 5 finish at drywall or plaster ceilings/walls unless otherwise directed by Architect.

5. Support luminaires weighing 56 LBS or more directly from structure with approved hangers.
 6. Use unwired or pre-wired luminaires as required.
 - a. Do not use pre-wired luminaires for through-wiring unless UL approved for the purpose.
 7. Wherever recessed luminaires are installed in insulated ceiling systems, it is responsibility of the Contractor to construct above-ceiling enclosures around non-insulation-contact-rated equipment to provide at least 3 IN or airspace on each side of the luminaire.
 8. Trims shall fit plumb and flush with ceiling or wall surface.
 9. There shall be no light leak around interface between lens door or holder trim flanges and ceiling or wall.
- M. Surface Mounted and Pendant-Hung Luminaires:
1. Attach surface mounted lighting luminaires to ceiling system with positive clamping devices that completely surround supporting members.
 - a. Attach safety wires between clamping device and adjacent ceiling hanger or to structure above.
 - b. Do not exceed design carrying capacity of supporting member for luminaire load.
 2. Support pendant hung lighting luminaires directly from structure above, using 9 GA steel wire, without relying on ceiling suspension system for support.
 3. Pierce ceiling material for hangers and outlet boxes as required.
 4. Do not remove ceiling material above surface mounted luminaires.
 5. Hang luminaires plumb with continuous rows in alignment.
 6. Unless otherwise noted, suspend luminaires in each room or area at same height regardless of varying clear height conditions.
 - a. Provide stem lengths as required.
 7. Cord of pendant fixtures must enter directly into approved wiring box without passing through plenum, in accordance with NEC.
 8. Provide suspended luminaires with flexible cord.
 - a. Flexible cord shall connect to a junction box located directly above luminaire feed point.
 - b. Flexible metal conduit and luminaire whips are not allowed for suspended luminaires.
 - c. Trim cords to length, and attach to suspension cable at regular intervals.
 - d. Do not coil flexible connections.
 9. Surface or pendant luminaires mounted end to end shall have flat end caps to assure flush alignment and shall be UL listed for through wiring.
 10. In exposed ceiling areas, install ballasts/drivers and auxiliary equipment non-integral to luminaire in accessible, permanently installed NEMA-rated metal cabinets or housings. Field paint exposed cabinets or housings to match adjacent surfaces.
 11. Provide pendant cylinder luminaires with swivel hangers which allow luminaire to swing in any direction but not permit stem to rotate.
 12. In mechanical, electrical and storage spaces, pendant mounted, open industrial luminaires, not in continuous rows, shall be supported by conduit or metal channel, similar to Unistrut, and All Thread.
 - a. Pendant mounted luminaires in continuous rows shall be fastened to each other or mounted on continuous metal channel.
 - b. Provide reflector alignment clips on industrial luminaires mounted in continuous rows.
 13. Contractor shall provide and/or coordinate additional bracing in wall or above ceiling as required to support fixture in accordance with manufacturer's recommendations.
- N. Continuous Luminaire Patterns:
1. Fasten sections together for continuously aligned appearance, with no dimpling or light leakage.
 - a. Provide end extensions where required.
 2. Where luminaires run continuously around inside or outside corners, provide prefabricated illuminated corner pieces.
 - a. Run luminaire lenses, baffles or louvers continuously with luminaire.

- b. Miter and/or fan at corners as directed.
- 3. Where lenses are used, open gaps shall not be visible.
 - a. Solid-state luminaires shall utilize mitered or rabbited lenses to prevent direct view of modules.
 - b. Maximum visible gap between the edge of lens and the end of luminaire trim is 1/16 IN, and not allow direct view of solid state modules.
- 4. Only where continuous runs do not end at a wall or fascia, provide a finished end plate, with no visible holes and concealed fasteners.
- 5. Provide a continuous light appearance over total length of assembly.
 - a. The luminaire shall run continuously wall to wall or wall to corner without a gap at either end of the fixture when located adjacent to a wall or corner. The maximum permitted non-illuminated length at either end shall not exceed 6 IN.
 - b. For fluorescent fixtures, utilize 3 FT and 4 FT linear lamps wherever possible.
 - 1) Where required, provide a 2 FT lamp in spaces less than 3 FT in length.
 - c. For continuous direct fluorescent fixtures, overlap sockets to prevent socket shadows.
- 6. Cove luminaires in architectural coves shall be installed continuously with no gaps between luminaires.
- 7. Coordinate installation and requirements of undercabinet luminaires with casework installation.
 - a. Provide separate segments of luminaires if luminaires cannot run continuously beneath cabinet.
 - b. Conceal wiring and conduit to luminaires.
- O. Emergency Battery Wall Pack Fixtures:
 - 1. Connect conduit directly to units; do not use plug-in connection.
 - 2. Mount lights on each unit, number as shown.
 - a. Mount each remote light on an outlet box cover plate, and splice wiring in box.
 - b. Feed remote lights from batteries with wire sized in accordance with manufacturer's recommendations for voltage drop and ampacity.
 - c. Aim at night, with no stray light from other sources, to maximize light along egress route.
 - 3. Test and verify operation prior to Owner occupancy.

3.3 COMMISSIONING

- A. Coordinate lighting operations, including support from Luminaire and Controls Manufacturers, with commissioning and controls.
- B. Synchronize fully functional lighting and lighting controls systems to address lighting operation in complete and code compliant manner.
- C. Provide documentation related to commissioning, including record drawings identifying luminaire control loops and addresses with respect to specific luminaire types and Initial Preset Schedule Spreadsheet.

3.4 ADJUSTING, RELAMPING AND CLEANING

- A. Perform final focusing of adjustable luminaires in presence of Owner's Representative, including times outside regular working hours. Furnish ladders scaffolding and rigging, as required, for focusing and adjustment of luminaires.
- B. Replace inoperable luminaires prior to final acceptance.
- C. Replace noisy and malfunctioning ballasts prior to final acceptance.
- D. Replace lamps and/or ballasts where necessary to eliminate strobing.
- E. Align luminaires and remove paint splatters, dirt and debris.
- F. Touch up any visible damages to luminaire finish.
- G. Wipe clean luminaire reflectors, lenses, lamps and trims, after installation.

- H. Install luminaires with caution to avoid fingerprints or smudges on surfaces of parabolic louvers and downlight reflectors.
 - 1. Use cleaning materials and methods that will not damage finish.
 - 2. Where fingerprints or smudges cannot be adequately removed, replace affected luminaire.
- I. Install architectural cove luminaires after cove has been painted.
 - 1. Vacuum construction debris from cove to ensure a dust-free reflector surface prior to date of Substantial Completion.

3.5 SPECIAL PROTECTION

- A. Remove protective covers immediately prior to date of Substantial Completion.

3.6 FIELD MODIFICATIONS STOCK

- A. To facilitate the addition of extra exit signs due to unforeseen deficiencies in satisfying life safety egress requirements, provide the following:
 - 1. Minimum of 5 PCT of each exit sign type.

3.7 REPLACEMENT STOCK

- A. Provide Owner's initial lamp replacement stock.
- B. Provide Owner LED boards or modules to replace the LEDs in 2 PCT of luminaires, but no fewer than 5 and no more than 30 of luminaire types using identical LED's. For luminaires that are longer than 8 FT in length. Modules to replace one 8 FT length shall be considered sufficient. If the exact same modules are used in multiple luminaire types, maximum quantity of modules/ boards to replace 30 luminaires of most type is sufficient cover all types.
 - 1. If LED's are irreplaceable and an inherent integral part of luminaire, no spares will be required unless otherwise indicated in Lighting Equipment Schedule.
- C. Provide Owner 2 PCT of each ballast/ driver/transformer type but not less than 5 or more than 30 of any one type.
 - 1. Match ballasts exactly with types specified and provided for installed luminaires.
- D. Warranty replacements are not be taken from replacement stock.

END OF SECTION

SECTION 26 56 00
SITE LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Exterior Lighting, as indicated, in accordance with provisions of Contract Documents.
- B. Section includes exterior luminaires and accessories, lamps, ballasts and drivers, poles, concrete bases and accessories, and grounding.
- C. See Section 26 51 13 for exterior building-mounted luminaires and accessories.

1.2 QUALITY ASSURANCE

- A. Luminaires shall be listed with nationally recognized testing laboratory, including but not limited to UL, CSA, ETL, under UL 1598 and UL 8750, or an equivalent standard from a recognized testing laboratory.
- B. Lamps and ballasts shall comply with U.S. Federal Efficiency laws.
- C. Materials and installations shall be in accordance with the latest revision of the National Electrical Code and any applicable Federal, State and local codes and regulations.
- D. Luminaires shall comply with current ANSI, CBM, ESTA, FCC, IEC, IEEE, IESNA, NEMA, NFPA, and UL standards and practices.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Details of special construction, accessories, and/or finishes.
- B. Product Data:
 - 1. Lighting:
 - a. Identify luminaires by Lighting Equipment Schedule designation. For each luminaire, provide the following:
 - 1) Name of manufacturer, cutsheet, catalog number and photometric data. Photometric data submitted shall be collected by an independent testing laboratory. Indicate optical performance developed using methods of the Illuminating Engineering Society of North America (IESNA) as follows:
 - a) Candlepower data presented graphically and numerically, in 10 degree (or smaller) increments. Develop data for up and down quadrants normal, parallel, and at 45 degree to lamp if light output is asymmetric.
 - b) Zonal lumens stated numerically in 10 degree increments as above.
 - 2) Lamp catalog cutsheet clearly indicating manufacturer, lamp selection, lamp length, lamp wattage, lumen output, color temperature, Color Rendering Index (CRI), lamp life, base configuration, and where applicable, Toxicity Characteristic Leaching Procedure (TCLP) compliance and beam angle.
 - 3) Solid-State Luminaires
 - a) LED luminaire:
 - (1) Total input wattage.
 - (2) Luminaire voltage.
 - (3) Delivered lumens.
 - (4) Color temperature, color rendering index (CRI), and individual R-values, measured in accordance with IESNA standards.
 - (5) Rated life, measured in accordance with IESNA standards.
 - (6) Total harmonic distortion (THD).

- (7) Submit in tabular format the characteristics of submitted fixture per the technical information categories of the Lighting Equipment Schedule. Deviations from specified criteria shall be identified by a +/- percentage.
 - (8) Submit the rated lumen maintenance life of LED luminaires. Life shall be reported based upon the light source's L70 rating.
- b) LED Drivers:
- (1) Driver manufacturer and model number.
 - (2) Driver rated life.
 - (3) Driver dimensions.
 - (4) Driver type (0-10V, constant voltage, constant current).
 - (5) If applicable, include lumen management protocols.
 - (6) Dimming range and control device compatibility list.
 - (7) Wiring Diagrams – as needed for special operation or interaction with other system(s).
- 4) Coordinate ballasts/drivers used with lamping/LED modules, lamp sockets, and control devices prior to submitting shop drawings.
 - 5) Upon request, provide calculations performed in AGi32 IN specific areas as identified by Lighting Designer for submitted optional manufacturers or substitutions.
- C. Project Information:
- 1. Manufacturer's installation instructions.
- D. Contract Closeout Information:
- 1. Warrant electronic fluorescent ballasts, HID ballasts, low voltage transformers, and/or LED drivers for five years from Date of Substantial Completion. Include labor allowance for full cost of ballast installation.
 - 2. Warrant the luminaire and all of its components (except the ballast/transformer/driver) to be free from defect in operation or finish for one year from the date of Date of Substantial Completion. As long as the luminaire has been operated within the rated voltage range, the Contractor is responsible for the cost of the materials and labor necessary to repair or replace the luminaire.
 - 3. It is the responsibility of the contractor to manage all warranty issues that may arise.
- E. Review of shop drawings and product data does not waive the Contractor of their obligations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Luminaires and Poles:
- 1. Base:
 - a. As indicated on Lighting Equipment Schedule.
 - 2. Optional:
 - a. As indicated on Lighting Equipment Schedule.
 - 3. Use catalog numbers listed as a guide only. Follow modifications and other requirements shown or specified.
- B. Drivers:
- 1. Osram Sylvania.
 - 2. Philips Advance.
 - 3. Mean Well.
 - 4. eldoLED.
 - 5. Hatch.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Luminaires:
 - 1. Resistant to corrosion and thermal and mechanical stresses encountered in normal application.
 - 2. Provide accessory equipment such as starters, sockets and lampholders, approved by UL and ETL, unless otherwise noted.
 - 3. Enclosures:
 - a. Complete with closed cell neoprene gaskets to form weatherproof assembly.
 - 4. Castings:
 - a. Uniform quality, free of imperfections affecting strength and appearance.
 - b. Exterior surfaces not receiving a finish coating shall be smooth and shall match adjacent surfaces.
 - c. Apply at least one coat of clear methacrylate lacquer unless a painted finish is specified.
 - 5. Housing:
 - a. Weatherproof; hinged and gasketed access door with catch; slip-fitter with set screws.
 - 6. Hardware:
 - a. Stainless steel or hot dip galvanized steel, except as noted otherwise.
- B. Poles and Accessories:
 - 1. Metal Poles:
 - a. Round, seamless aluminum continuously welded to base; with 2 IN x 4 IN grounding stud in shoe-base model.
 - 2. Shoe Base:
 - a. Bolt covers with tamper-proof stainless steel hardware.
 - 3. Assembly:
 - a. Designed to withstand wind loading of 100 MPH, with luminaires and brackets mounted.
 - 4. Anchor Bolts:
 - a. As recommended by pole manufacturer.
 - b. Provide anchor bolt templates, flat washers, lock washers, leveling shims and hex nuts.
 - 5. Metal Pole Finish:
 - a. As specified on schedule.
 - 6. Fuse Holders:
 - a. In-line waterproof fuse holder rated at 30 A, 600V, Bussman Limitron type, size rating 3-times load current.
 - 7. Ground Rods:
 - a. Copper.
 - 8. Circuit Identification:
 - a. Provide 3 IN x 1 IN aluminum tag riveted to pole identifying building name, electrical distribution panel name, and circuit number.
- C. LEDs:
 - 1. Color temperature specified shall be uniform for all LED modules within like luminaire types. Color temperature measurement shall have a maximum 3 SDCM on the MacAdam Ellipse.
 - 2. Minimum color rendering index (CRI) of 80.
 - 3. LED light output and efficacy shall be measured in accordance with IES LM-79 standards.
 - 4. LED life and lumen maintenance shall be measured in accordance with IES LM-80 standards.
 - a. Rated minimum L70 life of 50,000 HRS.
 - 5. Individual LED's shall be connected such that catastrophic loss or the failure of one LED will not result in light output loss of entire luminaire.
- D. Ballasts and Drivers:
 - 1. LED Drivers.
 - a. Driver shall operate from 60 Hz input source of 120V through 277V with sustained variations of +/- 10 PCT (voltage and frequency).

- b. Driver output shall be regulated to +/- 50 PCT across published load range.
 - c. Driver input current shall have Total Harmonic Distortion (THD) of less than 20 PCT when operated at nominal line voltage.
 - d. Driver shall have a Power Factor greater than 0.90.
 - e. Driver shall have a Class A sound rating.
 - f. Driver shall have a minimum operating temperature of -40 DEGC (-40 DEGF).
 - g. Driver shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.
 - h. Driver output ripple current shall be less than 15 PCT measured peak-to-average, with ripple frequency greater than 100 Hz.
 - i. Driver shall have integral common mode and differential mode surge protection of 3 kV.
 - j. Driver shall have integral thermal foldback to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.
 - k. Driver shall comply with NEMA 410 for in-rush current limits.
 - l. Driver shall incorporate an integral means of limiting surges to the LED's.
 - m. Driver shall not contain any Polychlorinated Biphenyls (PCB's).
 - n. Driver shall be Underwriter's Laboratories (UL) recognized Class 2 per UL 1310 or non-class 2 per UL 1012, as applicable.
 - o. Driver shall comply with ANSI C62.41 Category A for Transient protection.
 - p. Driver shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
 - q. The luminaire shall be capable of continuous dimming over a range of 100 PCT to 5 PCT of rated lumen output. Dimming shall be controlled by a 0-10VDC signal.
 - r. Control device must be compatible with type of driver, and coordinated prior to submission of shop drawings.
 - s. If driver is remote-mounted, provide maximum allowable distances for secondary wire runs to luminaires.
 - t. Driver shall be provided with integral color-coded leads.
 - u. Driver shall be available in an all metal-can construction for optimal heat performance.
 - v. Provide with mounting hardware as required.
2. Coordinate ballasts used with lamping, lamp sockets, and control devices prior to submitting shop drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's directions for lighting equipment.
 - 1. Assemble and wire luminaires, with lamps, in such a manner to ensure correct operation.
- B. Pole Luminaires:
 - 1. Provide complete assembly consisting of luminaire, pole and concrete base.
 - 2. Install rigid steel conduit elbow in concrete base to lead wiring into pole base. Splice wires in base of pole, and train leads up pole to luminaire. Provide encapsulated splice kits for wiring in handholes, manholes and underground junction boxes.
 - 3. Follow Section 26 05 05 for installation and coordination of concrete base and anchor bolts. Set poles plumb and secure. Face access door away from traffic. Install ground rod adjacent to pole base.
 - 4. Install a fuse holder in each phase conductor feeding outdoor pole mounted lighting fixtures. Locate fuse holders in handholes of poles if applicable. Provide fuse holders to isolate overhead fixtures from total circuit if trouble should occur.
 - 5. Install an in-line surge protector in pole-mounted luminaires without a 10 kA Maximum Peak Current Rating.
 - a. Clamping voltage: 320V.
 - b. Maximum energy: 430 Joules.

- c. Maximum peak current: 10 kA (8/20 us standard wave).
 - d. Thermal protection: thermally protected transient over-voltage circuit.
- C. Install marking tape over each buried conduit.
- 1. See Section 26 05 33.

3.2 RELAMPING AND CLEANING

- A. Replace inoperable lamps with new lamps prior to date of Substantial Completion.
- B. Replace noisy and malfunctioning ballasts/drivers prior to date of Substantial Completion.
- C. Remove paint splatters, dirt and debris.
 - 1. Touch up any visible damages to luminaire finish.
- D. Wipe clean luminaire reflectors, lenses, lamps and trims, after installation.
 - 1. Use cleaning materials and methods that will not damage finish.

3.3 SPECIAL PROTECTION

- A. Retain protective covers throughout construction period, and remove immediately prior to date of Substantial Completion.

3.4 REPLACEMENT STOCK

- A. Provide Owner 5 PCT of each lamp type but not fewer than 10 or more than 60 of any one type.
- B. Provide Owner 2 PCT of each ballast/ driver/transformer type but not fewer than 5 or more than 30 of any one type.
- C. Warranty replacements are not be taken from this stock.

END OF SECTION



DIVISION 27

COMMUNICATIONS



SECTION 27 05 32
WIRED TELECOMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of Drawings, General and Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

- A. This section defines the requirements of a complete structured cabling system network, which provides for voice and data transmission infrastructure throughout the facility.
- B. Related Sections:
1. Division 26
 2. Division 28

1.3 REFERENCES AND COMPLIANCES TO THE LATEST EDITIONS, AS RELATED

- A. Design, manufacture, test, and install telecommunications cabling networks per manufacture's requirements and in accordance with NFPA-70 (National Electrical Code), state codes, local codes, requirements of authorities having jurisdiction and particularly the following standards:
1. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises
 2. ANSI/TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard
 3. ANSI/TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 4. ANSI/TIA-568-C.3 - Optical Fiber Cabling Components Standard
 5. ANSI-J-STD-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 6. ANSI/TIA/EIA-606(A) The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 7. ANSI/TIA/EIA-526-14A -- Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant
 8. BICSI® Telecommunications Distributions Methods Manual, latest edition.
 9. ISO/IEC 11801 Generic Cabling for Customer Premises.
 10. National Electrical Code (NEC).
 11. IEEE C2-2002 National Electrical Safety Code (NESC®) current edition.
 12. FCC Part 68 Code of Federal Regulations, Title 47, Telecommunications.
 13. UL 1459 Underwriters Laboratories Standard for Safety—Telephone Equipment.
 14. UL 1863 Underwriters Laboratories Standard for Safety—Communication Circuit Accessories.
 15. National Fire Protection Agency (NFPA).
 16. American National Standards Institute (ANSI).
 17. Telecommunications Industry Association (TIA).
 18. Electronic Industries Alliance (EIA).
 19. National Electrical Safety Code (NESC).

1.4 SYSTEM DESCRIPTION

- A. Provide a fully functional communications infrastructure, which includes:
1. Build-out of all telecommunications areas, entrance facility, building distribution, floor distribution and data/telecommunication outlets meeting the requirements of ANSI/TIA+/EIA.

2. Adherence to the design guidelines for installation of cabling in pathways and spaces as defined by ANSI/TIA/EIA 569
3. All material, labor, tool, apparatus and equipment to furnish completely working telecommunication cabling system.
4. Horizontal cables, backbone cables, cross connects, patch cords and data/telecommunication outlets.
5. Complete grounding of all systems components and cabinets to the telecommunications main grounding busbar in compliance with ANSI/TIA/EIA 607.
6. Cable identification tags and system labeling shall match owners existing system.
7. Coordination of the entire installation with all other divisions.

1.5 SUBMITTALS

- A. Submit data consisting of shop drawings, wiring diagram, riser diagram, and original color catalog cuts complete with technical data necessary to evaluate the material and equipment.
 1. Submit dimensions, wiring and block diagrams, performance data, ratings, operational characteristics, and other descriptive data to describe the items proposed.
 2. Bill of materials, noting long lead time items.
 3. Optical loss budget calculations for each optical fiber run.
 4. Project schedule including all major work components that materially affect any other work on the project.
- B. Pre-Construction Meeting
 1. The contractor must schedule a pre-construction meeting with the Architects representative and the Denton County Department of Technology Services to review and coordinate the communications room build out, cabling installation, and labeling scheme.
- C. Electrical Contractor shall provide a submittal that shows the proposed means and methods for the installation of the conduit and back box for device locations for approval by owner prior to the start of any rough-in.

1.6 QUALITY ASSURANCE

- A. Contractor Qualifications: Company specializing in installation of structured data/telecom cabling systems networks for a minimum of five years. Experience shall include the following:
 1. List at least 10 facilities of equal size and technical requirements utilizing the equipment submitted.
 2. For each facility, list:
 - a. Name and location of facility
 - b. Date of occupancy by Owner
 - c. Owner's representative to contact and telephone number
 - d. Construction Manager or General Contractor
 - e. Architect
 3. Material and equipment shall be new, and conform to grade, quality, and standards specified. Equipment and materials of the same type shall be a product of the same manufacturer throughout
 4. The successful cabling contractor must meet the following two requirements:
 - a. Must be an authorized CommScope Netconnect Design Installer prior to bidding and maintain current status with the warranting manufacturer CommScope Netconnect, including all training requirements, for the duration of the Cable Infrastructure Project. The contractor shall staff each installation crew with the appropriate number of trained personnel, in accordance with their manufacturer/warranty contract agreement, to support the CommScope Netconnect 25-Year System Performance Warranty requirements. Prior to installing any cable on the site, the contractor must submit copies of the training certificates or certification cards for the installation crew to the Denton County Project Manager. After installation, the Contractor shall submit all documentation to support the warranty in accordance with the manufacturer's warranty requirements, and to apply for said warranty on behalf of Denton County. The system

warranty shall cover the components and labor associated with the repair/replacement of any failed link as a result of a defective product when a valid warranty claim is submitted within the warranty period.

- b. Must have a BICSI® certified RCDD review the drawings and meet with Denton County representatives to discuss the project and to ensure that a structured cabling system is installed that provides a comprehensive telecommunications infrastructure..
5. Equipment and materials of the type for which there are independent standard testing requirements, listings, and labels, shall be listed and labeled by the independent testing laboratory.
6. A complete technical specification for the submitted equipment, noting differences and adherence to this Section. Subcontractors shall assume all rights and obligations toward the contractor that the contractor assumes toward the owner and engineer/designer.

1.7 WARRANTY

- A. Contractor shall provide a certified CommScope Netconnect Cabling System with a minimum of 25-year warranty from the date of acceptance by the owner. The owner shall deem acceptance as beneficial use.
- B. Installation personnel shall meet manufacturer's training and education requirements for implementation of extended warranty program.
- C. Contractor shall agree to repair or replace defective components/materials and correct defective work when given notice by Owner during the warranty period.
- D. Damage caused to completed work done by others shall be replaced or repaired by the contractor.
- E. Effect replacement or substitutions of equipment within 12 hours upon receipt of warranty request from Owner during normal working hours.

1.8 EXTRA MATERIALS

- A. Provide the following Patch cables:
 1. 5 foot Black Category 6 patch cable – 9% of total number of Category 6 cables installed.
 2. 6 foot Black Category 6 patch cable – 49% of total number of Category 6 cables installed.
 3. 10 foot Black Category 6 patch cable – 25% of total number of Category 6 cables installed.
 4. 15 foot Black Category 6 patch cable – 5% of total number of Category 6 cables installed.
 5. 20 foot Black Category 6 patch cable – 5% of total number of Category 6 cables installed.
 6. 25 foot Black Category 6 patch cable – 5% of total number of Category 6 cables installed.
 7. 30 foot Black Category 6 patch cable – 2% of total number of Category 6 cables installed.

PART 2 - PRODUCTS

2.1 TRANSMISSION MEDIA

- A. Copper Cable
 1. Horizontal Cabling-Unshielded Twisted Pair (UTP):
 - a. Every cable run shall be a continuous single cable, homogenous in nature. Splices are not permitted anywhere.
 - b. The electrical performance of the overall cable shall comply with ANSI/TIA/EIA 568 requirements for category 6.
 - c. All horizontal and backbone cables shall be #24 AWG thermoplastic insulated solid conductors that are formed into four individually twisted-pairs and encased by a thermoplastic jacket.
 - d. All patch cables shall be #24 AWG stranded and factory pre-terminated.
 - e. CAT6 cables must be terminated with the SL termination tool.
 - f. All cables shall have appropriate rating: plenum and riser for their environment.

- g. All horizontal and backbone cables shall be installed with expansion capabilities to accommodate 25 percent future growth.

B. Fiber Optic Cable

1. Data Backbone Cabling Fiber Optics:
 - a. Fiber optic color-coding shall conform to the ANSI/TIA/EIA 598-A standard.
2. Provide 12 strand single mode and 12 strand XG multimode armored fiber cable data backbone between Low Voltage Room #L-112 and existing Security Electronics Room 2006, located within the existing Jail Expansion. Cabling between Low Voltage Room and existing Security Electronics Room shall be terminated within the rooms and be utilized specifically for Security System Network, separate from the Administrative Network. The fiber cabling should be terminated with LC connectors. LC connectors shall be epoxy polish.
3. A 6 port MRJ-21 panel shall be installed in existing Security Electronics Room 2006 and Low Voltage Room #L-112. These panels will be connected together with a 6 port cable, providing a 6 port backbone path between the two equipment rooms.

C. Copper Backbone Cable

1. A 25 pair copper cable terminated on 110 blocks on the wall (within Low Voltage Room #L-112) shall be installed between existing Security Electronics Room 2006 and Low Voltage Room #L-112
2. There shall be one 48 port CommScope Netconnect voice panels in Low Voltage Room #L-112 connected to a 110 block on the wall for voice service. The 25 pair cable will connect to the CommScope Netconnect voice panel using a CHAMP connector. This will be used to get voice service from the wall into the racks.

2.2 HARDWARE

A. Termination Blocks

1. All termination blocks shall be suitable for installation within a telecommunication facility for the termination of category 6 UTP cables.
2. The termination blocks shall meet or exceed category 6 specifications for termination blocks as defined by ANSI/TIA/EIA 568 B.2
3. All copper termination blocks and connectors shall be IDC (Insulation Displacement Connection) type.
4. Provide and install IDC-blocks sufficient to terminate all cables and 25 percent spare. Provide stand-off brackets
5. The termination blocks shall be capable of supporting, organizing, labeling and patching/cross connecting the station cables.
6. Termination blocks shall be rack mountable to a 19 IN equipment rack.

B. Patch Panels

1. The patch panels in the rack shall be 48 port and use black angled CommScope Netconnect Category 6 SL Series for all terminations. Denton County Department of Technology Services must review and approve layout prior to termination of cables. Reference Appendix "A".
2. Patch panels shall have IDC-type termination for station cables and have RJ-45 ports. Each port shall be a category 6, 8-pin, 8-conductor modular jack employing T568B wiring protocol. All patch panel ports shall be populated with an insert that contains a bend-limiting strain relief.
3. Patch panels shall be capable of supporting, organizing, labeling and patching between station termination field and the equipment.
4. Patch panels shall be 19 IN rack mounted horizontally.
5. Cable support bars shall be installed behind each patch panel to provide additional cable support and cable routing control.

- C. Fiber Optics Patch Panels
 - 1. Patch panels shall have 6 multi-mode duplex LC adapters, expandable to at least 24 duplex LC adapters. (Reference Appendix A)
 - 2. Provide Single mode Patch panels, which shall have 6 single-mode duplex LC adapters, expandable to at least 24 duplex LC adapters.
 - 3. Patch panels shall be rack mountable , capable of accepting 8 adapter panels, and provide a splice tray for protection of mechanical or fusion splices while maintaining minimum bend radius requirements.
- D. Category 6 Cabling
 - 1. Horizontal Category 6 cabling shall be 23 AWG, 4-pair UTP, UL/NEC CMP rated, with a white plenum-rated jacket for County Network cabling. Individual conductors shall be 100% virgin FEP insulated. Cable jacketing shall be lead-free. All cable shall meet or exceed all Category 6 / Class E requirements. Cable shall be supplied on wooden reels or in reel-in-box. Individual conductors shall be 100% virgin FEP insulated. Cable jacketing shall be lead-free. All cable shall meet or exceed all Category 6 / Class E requirements. Cable shall be supplied on wooden reels or in reel-in-box.
- E. Fiber Optic Cable and Termination Hardware
 - 1. Fiber optic backbone cabling shall consist of singlemode and 850 nm laser optimized 50/125 multimode XG OM3 optical fiber. CommScope Netconnect cable and components shall be used for all fiber backbone cabling. Industry standard LC Duplex connectors shall be housed in enclosures sized for the number of strands being terminated. Multimode fiber shall have an aqua outer jacket. Singlemode backbone fiber shall have a yellow outer jacket. Backbone fiber shall be contained in a flex-armor jacket and Plenum or riser rated as defined by the building specifications. The network backbone cabling shall be installed between existing Security Electronics Room 2006 and Low Voltage Room #L-112 unless otherwise specified.
- F. Copper Backbone Cabling
 - 1. Install 1– 25 pair cable in low voltage equipment room between the rack and the wall. Terminate on 110 block with wire management on the wall and a Champ connector on one 48 port CommScope Netconnect voice patch panels in the rack.
- G. Modular Jacks - All modular jacks shall contain a dust cover and be un-keyed, unshielded, 4-pair, RJ-45, and shall fit in a .790 inch x .582 inch opening. Modular jacks shall terminate using 110- style pc board connectors, color-coded for both the T568A and T568B wiring scheme. Each modular jack shall be wired using the T568B wiring scheme. The 110-style insulation displacement connectors shall be capable of terminating 22-24 AWG solid or 24 AWG stranded conductors. The insulation displacement contacts shall be paired with additional space between pairs to improve crosstalk performance. Modular jacks shall utilize a secondary PC board separate from the signal path for crosstalk compensation.
 - 1. Each modular jack shall meet the Category 6 performance standards and requirements.
 - 2. Modular jacks shall be compatible with the CommScope Netconnect SL Series Modular Jack Termination Tool. Each modular jack shall be provided with a bend-limiting strain relief. The strain relief shall provide cylindrical support to limit the bend radius at the point of termination.
 - 3. Faceplates shall be Semtron Stainless steel, 1FM-xxx-COMMSCOPE NETCONNECT series.
- H. Coax Cabling - Coax cabling shall be RG-6/U quad shield, UL/NEC CMP rated, with a blue plenum rated jacket. Coax cables shall be terminated on both ends with RG-6 compression F connectors.
- I. All hardware used for electronic enclosures, device outlets or solid cable trough lid shall be tamper resistant.

2.3 FIRESTOP

- A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, etc. shall be properly firestopped.
- C. The Contractor shall provide cable penetrations of fire rated walls.
- D. Penetrations shall be sleeved with a built-in fire stop system that automatically adjusts to the number of cables installed and in compliance with NEC and the local fire codes.
 - 1. Hilti Fire Stop CP 653 4 IN Speed Sleeve for pass through between floors.
 - 2. EZ Path Fire Rated Pathway for pass through between walls.
- E. Provide and install additional fire stop assemblies where necessary for cable routing if available pathways or conduit sleeves do not exist such as transition for cable tray systems.
- F. Provide and install the proper amount of firestop assemblies with a 40% fill ratio, a 35% growth factor and an overall 25% spare capacity.
- G. Any wall penetration shall not decrease the original fire rating of the wall.
- H. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system(s).

2.4 DATA/TELECOM OUTLETS

- A. Work areas or offices must have at least two communications outlets. Each communications outlet shall be sized to accommodate two or three Category 6 cables and connectors as designated on the project drawings. Each work area outlet shall consist of a double gang electrical box with a minimum depth of 2-1/2 inches and 1 inch knockouts. Each double gang box shall have a 1 inch conduit routed to the closest cable tray for routing of cables to the communications room, consolidating of individual 1 inch conduits into a larger homerun is acceptable. Maximum 40% fill must be maintained when consolidating homeruns. Work area outlets boxes shall not be daisy chained together. Communications outlets shall be within 3 feet of an electrical outlet and installed at the same height, unless otherwise specified. Communications outlets shall be placed so that the work area or workstation cable does not exceed 16 feet in length. This length is figured into the total horizontal cabling length and must not be exceeded. Floor boxes and poke-thru devices shall be submitted and approved by Denton County. Floor boxes, poke-thru devices, and covers shall be heavy duty in construction and easily accessible by users. They shall accommodate a complete line of connectivity outlets and modular inserts for UTP, STP, fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting.

Modular inserts shall snap directly into each flange through the use of a mounting bezel. Where electrical and data share the same floor box or poke-thru device, the floor box or poke-thru device shall be designed to simultaneously accommodate both electrical and data cabling without compromising the performance of the data cabling. Floor boxes and poke-thru devices shall not obstruct the floor area. In addition to the conduit for electrical, each floor box and poke-thru shall have a 1 inch conduit stubbed out above the ceiling. In addition to this 1 inch conduit, each floor box and poke-thru shall have an additional 1 inch conduit to a double gang box in the wall. The double gang box shall also have a 1 inch conduit stubbed out above the ceiling.

- B. Standard Office Outlets - Standard office communications outlets shall consist of one double gang Semtron stainless steel faceplate with security screws. Faceplates shall contain white Category 6 cables terminated on Category 6, 8-position, 8- conductor inserts. Inserts shall be white to match Cat-6 cable color. Faceplates shall be laser engraved/screened with outlet numbers located to the right of each port.
- C. Wall Phone Outlet - Standard wall phone outlets shall consist of one double gang single port Semtron stainless steel wall phone faceplate with security screws. Faceplates shall contain one white Category 6 cable terminated on a Category 6, 8-position, 8- conductor insert. Wall phone outlets shall be installed at the standard ADA wall phone height. Faceplates shall be laser engraved/screened with outlet numbers located to the right of each port.
- D. Wireless Access Point Outlets - Wireless access points (WAP) outlets shall be located above the ceiling and be spaced at intervals to form a grid over the area to be served by the wireless signal. Each WAP outlet shall consist of one white Category 6 cables terminated on a Category 6, 8-position, 8- conductor inserts (white inserts) mounted in an biscuit box mounted above the ceiling tile for suspended ceilings or placed in approved locations. The location of these outlets must be fully accessible and provide adequate space to install the WAP. WAP outlet locations must be indicated on the drawings.
- E. At the Security Electronics Equipment room, coax shall be terminated on the wall in the multimedia SL series patch panel using coax inserts.
- F. All faceplates in the Inmate/Secure areas shall be Semtron Stainless steel plates installed with security fasteners as specified in Division 11.
- G. Different types of outlets and corresponding locations are as indicated on drawings.
- H. Each 8-pin, 8-conductor modular insert shall have a Cat 6 4-pair UTP cable terminated according to T568B wiring protocol.
- I. Security Cameras Outlets - strategically locate an electrical enclosure to serve as a network data cabling hub between the devices being installed and the network data cabling horizontal backbone cabling infrastructure. The electrical enclosure shall be 8 IN X 8 IN X 4 IN for one to two devices or 16 In x 16 IN x 6 IN for two to four devices, and shall have a securable door with cabinet lock, or a cover plate held in place with security screws. A one-inch EMT conduit run shall be installed from the area equipment room to the enclosure. From the enclosure to the device, a 1/2 –inch flex seal tight conduit or a 3/4 -inch EMT conduit run shall be installed, depending on the type of conduit pathway needed for the particular device. Each device shall receive one Cat6 cable. The device endpoint of this network data cabling horizontal backbone cabling infrastructure cable shall be at the enclosure. The Cat6 cable shall have a Cat6 insert (RJ-45) terminated on the end and be placed into a two cable biscuit box. The specified length of cabling service loop shall be created and neatly dressed within the enclosure with the biscuit box. Pull string shall be installed and left in place in the one-inch EMT conduit runs that exist between the enclosures and the area equipment room. From the device being installed, either a 1/2 –inch flex seal tight conduit run or a 3/4 -inch EMT conduit run shall be installed between the device and the electrical enclosure. A Cat6 patch cable shall be installed in the conduit run that exists between the device and the enclosure and connected at the device and at the data cabling biscuit box located in the enclosure, with extra patch cabling slack properly dressed in the enclosure. Electrical quad boxes and “LB” 90-degree bend devices shall be installed as needed within the conduit pathways to establish pull points and assist with the cabling installation.
- J. Patch Panels and Wire Management:
 - 1. All horizontal cables shall be terminated on Category 6 angled patch panels in the telecommunications room. Patch panels shall provide 48 modular jack ports wired using the T568B wiring scheme and accept RJ-45, 8-Position modular plugs. Patch panels shall be configured as 6-port modules with individually replaceable jacks. The front of each module shall be capable of accepting CommScope Netconnect labels for patch panels. Each port shall be capable of accepting an icon to indicate its function. Patch panels shall terminate

the building cabling on 110-style insulation displacement connectors. Patch panels shall be supplied unloaded with jacks bagged separately, for terminating using the CommScope Netconnect SL Series Termination Tool. Each modular jack shall be provided with a bend-limiting strain relief. The strain relief shall provide cylindrical support to limit the bend radius at the point of termination. All patch panels shall meet or exceed all Category 6 performance requirements.

2. Each rack shall contain CPI horizontal, double sided, 2U wire management (p/n: 30530-719). 8 Foot, CPI vertical, double sided 6 IN wide, wire management (p/n: 30095-715) shall be installed on each end of the rack in Low Voltage Room #L-112.
- K. All racks, cabinets, ladder, and brackets shall be black in color.
- L. All racks, cabinets, and ladders are to be properly grounded to the grounding bar. Remove all paint on racks and/or ladders where grounding wires are attached.
- M. Provide end caps for all racks and ladder.
- N. All racks in equipment room shall be 8FT tall.
- O. All ladder racks shall be 12 IN wide.
- P. Ladder rack shall be installed within the equipment room as shown on the drawings and also mounted vertically on the walls above the ladder racks for access to incoming cabling.
- Q. Runway radius and e-bends shall be installed to accommodate the proper installation and bend radius of the cabling.
- R. Access doors, panels and frames: See Section 08 31 16:
1. Where not indicated on drawing, provide access panels and/or doors at walls, and inaccessible ceilings to permit access to equipment, devices and cabling electrical enclosures.

2.5 MANUFACTURERS

- A. Refer to Section Appendix "A" for acceptable manufacturers.

PART 3 - EXECUTION

3.1 GENERAL

- A. All work must conform to the latest editions of:
1. Manufacturer's specifications
 2. National Electrical Code
 3. National Electrical Safety Code
 4. ANSI/TIA/EIA
 5. All local codes and ordinances
- B. Contractors shall be a current and authorized CommScope Netconnect Design & Installation contractor at the time bids are due and conform to the specifications.
- C. Contractor shall supply the full names of the installers to be on site during cable installation and shall also supply copies of the installers' CommScope Netconnect Certification cards. CommScope Netconnect Certification cards must be carried by the installers at all times.
- D. Use methods and lubricating compounds on cables and wires to prevent damage to cables and wires during pulling-in. Provide compounds that are not injurious to the cable and wire jackets and do not harden or become adhesive.
- E. Conduit and wall penetration fill ratio shall not exceed 40% for conduits and penetrations with 3 or more cables.
- F. All CAT 6 network drops located above ceilings shall be grouped together and terminated adjacent to each other on the patch panels in the racks.

- G. A cable bundle organizing tool “honeycomb” shall be used to neatly organize and dress the cabling. The tool shall be placed on the cable at the location it enters the room and shall be pulled toward the racks and patch panels. The tool shall not be pulled backwards toward the wall to organize and dress the cabling.
- H. Inspect all conduit bends to verify proper radius. Comply with code for minimum permissible radius and maximum permissible length before insertion of pull stations. Any conduit run that has more than two 90 degree bends in the run shall have an accessible pull-point location established between the beginning and end points of the conduit cable run. The pull point shall consist of an electrical quad box with a removable cover.
- I. At no time shall a station run exceed 90 meters (295 feet).
- J. When terminating a station cable the integrity of the twist for each individual pair shall be maintained up to the point of termination, not to exceed ½ inch.
- K. Adhere to manufacturer’s published specifications for pulling tension, minimum bend radii, and sidewall pressure when installing cable.
- L. Penetrations through floor and fire-rated walls shall utilize a fire stopping assembly approved for that application in accordance with ANSI/TIA/EIA 569-A. Fire stop shall be 3M fire barrier pass-through device.
- M. Provide cable service loops at all junction/pull boxes. Service loops shall be neatly contained in the boxes.
- N. Three to five foot service loops shall be coiled neatly above the ceiling on all cables.
- O. Where drawings specifically allow the installation of cable in void, plenum or suspended ceiling areas, the contractor shall conform to ANSI/TIA/EIA 569-A with respect to the separation from power and EMI sources.
- P. Tie-wrap cables and cut to length at termination point.
- Q. Comply with ANSI/TIA/EIA-607 for all grounding and bonding of the entire system.
- R. Leave 6 IN slack protruding from wall at outlet mounting point and protect from damage by workmen prior to installing outlet.
- S. Cable terminations at all locations shall be neat orderly and display quality workmanship.
- T. Minimize removal of cable insulation jacket at all terminations.
- U. Contractor shall install white category 6, 4-pair UTP for County Network drops and blue category 6, 4-pair UTP for Security Network drops.
- V. All cabling shall be dressed utilizing velcro cable management ties.
- W. Fiber cables shall have their sheathing removed so that no more than 18 IN of un-stripped cable enters the panel. Cables shall be stripped back a sufficient amount so that the fiber strands wrap at least one full circle inside of the panel with their connectorized ends attached to the distribution panel’s bulkhead.
- X. Category 6 cable shall be installed within the cable tray system and shall not share pathways with any other wiring or cabling.
- Y. Fiber strands shall be installed in an order compliant with the ANSI/TIA/EIA 598-A Color Code.
- Z. Provide, install, connect and interconnect in all telecommunication and Security Electronics rooms: telecommunication main grounding busbar, telecommunication grounding busbar and all required interconnections, per ANSI/TIA/EIA-607.
- AA. Connect the telecommunications main grounding busbar to the main electrical distribution panel’s ground and building steel.

- BB. Cabling in tray shall be dressed and bundled using velcro (hook and loop) straps.
- CC. All surface raceway shall conform to ANSI/TIA/EIA 569-A Surface Raceway, where applicable.
- DD. All conduits shall have grommets and bushings. Comply with Division 26 general requirements.
- EE. Contractor shall not place or attach conduit directly to T-bar grid, concealed spline grid, flexible or rigid ductwork, HVAC registers, sprinkler piping or fixtures, or light fixtures.

3.2 LOW VOLTAGE ROOM

- A. Low Voltage equipment room shall have two NEMA L14-30 receptacles, each on a dedicated circuit, located at the bottom of each network rack. The room shall also have four dedicated quad NEMA 5-20 receptacles and two dedicated duplex NEMA 5-20 receptacles. The location of these receptacles shall be coordinated with Denton County. All electrical circuits and HVAC in the low voltage room shall be on a generator circuit.
- B. Fire retardant 4 feet x 8 feet x 3/4 inch AC grade plywood backboards free of defects (knots and voids shall be considered a defect) shall be installed on each identified wall. The plywood shall be installed 12 inches AFF and extend at least 9 feet AFF. Plywood shall be mounted with the A side exposed to the interior of the room and the C side against the wall. Backboards shall be painted off-white in color leaving the UL fire-rating symbol unpainted and visible. Each telecommunications closet shall have overhead ladder rack and ladder rack secured to the wall for riser cables. Low Voltage equipment room shall be provided with a telecommunications ground bus bar (TGB).

3.3 CABLE TESTING

- A. All data cables shall be tested with a 568B compliant test unit. Tests must be performed using the appropriate test and tool for the type of cabling being installed (i.e. a Category 6 compliant test should be used to test Category 6 cable).
- B. Cable test results for each cable installation must be submitted and approved by the Architect and Denton County Department of Technology Services.
- C. If copper backbone cable contains more than one (1) percent bad pairs, remove and replace entire cable.
- D. All cables shall be tested for DC continuity of each conductor, shorts between conductors and shields and operation of shorting bars in connectors.
- E. Test shall be performed after data connectors have been installed and cable terminated on outlet ports at both ends.
- F. The Contractor shall provide written verification of cable testing results indicating date of test performed and results, signed by job foreman.
- G. Bi-directional testing of optical fibers is required.

3.4 CABLING DOCUMENTATION

- A. All station labeling shall be laser engraved/screened and terminal room labeling will be machine generated.
- B. All cables must be clearly labeled on each end with machine-generated labels. The cables must also be labeled on each end with a wrap around cable label. This label should be wrapped around the sheathing of the cable prior to terminating each end.
- C. Cabling shall be protected against damage during installation.
- D. Cabling on the first floor shall begin with 1001 and continue up to the number of cables. Cabling on the second floor shall begin with 2001 and continue up to the number of cables. Each cable shall have a unique label. The numbering scheme must be approved by the Denton County Department of Technology Services prior to installation.

- E. Computer icons are to be used on patch panels.
- F. Provide to Owner, prior to final acceptance, complete schedules identifying each conductor from outlet jack to main terminal room blocks.
- G. Prior to Substantial Completion, submit project record drawings and data identifying system architecture and component distribution.
- H. Documentation shall be provided on cable installation as well as all tests performed on the cable, including test upon cable arrival.
- I. As-built documentation must be submitted in electronic AutoCAD format (.DWG)
- J. Printed as-builts must be laminated and mounted on a foam core. The finished as-builts must have a border tape on all 4 edges and one 3/16 IN ID metal grommet at each corner for mounting. The drawing shall be approved by the Architect as well as Denton County Department of Technology Services prior to being printed and mounted.

3.5 OPERATION TRAINING AND MAINTENANCE DATA

- A. Demonstrate to the Owner's designated representatives, Contractor, Architect, and representatives of the authorities having jurisdiction, the features and functions of the system and subsystems. Instruct the Owner and designated representatives in the proper operation and maintenance of the system.
- B. Provide operation parts and maintenance manuals defining operation and troubleshooting methods.
- C. Furnish the necessary trained personnel to perform the demonstration and instructions and arrange to have the manufacturer's representatives present to assist with the demonstrations.
- D. Allow a minimum of 16 hours time for performing the prescribed demonstrations/training.
- E. Arrange with the Owner's designated representative the date and times for performing the demonstrations.
- F. The Owner will select date and time for demonstration.
- G. Comply with requirements of the General Provisions of the Contract Systems Demonstrations.

END OF SECTION

The following table lists the most commonly used components of the Denton County copper and fiber optic cabling system. Consult the manufacturer's web site for coordination of the most current item descriptions and part numbers. For building compatibility, commonly used structured cabling system components such as racks, ladder rack, cable management and other associated hardware shall be manufactured by Chatsworth Products, Inc. Any substitution must be approved by Denton County. Not all items listed below will be used for this project. Reference drawings for specific call-outs.

APPENDIX 'A'

Manufacturer	Description	Part Number
CommScope Netconnect	XG Category 6A F/UTP (ScTP) Cable, 4-Pair, Plenum (CMP) rated, 23AWG, Wooden Reel (X= Color) Colors required specified in specification documentation	4-1499416-X
	XG Category 6A AMP-TWIST Shielded Modular Jacks	1711160-2
	Colored Dust Covers for XG Cat 6A AMP-TWIST Modular Jacks (x=color) Color shall match Cable Color terminated on jack	1711511-X
	XG Category 6A AMP-TWIST Shielded Patch Panels 24 port (Angled)	1933321-2
	XG Category 6A AMP-TWIST Shielded Patch Panels 48 port (Angled)	1933322-2
	XG Category 6A AMP-TWIST Shielded Patch Panels 24 port (Standard)	1933319-2
	XG Category 6A AMP-TWIST Shielded Patch Panels 48 port (Standard)	1933320-2
	XG Category 6A F/UTP Slim Line Patch Cables Length, Color and Part Number vary. Check specification documentation	X-193388X-X
	Category 6 UTP Cable, 4-Pair, Plenum (CMP) rated, 23AWG, reel-in-box (X=Color) Colors required specified in specification documentation	219567-X
	Category 6 SL Series Modular Jack with Dust Cover, Unshielded (x=color) Colors required specified in specification documentation	1375187-X
	SL Series Modular Jack Bend Limiting Strain Relief	1375200-1
	SL Series Blank Insert (x=color) Color shall match electrical outlets, switches and faceplates	1116412-X
	SL Series Patch Panel, Category 6, 24-port, 1U, Universal Wiring (T568A/T568B) (Standard)	1375014-2

	SL Series Patch Panel, Category 6, 48-port, 2U, Universal Wiring (T568A/T568B) (Standard)	1375015-2
	SL Series Patch Panel, Category 6, 24-port, 1U, Universal Wiring (T568A/T568B) (Angled)	1499600-2
	SL Series Patch Panel, Category 6, 48-port, 2, Universal Wiring (T568A/T568B) (Angled)	1499601-2
	4-port Angled Faceplate (x=color) Color shall match electrical outlets, switches and faceplates	406185-X
	2-port Angled Faceplate (x=color) Color shall match electrical outlets, switches and faceplates	1375155-X
	1-port Wall Phone Flush Faceplate (x=color) Color shall match electrical outlets, switches and faceplates	1479152-X
	Category 6 Slim Line Patch Cables Length, Color and Part Number vary. Check specification documentation	X-19331XX-X
Manufacturer	Description	Part Number
	Category 5e UTP cable, 4 pair, reel-in-box (X=Color) Colors required specified in specifications documentation	57826-X (CMR)
	Category 5e UTP cable, 4 pair, reel-in-box (X=Color) Colors required specified in specifications documentation	57825-X (CMP)
	Category 5e UTP cable, 25 pair, Wooden Reel (X=Color) (for cable sizes greater than 25 pair, substitute another manufacturer) Colors required specified in specifications documentation	1499418-X (CMR)
	Category 5e UTP cable, 25 pair, Wooden Reel (X=Color) (for cable sizes greater than 25 pair, substitute another manufacturer) Colors required specified in specifications documentation	1499419-X (CMP)
	Category 5e UTP cable, Etherseal, Wooden Reel (CMP) (Exterior Use)	1499448-3
	SL Series Category 5e Modular Jacks, Unshielded (X=Color)	1375190-X
	SL Series Modular Jack Strain Relief	1375200-2
	SL Series Patch Panel, Category 5e, 48-port, 2U, Universal Wiring (T568A/T568B)	1479155-2
	SL Series Modular Jack Termination Tool	1725150-1
	MRJ21 Cassette 6 port	1479459-1
	MRJ21 Cassette Blank	1777046-1
	MRJ21 Cassette Panel	1479451-1
	MRJ21 Cassette 48 Port Angled Patch Panel Non-AMPTRAC	1777052-1
	MRJ21 Cassette 48 Port Standard Patch Panel Non-AMPTRAC	1435971-1
	MRJ21 Cassette Label Holder Panel, Angled	1777054-1
	MRJ21 Cassette Label Holder Panel, Standard	1777040-1
	MRJ21 Cassette Label Holder Label Sheets (X=Color)	1375354-X
	MRJ21 Cable Assemblies (CMP) A to A Blue Jacket (X= Length)	X-1499518-X
	MRJ21 Cable Support Bar 12 in.	1933352-3
	Category 3 Patch Panel, 24 Port, 1U, RJ14C (2 Pair)	557403-1
	Category 3 25-Pair Patch Panel, 48 Port, 3U, RJ45 (1 Pair)	555482-1
	Champ Plug, Male, Champ-Lok (RJ21)	553913-1
	2-Port Modular Jack Box (x=color) Color shall match electrical outlets, switches and faceplates	1116698-X

	Icon Wheels (Data) (X=Color) (Blank) (X=Color)	558198-X 558821-X
	110Connect Category 5e Patch Panel, 24 Port	406330-1
	110Connect XC Category 5e Kit, Wiring Block with legs, 50-Pair	569433-1
	110Connect XC Category 5e Kit, Wiring Block with legs, 100-Pair	569439-1
	110Connect XC Category 5e Kit, Wiring Block with legs, 300-Pair	569445-1
	110Connect XC Cable Management Trough with legs	569389-1
	Clear Label Holder for 110Connect XC Wiring Blocks	558417-1
	Multimedia SL Series Patch Panel 24 Port Unshielded Angled	1499622-1
	Multimedia SL Series Patch Panel 48 Port Unshielded Angled	1499623-1
	Multimedia SL Series Patch Panel 24 Port Unshielded	1375291-1
	Multimedia SL Series Patch Panel 48 Port Unshielded	1375292-1
	Cover for Angled Patch Panels	1499614-1
	Angled 1U Blank Panels	1479992-1
	Standard 1U Blank Panels	556965-1
	Front Cable Management Assembly	1777240-1
Manufacturer	Description	Part Number
	SL Series Multimedia Adapter Plate	1479506-1
	Hybrid SM/XG 50/125um, 48 strand (2 SM 12, 2 MM 12), Plenum Interlocking Armored Fiber Cable (Use within buildings)	varies
	Single-mode 12 Strand, Armored Fiber Cable, Plenum Rated (Use within buildings)	varies
	XG OM3 Multimode 12 Strand, Armored Fiber Cable, Plenum Rated (Use within buildings)	varies
	Outside Plant Armored (OSPA), 6-144 Fiber Cable, (Use between buildings, Fiber count varies per project)	varies
	Outside Plant Armored (OSPA), 6 Fiber Cable, Single-mode	varies
	Outside Plant Armored (OSPA), 72 Fiber Cable, Single-mode	varies
	3U Rack Mount Fiber Patch Enclosure for Armored Cables	1435557-1
	XG OM3 Multimode Snap-in Adapter Plate LC Duplex 24 Fiber	1435516-5
	XG OM3 Multimode Snap-in Adapter Plate LC Duplex 12 Fiber	1374463-5
	Single-mode Snap-In Adapter Plate LC Duplex 24 fiber	1435516-1
	Single-mode Snap-In Adapter Plate LC Duplex 12 fiber	1374463-1
	Blank Snap-In Plate	559523-1
	1U Rack Mount Fiber Patch Enclosure for Armored Cable	1435555-1
	Easy Access Zone Enclosure	1777215-1
	Easy Access Zone Strain Relief Bracket	1777224-1
	LC Simplex LightCrimp PLUS Connector for XG OM3 fiber cable	6754483-4
	LC Simplex LightCrimp PLUS Connector for Single-mode fiber cable	6754482-1
	Duplex LC Clip, Package of 6 (Blue)	1754371-4
	Duplex LC Clip, Package of 6 (Black)	1754371-2
	Buffer Tube Splitter Kits (XX=Multiple or Single)	14350XX-1
	MPO Optical Fiber Cassette LC Duplex XG 50um OM3 24 Fiber	1918784-1
	MPO Optical Fiber Cassette LC Duplex Single-mode 24 Fiber	1918786-1
	MPO Optical Fiber Cable Assembly XG OM3 50um 12 fiber OFNP (X=Length)	X-1907404-X
	MPO Optical Fiber Cable Assembly Single-mode 12 fiber OFNP	X-6435070-X

	(X=Length)	
	1U Rack Mount Fiber Optic Patch Panel	1777125-1
	PARA-OPTIX Backbone Enclosure Kit, 36 XG OM3 Duplex LC Ports (72 Fiber)	1919547-1
	PARA-OPTIX MPO-Style Trunk Cable Assembly, XG OM3 (72 Fiber) (OFNP) (X=Length)	X-1919505-X
	F-Connector Coupler Insert for SL Modular Jack Patch Panel (X=Color)	1499855-X
Varies		
	Wall Mount Rack Bracket to Vertically Mount 24 or 48 Port SL Multimedia Patch Panel (something similar to http://rs.innovationfirst.com/wall-mount-rack-brackets.shtml or http://www.rackmountsolutions.net/Wallmount Rack V Series.asp)	Varies
	Coyote Splice Enclosure	Varies
Chatsworth		
Products, Inc.	18 inch Universal cable runway – Black	10250-718
	Cable Runway Radius Bend – Black, Outside Bend	10723-718
Manufacturer	Description	Part Number
	Cable Runway Radius Bend – Black, Inside Bend	10724-718
	Cable Runway E-Bend – Black	10822-718
	Runway Radius Drop, Cross Member – Black	12100-718
	Cable runway end closing kit - Black	11700-718
	Cable runway protective end caps	10642-001
	Cable runway wall angle support – Black	11421-718
	Cable runway triangular support bracket - Black	11312-718
	Cable runway elevation kit - Black	10506-718
	Cable runway junction and splice hardware - Black	
	19 inch Standard Rack – 8 foot Black	55053-715
	Double sided universal horizontal cable manager, black – 2RMU	30530-719
	Double sided vertical cable manager, black – 6 inches wide, 8 foot tall	30095-715
	Raised Floor Enclosure for Fiber, 4U	A0822-RF-F
	OnTrac Wire Mesh Cable Tray, 4 x 12, Zinc Finish	34821-512
	OnTrac Wire Mesh Standard Splice Kit, Zinc Finish	34738-501
	OnTrac Wire Mesh Splice Bar, Zinc Finish	34739-501
	OnTrac Wire Mesh Splice Washer and Bolt Kit, Zinc Finish	34728-501
	OnTrac Wire Mesh Clamp Washer, Zinc Finish	34746-501
	OnTrac Wire Mesh Carriage Bolt Hardware Kit, Zinc Finish	34728-502
	OnTrac Wire Mesh 90 degree Splice Bar Kit, Zinc Finish	34740-501
	OnTrac Wire Mesh Pedestal Clamp Support Kit, Zinc Finish	34737-502
	OnTrac Wire Mesh Pedestal Clamp Bracket, Zinc Finish	34737-501
	OnTrac Wire Mesh L Support Bracket, Zinc Finish	34734-512
	OnTrac Wire Mesh Split Bolt Grounding Clamp	34838-001
	OnTrac Wire Mesh Label Holder	34749-001
	OnTrac Wire Mesh Cable Tray Installation Cutting Tool	34839-001
	OnTrac Wire Mesh Cable Tray Installation Shear Cutting Tool	13367-001
	Grounding Busbar Assembly with Lug Kit (TGB Pattern)	40156-012
	Grounding Busbar Assembly with Lug Kit (TMGB Pattern)	40158-012
	Velocity 2U Horizontal Cable Manager	13930-702

	KoldLok Mini Grommet (see also Upsite Technologies)	13871-001
	Vertical Cable Manager for F-Series TeraFrame 51U Cabinets	35095-C11
	Front to Back Horizontal Cable Manager for F-Series TeraFrame Cabinets	35108-C01
	F-Series TeraFrame Cabinet with accessories, 1 Side Panel Chatsworth Custom Cabinet Part Number. Contact CPI	TS1009768
	F-Series TeraFrame Cabinet with accessories, 2 Side Panels Chatsworth Custom Cabinet Part Number. Contact CPI	TS1009773
Upsite Technologies		
	KoldLok Mini Split Floor Grommet (Brush Type)	10077
	HotLok 1 U Blanking Panel	10015
	HotLok 1 U Blanking Panel with Temperature Strip	10025
3M		
	3M Fire Barrier Pass-Through Device – Square	98-0400-55XX-X
	3M Fire Barrier Pass-Through Device Mounting Bracket – Single, Triplex, Sixplex	98-0400-55XX-X
Manufacturer	Description	Part Number
Belden or equivalent		
	RG-6/U Quad Shield Coax, Plenum, Color as specified	varies
	RG-6 Compression F-Connectors	varies
ACP International		
	72 inch Fiberglass Line Marker, Orange with orange decals on both sides, black text	ACP-072
	Curled vinyl wrap around markers, Orange, black text	DN-33, DN-34
	3 inch round Crystal Cap Curb Markers	CC-3
Legrand/Wiremold		
	Legrand/Wiremold Resource RFB Series Floor Box with Evolution Series Cover	RFB6E with Evolution Series Cover
	Legrand/Wiremold Evolution Series Poke-Thru Device	6AT Series
	Legrand/Wiremold Evolution Series Work Surface Portal	WS6SBK
APC		
	UPS 3000VA, 2U, L5-30 Input	SUM3000RML2U
	UPS 1500VA, 2U, L5-15 Input	SUM1500RML2U
	UPS Extended Run Battery Pack	SUM48RMLBP2U
Semtron, Inc.		
www.semtron.com	2 Gng 1 Port 110,SL** Stainless Faceplate – laser engraved labeling	2FM-0E-AMP
	2 Gng 2 Port 110,SL** Stainless Faceplate – laser engraved labeling	2FM-(2)0E-AMP
	2 Gng 3 Port 110,SL** Stainless Faceplate – laser engraved labeling	2FM-(3)0E-AMP
	2 Gng 4 Port 110,SL** Stainless Faceplate – laser engraved labeling	2FM-(4)0E-AMP
	2 Gng 1 Port Flush AMP110,SL Stainless Faceplate – laser engraved labeling	2FM-0E-PHONE-AMPCIS

	2 Gng stainless F-Connector faceplate – laser engraved labeling	2FM-(2)0E-AMP
--	---	---------------

END OF APPENDIX



DIVISION 28

ELECTRONIC SAFETY AND SECURITY



SECTION 28 05 00
BASIC MATERIALS & METHODS FOR ELECTRONIC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Drawings and specifications sections “General Conditions,” “Special Requirements” and “General Requirements” form a part of this section and other Division 28 sections by this reference thereto and shall have the same force and effect as if printed herewith in full. All contractors for this work shall have read all General and Special Conditions, Division 01 Specifications sections and other referenced sections in the execution of all work and will be bound by all conditions and requirements therein.
- B. Related sections:
1. Division 00 - Bidding Requirements and Contract Forms
 2. Division 01 - General Requirements
 3. Division 08 - Door Hardware
 4. Division 11 - Detention Equipment
 5. Division 26 - Electrical Requirements
 6. Division 27 - Cabling Requirements
 7. Division 31 - Earthwork
 8. Section 28 05 05 - Uninterruptible Power Supply Systems
 9. Section 28 05 10 - Detention Area Intercom/Paging System
 10. Section 28 05 15 - Detention Door Control System
 11. Section 28 13 13 - Card Access Control System
 12. Section 28 23 13 - Video Surveillance System
- C. Drawings use and interpretation:
1. Drawings are diagrammatic and indicate general arrangement of systems and equipment, except when specifically dimensioned or detailed.
 2. For exact locations of building elements, refer to dimensioned architectural/structural drawings.
 3. Field measurements take precedence over dimensioned drawings.
 4. Intention is to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement.
- D. Installation of all electronic systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.
- E. Dimensions indicated are limiting dimensions.
- F. Do not use equipment exceeding dimensions indicated or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.
- G. Description of systems:
1. Provide materials to provide functioning systems in compliance with performance requirements specified.
 2. Provide modifications required by reviewed shop drawings and field coordinated drawings.
- H. The work of this division shall consist of, but shall not be limited to, the providing of the following systems:
1. Section 28 05 05 - Uninterruptible Power Supply System
 2. Section 28 05 10 - Detention Intercom and Paging System

 3. Section 28 05 15 - Detention Door Control System

4. Section 28 13 13 - Access Control System
 5. Section 28 23 13 - Video Surveillance System
- I. This section includes basic design requirement specifications for the security monitoring and control system. This section contains requirements that pertain to all Division 28 security sections, and includes the design basis, as well as requirements for submittals, quality assurance, product handling, record documents, project conditions, installation, demonstrations and training.

1.2 INITIAL CONTRACTOR SURVEY

- A. Prior to commencing any work on site, the contractor shall perform a complete functional system test of the existing systems to be upgraded and/or replaced.
- B. Upon completion of the test, the contractor shall submit a complete list of the existing systems operational status by system and device including device functions and note ANY deficiencies found.
- C. The test report and deficiency list shall be submitted to the General Contractor (GC) and Architectural/Engineer (A/E) for review.
 1. The A/E will retain this document as a Project Record Document that will become part of this contract.
 2. The A/E will review the list with the GC and OWNER for a period of 2 weeks.
 3. After the 2 week review period the GC will issue a formal Notice to Proceed (NTP) noting known deficiencies.
 4. A request for price will be issued for the deficiencies found that are desired to be corrected.
- D. It will be noted that the only deficiencies for the project have been submitted by the contractor and any further deficiencies not identified at that time are the responsibility of the contractor.

1.3 SUBMITTALS (SEE DIVISION 01)

- A. Shop drawings:
 1. As indicated in each Division 28 section and as indicated herein.
 2. All contractor provided equipment shall be identified in the shop drawing package by its associated room designation (i.e. PLC-A122, do not label equipment PLC-1, PLC-2, TS-1, TS-2, etc...).
 3. Submit for review by the A/E, complete engineering data for each system for evaluation of the proposed system with respect to specification requirements.
 4. "Point-to-Point" sheet and detail references shall be provided throughout the shop drawing set to specifically identify:
 - a. Field device location on floorplan to cable termination location.
 - b. Cable termination location to equipment cabinet elevation.
 - c. Equipment cabinet elevation to equipment component detail.
 - d. Equipment component detail to equipment wiring diagram.
 - e. Equipment wiring diagram to termination schedule
 - f. Termination schedule including:
 - 1) PLC input/output information.
 - 2) Power supply information.
 - 3) Field device wiring diagram.
 - 4) Field device rough-in detail.
 - 5) Programming information.
 - 6) Functional information.
 - 7) Interface to other system information (camera call-up to intercom/alarm, etc...)
 - 8) Any pertinent or device specific special operational information.
 - g. The cross-references shall be backwards and forwards referencing throughout the shop drawings to the level that each field device can be referenced from its floorplan location to its specific termination location and associated wiring information.

5. Submittals for each system shall consist of engineering data sheets, schedules, and manufacturer's descriptive catalog sheets for each system component and manufacturer prepared shop drawings to indicate conformance with the contract documents.
 - a. Provide complete floor plans. Each plan shall show proposed device locations.
 - 1) Show actual device nomenclature as illustrated on riser and single line diagrams.
 - 2) Show pullboxes, equipment enclosures and terminal cabinets.
 - 3) Show conduits and fill (optional if lateral conduits are shown with size and fill on the riser).
 - b. Riser diagram:
 - 1) Illustrate conduit relationships between devices shown on the floor plans.
 - 2) (Lateral conduits are optional if shown on the plans).
 - 3) Show actual device nomenclature as illustrated on the plans and breaker number where the power will be sourced.
 - c. Single-line diagrams:
 - 1) Show signal relationships of devices within the system.
 - 2) Show actual device nomenclature as illustrated on the riser and plans.
 - 3) Show wire numbers.
 - d. Equipment enclosure wiring diagrams:
 - 1) Show a pictorial illustration of each equipment enclosure and/or terminal cabinet.
 - 2) Show the device nomenclatures exactly as shown on the single line diagrams.
 - 3) Show the terminations including the wire numbers as shown on the single line diagrams.
 - 4) Show wire colors for each terminal.
 - 5) For each wire exiting the enclosure, show the destination of the wire by floor, room number and the drawing number of the panel where the wire terminates.
 - e. Field device wiring diagrams:
 - 1) For each field device, existing or new, provide a detailed wiring diagram.
 - 2) Show the termination connectors on the device.
 - 3) Show the wire numbers attached to the connectors, pigtails or terminal blocks.
 - 4) Show the wire colors connected to the pins, pigtails or terminal blocks on each device connector.
 - f. Freestanding device wiring diagrams:
 - 1) For each freestanding device, such as a computer, printer or the like, show the rear elevation of the device as a pictorial.
 - 2) Show the termination connectors on the device.
 - 3) Show the wire numbers attached to the connectors.
 - 4) Schedule the wire colors connected to the pins on each device connector.
 - g. Custom assembly diagrams:
 - 1) For each custom assembly such as a receptacle assembly, control panel or the like, provide an assembly drawing illustrating the appearance of the assembled device including dimensions, assembly components and functional attributes (momentary or alternate action switch, lens color, panel finish and the like).
 - h. Specification comparison:
 - 1) Copy of specification annotated on line by line basis where proposed product or system differs from specified product or system. Any differences to be explained.
6. When application engineering and submittals have been prepared, a meeting shall be set up with the A/E, GC and OWNER for preliminary shop drawing review. The project superintendent for the work of this division shall explain the entire system operation, equipment and other items as called for in the specification. Any drawings required shall be submitted one week in advance of proposed meeting date and preliminarily reviewed at this meeting. This meeting will be held at the project site.
7. Each individual submittal item for materials and equipment shall be marked to show specification section and paragraph number which pertains to the item. Manufacturer's description sheets shall have an arrow stamp pointing to each item on the sheet that is intended for review. Each operational feature of the systems included shall be addressed in narrative form and relate to specific system requirements described in the plans and

specifications. All drawing submittals shall be submitted on same size sheets, identified by system, and sequentially numbered throughout the entire set.

8. Submittals shall be made for each of the systems being supplied for the project.
 9. All shop drawings required shall be submitted at the same time in one complete packaged submittal. Any supplemental sheets added during construction will need to be submitted separately for approval.
 10. Provide (2) ARCH-F 30" x 42" hard copies, (2) ARCH-C 18" x 24" hard copies, and (2) PDF on CD-RW digital copies of each submission.
- B. Product data:
1. Table of Contents in the form of the Bill of Materials provided as defined by each Division 28 section.
 2. Data sheets for each device as indicated in each Division 28 section and as indicated herein.
 3. Where multiple options are shown on a single data sheet, highlight product options that will be provided and strikethrough options that are not applicable or otherwise specifically identify all options/features to be included in the project.
 4. Each data sheet shall have a footer each page with the following information:
 - a. Submitting Contractor's Logo
 - b. Specification Section
 - c. Specification Reference
 - d. Manufacturer Name
 - e. Manufacturer Part Number
 - f. Brief Description
 5. Description of system operation indicating overall system operation and purpose and capabilities of each component within system.
 6. Cross reference data sheets to components shown on system/riser diagrams.
 7. Provide (4) ANSI-A 8.5" x 11" colored, tabbed, hard copies in 3-ring binders, and (2) PDF on CD-RW colored, digitally tabbed, digital copies of each submission.
- C. Security Electronics Control System (SECS) Graphic Maps:
1. Graphic maps shall be submitted for each control station for approval by A/E and OWNER.
 2. Provide (4) ANSI-A 8.5" x 11" colored, tabbed, hard copies in 3-ring binders, and (2) PDF on CD-RW colored, digitally tabbed, digital copies of each submission.
- D. Samples:
1. As indicated in each Division 28 section.
- E. Project information:
1. As indicated in each Division 28 section.
- F. Factory Acceptance Test:
1. Provide travel, lodging and a rental vehicle for (2) OWNER representatives, (1) GC representative and (1) A/E representative for an attendance period of (2) Days at the contractor's electronic control system fabrication shop.
 2. The entire Security Electronics Control System (SECS) shall be a fully programmed and operational mock-up to simulate system functionality, as it will operate when installed on-site.

1.4 OPERATION AND MAINTENANCE MANUALS

- A. Contract closeout information:
1. As indicated in each Division 28 section.
- B. Record drawings:
1. Keep a complete set of all electronic systems drawings in job site office for showing actual installation of electronic systems and equipment. Drawings shall show exact location of devices, equipment and routing of conduit and cable.

2. Use this set of drawings for no other purpose.
 3. Where any material, equipment, or system components are installed differently from that shown, indicate differences clearly and neatly using ink or indelible pencil during construction.
 4. At project completion, update shop drawings with a notated revision to reflect all AsBuilt changes and submit final record set of drawings to A/E for approval.
 5. Upon A/E approval, provide (2) ARCH-F 30" x 42" hard copies, (2) ARCH-C 18" x 24" hard copies, and (2) PDF on CD-RW digital copies to A/E for distribution to the OWNER.
- C. Operation and Maintenance Manuals:
1. Table of Contents in the form of the Bill of Materials provided as defined by each Division 28 section.
 2. Data sheets for each device as indicated in each Division 28 section and as indicated herein.
 3. Where multiple options are shown on a single data sheet, highlight product options that will be provided and strikethrough options that are not applicable or otherwise specifically identify all options/features to be included in the project.
 4. Stamp each data sheet with its associated specification section reference.
 5. Following each data sheet provide its corresponding Operation and Maintenance technical manual.
 6. Description of system operation indicating overall system operation and purpose and capabilities of each component within system.
 7. Cross reference data sheets to components shown on system/riser diagrams.
 8. Provide (4) ANSI-A 8.5 IN x 11 IN colored, tabbed, hard copies in 3-ring binders, and (2) PDF on CD-RW colored, digitally tabbed, digital copies of each submission.
- D. Equipment Enclosure Guide:
1. Equipment cabinets or racks for the electronic systems shall include a laminated layout drawing permanently affixed inside the door or cover of each enclosure sized to fit with each item of equipment within the enclosure identified and cross-referenced with equipment data sheet.
- E. Operation and Maintenance Data:
1. Shall include a complete terminal block schedule for each panel with the following data for each point within the electronic control system
 2. Type of point, i.e., input, output, etc...
 3. Schedule relating points, terminal block numbers, and signal source or destination.
 4. Input and output schedule.
 5. Location and type of input source device.
 6. Location and type of output device controlled.
 7. Project-specific, illustrated user's manual.
 8. Provide detailed electrical schematics for all electrical/electronic components.
- F. On-site Digital Storage:
1. The AsBuilt Drawings and Operation and Maintenance Documents as defined in Section 28 shall be digitally stored within 6ft of each SECS Server Location on the project. A Space Age Electronics Storage Device (eFAD) shall be installed in an IGB series single gang electrical back box with a red Décor plate cover. The unit shall be permanently marked "SECS Documents" and will not be able to be removed from the surface. The unit will install like an electrical device and be securely fastened. The eFAD unit shall have a minimum capacity of 4GB's of digital storage. The access will be an USB type B connector on the front faceplate.
- G. Maintenance and operating instructions on all systems.
- H. Control wiring diagrams for all locking systems with each system identified.

- I. Certification from system manufacturers that systems are installed in accordance with manufacturer's recommendations and are functioning correctly at the time of final inspection.

1.5 QUALITY ASSURANCE

- A. Perform all work in accord with following codes:
 1. Federal, state and local codes, regulations and ordinances
 2. Underwriter's (UL) code requirements
 3. NFPA 70 National Electrical Code (NEC) (Latest Edition)
 4. Occupational Safety and Health Act (OSHA)
 5. All authorities having jurisdiction
 6. Factory Mutual System (FM) requirements
 7. NFPA 101: Life safety code (Latest Edition)
 8. ANSI-A117.1: Handicap code, Chapter 553 - Part V
 9. Uniform Building Code
 10. American's with Disabilities Act (ADA)
- B. The intent of these specifications is to insure the systems described in this division are provided and installed by a technically experienced installer and, further, that the work is fully coordinated between the various systems by a single installer who is technically qualified as described herein.
- C. Where the installer is a branch office or other division of a larger organization, the qualifications of the branch office or other division shall meet the requirements of the Contract Documents. The installer incorporated under the same name, shall have successfully completed a minimum of three similar construction projects, both in scope and system types.
- D. The work of this division shall be managed and supervised by a full-time site project superintendent who shall have the following qualifications:
 1. Experience in the applications engineering, installation, and supervision of similar construction projects both in scope and system type for a minimum of 5 years
 2. Full time employee of the installer
 3. Have a working knowledge of all systems installed under this division.
 4. Project superintendent shall be on site full time through duration of construction.
- E. Acceptable installers/integrators: Subject to their adherence to these specifications, the following are pre-qualified to perform the electronic systems installation/integration work of this section:
 1. MCS (Argyle Security Group), San Antonio, TX.
 2. Trentech (Cornerstone Electronics), Montgomery, AL.
 3. Com-Tec, Appleton, WI.
 4. Engineered Control Systems, Spokane, WA
 5. Southern Folger, San Antonio, TX
- F. Firms other than those previously listed desiring approval to bid the project shall submit a Substitution Request in accordance with Section 00 26 00. Attach the following information:
 1. The submitting systems integrator shall provide copies of the company license number issued by the state, which signifies they are approved to do security work in the state (if applicable).
 2. A list of 10 projects that were completed by the submitting integrator. These projects must have been designed to use industrial programmable controllers and touchscreens as described in this specification and applied in a detention security application. The 10 projects should be similar in size, scope, and price to this project. If SUBCONTRACTORS were used by the submitting Systems Integrator, then that project SHALL NOT be used or included in the list, as this project is requiring a "Single Source Responsibility" format requiring complete installation by full time employed employees of the submitting Systems Integrator. The architect will review each project submitted and disallow any project not meeting the above requirements. If the total approved projects do not meet the minimum 10 required, the Architect/Owner will not approve the submitting systems integrator.
 - a. For each project listed provide:

- 1) The brand of PLC, Audio, Video and backbone equipment used.
 - 2) Values of the subsystems and total contract price.
 - 3) Technically describe the security components integration with each system.
 - 4) Provide Contact Person Name and Phone Number at each submitted project site that can confirm that the systems integrator preformed the installation in an acceptable manner.
 - 5) List the names and roles of employees on the submitted projects.
3. The names and up to date phone numbers of the Architect, System Engineer and Owner of ALL Jail/Detention/Corrections projects installed by the submitting systems integrator, within the last 5 years.
 4. A notarized statement from the Owner or President, listing those products that will be used for each section of Security Electronics. No exceptions to this bill of material shall be accepted after the awarding of the contract. Multiple selections are NOT ACCEPTABLE. State in writing, your intent to “comply fully with the requirements of this specification and to hold harmless the Architect, Engineer and Owner from omissions of a casual nature that would be considered to be an implied requirement for a fully operational security electronics integrated system” Provide a list of “compliance to” or “non-compliance” for each paragraph of this specification. Compliance/Non-compliance must be in a format listing each section/subsection/paragraph of this specification and an explanation of compliance/non-compliance for each entry.
 5. A list of all outstanding, past judgments or lawsuits against the company or owners under their current name or any previous name or business entity.
 6. Company’s history providing detention control systems.
 7. Organizational chart with the resumes of individuals.
 8. Provide a narrative description of all software to be utilized, network types, and interfaces with other systems. Any custom software that is to be developed by the contractor needs to be described in detail.
 9. Provide written confirmation, “Software Assurance Letter”, that at the completion of the Factory Acceptance Test, the submitting systems integrator will provide to the owner, at no charge, the complete ladder-logic program used on this project to date, fully commented, the complete list of scripts and routines used in the GUI touchscreen package fully commented and the documented source code of any custom or proprietary DLL, EXE, NET or software module written by the submitting systems integrator for use on this project. At the completion of the project, before acceptance from the owner and the final retainage payment, the systems integrator will provide the final, fully commented documentation, listed above, for the project. If this “Software Assurance Letter” is not included, the submitting systems integrator WILL NOT BE APPROVED to bid this project.
 10. A letter from the Surety Company reflecting the Surety Company’s history and experience with the Integrator providing the Security Electronics and the current bonding limit.
- G. Systems Integrators who do not meet these specifications, fail to turn a valid prequalification, or do not have an acceptable reputation of good service will not be allowed to bid. Additional firms approved to bid shall be listed by addendum only.

1.6 PROJECT CONDITIONS

- A. Examine Contract Documents to determine how other work will affect execution of electronic systems work.
- B. Make arrangements for and pay for necessary permits, licenses, and inspections.
- C. Determine and verify locations of all existing utilities on or near site.
- D. Provide covering and shielding for all equipment to protect from damage.
- E. Repair, restore or replace damaged, corroded and rejected items.

1.7 OWNER'S TRAINING (SEE DIVISION 01).

- A. Include all costs required to:
 - 1. Train operation and maintenance personnel in use and maintenance of systems provided under this section.
 - 2. Train maintenance staff in troubleshooting and maintenance of each system.
 - 3. Provide copies of technical manuals, including function and operational circuit and operational circuit characteristics and schematic diagrams, for each system and system components.
- B. Training sessions shall be conducted by instructors certified in writing by manufacturer of specific system.
 - 1. Conduct sessions for not less than four hour periods during normal working hours, i.e., Monday through Friday, 8:00 AM to 5:00 PM.
 - 2. Training session schedules shall conform to requirements of Owner.
 - 3. Submit schedules to Owner for approval not less than two weeks prior to training session.
 - 4. Do not schedule training sessions for different systems concurrently.
 - 5. Training hours shall be cumulative of hours specified in each section.
- C. Instruct operating staff in proper operation, including hands-on training.
- D. Video record all training sessions including but not limited to classroom training, operational training and hands on training:
 - 1. Provide (2) interactive DVD/R copies and (2) USB copies of recorded training material to OWNER.

1.8 EXTRA MATERIALS (SEE DIVISION 01)

- A. Furnish spare parts required in each Division 28 section.
- B. Spare parts required in each Division 28 section shall be stored within 6ft of each SECS Server Location on the project. A Space Age Electronics Records, Parts and Battery Box (RPB) Spare Parts and Battery Box shall be installed. The enclosure shall be UL Listed, constructed of 16 gauge cold rolled steel. It shall have a red powder coat epoxy finish. The access door shall be locked with a 3/4" barrel lock and a lift away hinge with a grounding Strap. The enclosure will supply 4 mounting holes and a grounding lug. Inside the enclosure will accommodate standard 8 1/2 x 11 manuals and loose document records that will be protected within the enclosure. The enclosure shall also provide 2 key ring holders with a location to mount standard business type cards for key contact personnel.
- C. All spare parts shall be new and in original packaging from manufacturer.
- D. Insure parts are package to protect from damage and to allow for easy storage.
- E. Provide inventory of all spare parts.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Individual items:
 - a. Base:
 - 1) As noted in each Division 28 section.
 - b. Optional: As noted in each Division 28 section.
 - 2. Other manufacturers desiring approval comply with Section 00 26 00.
- B. Use only prime quality, new materials, apparatus and equipment.
- C. Any peripheral accessories required shall be provided to insure intended function.

- D. Use UL labeled electrical materials where listing has been established for materials or devices in question.
- E. Structural steel for supports: ASTM-A36/A36M.
 - 1. Galvanize members installed in areas of high humidity or condensation.
 - 2. Furnish other members with shop coat of rust inhibiting primer.
 - 3. Shop fabricate for field assembly using bolts.
 - 4. Minimize field welding.
 - 5. Retouch primer and galvanizing after field welding.
- F. Access doors, panels and frames (as specified in Section 08 31 16)
 - 1. Style and type required for material in which installed.
 - 2. Provide in walls, floors, and ceilings to permit access to all equipment requiring service, adjustment or inspection. Include any location where splicing occurs.
- G. Provide security equipment that is institutionally rated.

2.2 WEATHER PROOF EQUIPMENT

- A. Use weatherproof (WP) enclosures for all exterior devices and equipment.
- B. For applications that are on exterior doors, in unconditioned spaces, exterior areas or in an environment where moisture could be an issue, silicone filled connectors shall be used for all wiring connections and terminations.

2.3 LIGHTNING PROTECTION (SURGE PROTECTION DEVICES-SPD)

- A. Acceptable manufacturers:
 - 1. Surge Protection Devices:
 - a. Base:
 - 1) Ditek
 - b. Optional:
 - 1) Northern Technologies
 - 2) Transtector systems
 - 3) Leviton
 - c. Indicate on shop drawings locations of all transient voltage surge protection devices.
 - 2. All SPD devices shall be provided by one manufacturer.
 - 3. SPD manufacturer shall have a company-wide quality program and be ISO 9001 certified by an accredited organization.
- B. Protect all communication, video, and data equipment against surges induced on all control, communication, video, sensor and data cables. All cables and conductors which serve as control, sensor, audio, or data conductors which leave the building (including devices mounted on building exterior) shall have surge protection circuits installed that meet the IEEE 472 surge withstand capability test and the electrical transient tests as established in UL 365-1985. Fuses shall not be used for surge protection.
- C. Lightning protection devices for protection of control, sensor, audio, and data cabling shall be located as recommended by the manufacturer.
- D. All control, communications, video, sensor, and data cables connected to lightning protection devices shall be isolated from all other building internal and external wiring, and shall not occupy the same conduit raceway, junction boxes, or wireways.
- E. All systems and components as specified herein shall be equipped with lightning protection devices, installed as described herein.
- F. All power connections, including 24VDC and 24VAC power supplies and direct wired or plug-in 120VAC power connections, for all systems and components as specified herein, shall be equipped with lightning suppression devices. All communication, data and power lightning

protection devices shall be bonded to building grounding system in accordance with Article 250 of the National Electrical Code.

G. Communication, data and signal:

1. Shall incorporate Silicon Avalanche Diode devices as the primary protection means
2. Shall have a surge life of at least 10 operations for 10,000 amp, 8 x 20 microsecond wave
3. Shall have an initial clamping voltage suitable to the application and shall not exceed 200 percent of the peak signal voltage rating of the circuit.
4. Shall have a peak clamping voltage suitable to the application and shall not exceed 300 percent of the peak signal voltage rating of the circuit.
5. Shall be selected as required for the particular data frequencies and signal level characteristics of the application

H. Branch power circuits:

1. Shall incorporate Silicon Avalanche Diode devices as the primary protection means
2. Shall have a surge life of at least 200 operations for 3,000 amps, 8 x 20 microsecond wave for 120V single phase application
3. Shall have a maximum single surge capacity of at least 19,000 amps for 8 x 20 microsecond wave
4. Shall have an initial clamping voltage of no greater than 250V (location category B, 500A) for 120V single phase application.
5. Shall have a peak clamping voltage of not greater than 500V (location category B, 500A) for 120V single phase application.

2.4 EQUIPMENT HOUSING

- A. Equipment housed in security equipment rooms shall be housed in equipment cabinets. Refer to Section 28 05 15 for cabinet specifications.

2.5 ACCESS DOORS, PANELS AND FRAMES

- A. Access doors, panels and frames: See Section 08 31 16.
1. Where not indicated on Drawings, provide access panels and/or doors at walls, and inaccessible ceilings as required to permit access to equipment, devices and enclosures requiring service, adjustment, or inspection.
 2. Size:
 - a. As required to allow access, inspection, service, and removal of items served.
 - b. Minimum 24 x 24 IN

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All cabling for the Electronic Security Systems Network Connectivity and Video Surveillance System shall be provided by the structured cabling systems contractor. See Section 27 05 32 for detailed specifications. All other system cabling shall conform to paragraph 3.6 "Wiring".
- B. Use only thorough, highly skilled, and experienced workers.
- C. When changes in location of any work are required, obtain approval of Architect before making change.
1. Make changes at no extra cost.
- D. Do not change indicated sizes without written approval of Architect.
- E. Provide to Division 26 installer non-standard electrical boxes.
- F. Work provided by Division 26.
1. Complete raceway system from the main head end equipment to the end devices, including any necessary standard size backboxes, wireways, pullboxes and manholes.

2. 120 volt AC wiring and connections to UPS equipment
 3. Under Division 28 submit conduit requirements and special backboxes for work of Division 26 in a timely manner so as not to impede the progress of the work.
 4. Under Division 28 provide additional conduits required or increase in size of conduit to effect the installation of the electronic systems contained herein.
 5. Division 28 responsible for 120 volt AC wiring and connections from the output of UPS systems to Division 28 equipment including required connections
- G. Fill percentage: Conduit fill shall not exceed 40 percent.
- H. Conduit verification:
1. Verify that all conduit is clear of foreign matter and substances prior to pulling of wire or cable.
 2. Apply a chemically inert conduit lubricant to all wire and cable prior to pulling. Do not subject wire and cable to tension greater than recommended by the manufacturer. Under no circumstances shall wire or cable be "jerked", "yanked" or attached to any mechanical pulling device which exerts excessive force; shear or tensile.
 3. Secure all wire and cable runs vertically in conduit for continuous distances greater than thirty (30) feet at the vertical run terminations. Non-coaxial cables shall be secured by screw-flange nylon cable ties or similar devices. Symmetrical clamping devices with split, circular or other wire conforming, non-metallic bushings shall be provided for all other cables.
- I. Division 28 systems (i.e., door control, CCTV, access control) shall not occupy the same conduit raceway. All Class 1 and Class 2 circuits shall be routed within separate raceways and shall be portioned within all wireways.
- J. Door position monitor switches may be wired electronically "in series" with applications involving double doors in areas of non-inmate circulation.
- K. Provide installation, including electrical connections, cable pulling, testing and interfacing of systems.
- L. Deliver materials and equipment to project and store in original containers or cartons, properly protected from elements.
- M. Denton County requires that all threaded screws be hand turned using non-electrified tools. However, electric screwdrivers tools may be used with caution. Installers shall assume all responsibility for any device or surface damaged during the installation. The use of electric power "impact" tools shall not be permitted on any door hardware or other device installations for any aspect of the security system. No Security equipment shall be installed in a manner where it is firmly secured against the surface it is being mounted to and is mounted where it is level. The installers shall use a leveling device to check for installation accuracy with leveling.
- N. The Security Contractor shall pre-drill all holes for work performed on wood doors, plywood, cabinets, built-in furniture, and wood-like material applications.
- O. Sheetrock anchors shall be metal. No plastic anchors are allowed for drywall installations.
- P. Metal toggle bolts shall be used for mounting devices in ceiling tiles.
- Q. Greenlee Manufacturing concrete anchors shall be used for installation of card readers and any other access control devices on concrete, stone, cinder block, or brick.
- R. Metal mud rings shall be used for any installation application where a single gang drywall cut out is required.
- S. The use of a stud finder is highly recommended to avoid installing parts and equipment over metal studs.
- T. Cabling penetrations through interior walls above the ceiling shall use a fire rated sleeve.
- U. Service loops shall be installed at both ends of all cable runs.

- V. Remove and vacuum drywall particles, wire fragments, unused spade lugs and other debris from all J-boxes, enclosures and boxes.
- W. Store items subject to moisture or temperature damage in dry, temperature controlled spaces.
- X. Execute all work described in this specification and shown on drawings and all work dependent upon, and necessary to, complete finish of the work so described or shown, in a workmanlike manner using materials best adapted to purposes where such work or material is not specifically mentioned.
- Y. All parts that are packaged with installed devices and not used during the installation and installation instruction sheets and templates shall be saved and turned over to Denton County at the completion of the project.
- Z. Grounding:
 - 1. Ground cable shields, drain conductors, and equipment to a ground source as specified in Division 26 Section "Grounding", and in accordance with NEC
 - 2. Bond shields and drain conductors to ground at only one point in each circuit.
 - 3. Ground Bus: Mount on inside of each security equipment panel. Connect ground cable furnished by Division 26 to ground bus.
 - 4. Coordinate with Division 26 the locations and the grounding requirements for the security equipment.

3.2 CUTTING AND PATCHING (SEE SECTION 01 73 29)

- A. Provide cutting, fitting, repairing, patching and finishing of installed work.
 - 1. Include installed work of other sections where it is necessary to disturb such work to permit installation of electronic systems work.
 - 2. Repair or replace existing or new work disturbed.
- B. Avoid cutting, where possible, by setting sleeves or frames, and by requesting openings in advance.
- C. Before cutting, obtain approval of Architect.
 - 1. Use only approved methods.
 - 2. Cut all holes neatly and as small as possible to admit work.
 - 3. Do not weaken walls or floors; locate holes in concrete to miss structural sections.
- D. Locate openings and sleeves to permit neat installation of conduits and equipment.
- E. Do not remove or damage fireproofing materials.
 - 1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
 - 2. Repair or replace fireproofing removed or damaged, at no extra cost.

3.3 COORDINATION

- A. General:
 - 1. Coordinate the work with the other trades to assure that where this work interfaces to other trades, those interfaces are provided, complete and functional.
 - 2. Verify all field conditions.
 - 3. The Contractor shall work with the general contractor and the electrical contractor to oversee, design, manage, and complete the installation of all necessary conduit work for access control and security.
 - 4. Coordinate the conduit routing to the door openings and to rough in boxes for the door position switch and electrical hardware with Divisions 8, 11 and 26.
 - 5. Positioning Members: Provide additional support or positioning members as required for the proper installation and operation of equipment, materials and devices provided as part of this work as approved by the Architect or Owner without additional expense.
 - 6. Interface Devices: Provide all items necessary to complete this work in conformance with the Contract Documents or the satisfaction of the Owner without any additional expense.

7. The Contractor shall work with the general contractor and the electrical contractor to oversee, design, manage, and complete the installation of all necessary conduit work for security equipment.

3.4 INSTALLATION OF EQUIPMENT

- A. Install all equipment in accord with manufacturer's recommendations.
- B. Provide all necessary anchoring devices and supports.
 1. Use structural supports suitable for equipment.
 2. Check loadings and dimensions of equipment with shop drawings.
 3. Do not cut, or weld to, building structural members.
- C. Work performed on wood products shall require pre-drilled holes prior to fastening cable or equipment.
- D. Verify that equipment will fit support layouts indicated.
 1. Where substitute equipment is used, revise indicated supports to fit at no additional cost.
- E. Arrange for necessary openings to allow entry of equipment.
 1. Where equipment cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves or other devices to allow later installation.
- F. Installation of security electronics head end equipment shall not proceed until the progress of construction has reached the following status in the area of installation:
 1. Temperature and humidity are controlled
 2. Finished ceiling, if any, is installed
 3. Walls are prime coated
 4. Floors are either finished or sealed
- G. Installation of security electronics equipment shall not proceed until the progress of construction has reached the following status in the area of installation:
 1. Temperature and humidity are controlled
 2. Finished ceiling, if any, is installed
 3. Walls are prime coated
 4. Floors are either finished or sealed
 5. Millwork is complete
- H. Equipment installed in areas where the previously described conditions have not been met and maintained after equipment installation shall be removed and either cleaned or replaced at the Architect/Engineer's discretion.
- I. Install equipment to permit easy access for normal maintenance.
 1. Maintain easy access to switches, pull boxes, panels, receptacles, etc...
 2. Relocate items which interfere with access
- J. Provide tamper resistant security fasteners on all device plates, etc., and for all exposed fasteners, in inmate areas within secure detention perimeter. These areas include but are not limited to the following: all spaces within the vehicular sallyport, inmate sallyport, holding cells, visitation booths, movement corridors, movement elevators and court holding cell areas within secure perimeter and all other areas as directed.

3.5 PAINTING (SEE DIVISION 09)

3.6 WIRING

- A. All wiring:
 1. Point to point with appropriate terminal connections for every wire and component termination.
 2. All connections mechanically secure.

3. Clearly identify, label and tag all wiring and terminals at each junction box and each terminal end to facilitate installation and maintenance.
 4. All cables shall be labeled at both ends with both hand written notations on the cabling and machine-generated labels using easily understandable descriptions, or if numbered, documentation provided to show the termination point of both cable ends.
 5. Terminate all stranded wire with solderless, crimp on, insulated terminals properly sized for gauge and type wire and screw terminal.
 6. Identify all wire and cable clearly with permanent labels (wire tags) wrapped around the full circumference at least twice within 1 IN of each connection. Indicate the number designated on the associated shop or field drawings or run sheet, as applies. Assign wire or cable designations consistently throughout a given system. Each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations.
 7. All wiring shall be color coded. Power circuits shall be color coded in accord with NEC. Lock wiring shall be color coded to match locking device color code where possible.
 8. Coaxial Cables shall be RG-6 quad shield unless specified otherwise.
 9. Wiring of different systems shall not be placed in the same conduit raceway systems.
- B. All cable and wire:
1. Standard type available from more than one cable manufacturer
 2. Manufacturer and installer are responsible for system performance
- C. All cabling, wiring, conduits and equipment housings: In strict accordance with recommendations of equipment manufacturer; finish and color of all face plates as directed by Architect.
- D. Furnish and install all wiring and cable for Security Electronics systems, and perform all connections and equipment terminations.
1. Check each cabling system run thoroughly for opens, shorts, faults, and other discontinuities.
 2. Test each system receptacle for continuity, ground condition, and voltage level prior to allowing plug-in of system equipment.
 3. All conductors from outgoing terminal blocks in control consoles, panels and/or systems equipment cabinets to devices controlled to be continuous.
 - a. No splicing of conductors allowed.
 4. Field device terminations to be per manufacturer's requirements:
 - a. Conductor to conductor connections to be fully insulated crimp on male/female tab type or pin and sleeve type
 - b. No conical spring connectors to be used.
- E. Install electronic systems wiring in conduit 1 inch minimum, unless otherwise indicated.
- F. Conductors:
1. All conductors to be stranded
 2. 120 VAC and power supply connections: Minimum 12 GA, 600V insulation.
 3. 120 VAC and 24 VAC door power circuits: Minimum 14 GA, 600V insulation.
 4. Class 1, remote control and signaling circuits: Minimum 18 GA, 600 volt insulation.
 5. Class 2, remote control and signaling circuits: Minimum 20 GA, 300 volt insulation.
 6. Use larger wire size when recommended by equipment manufacturer or required for voltage drop.
 7. All communications wire to be rated for minimum 300 volt.
 8. Provide ground wire to all electric motor driven or solenoid locks with a rated voltage greater than 30 volts.
 9. All audio cable shielded.
- G. Wire lacing and dressing:
1. Lace, tie or harness wire and cable vertically, horizontally and at right angles to the enclosure surfaces as required herein and in accordance with accepted professional practice. Provide service loops where harnesses of different classes cross or where hinged panels are to be interconnected.

2. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections. No wire or cable shall be supported by a connection point.
- H. Boxes: Provide a 6 IN loop for all wire and cable routed through pull boxes or distribution panels. Cable loops and bends shall not be at a radius smaller than that recommended by the manufacturer. Enlarge pull boxes as necessary to accommodate this requirement.
- I. Wiring practices:
1. Non-coaxial connections: Make all non-coaxial connections (except microphone or line level) to screw-type barrier blocks with insulated crimp-type spade lugs or Kulka 3700 type barrier blocks. Use of rail mount compression terminals is allowable. Size all lugs properly to assure high electrical integrity, i.e., low resistance connections. Connect only one (1) wire per spade lug and not more than two (2) lugs per screw terminal. No "free" (i.e., stak-on) splices are acceptable. Wire nuts and/or electrical tape connections are absolutely forbidden.
 2. Security cabling and conduit penetrations into metal, including metal studs and top plates, shall use insulated bushings or grommets.
 3. Security cabling applications for walls that are typical commercial drywall construction shall be concealed within the wall partitions or door frames and may not be installed into surface mounted conduit or installed as exposed wiring unless specifically approved by Denton County.

3.7 FIELD QUALITY CONTROL

- A. Perform indicated tests to demonstrate workmanship, operation, and performance:
1. Conduct tests in presence of Architect, Owner and, if required inspectors of agencies having jurisdiction
 2. Arrange date of tests in advance with Architect, manufacturer and installer.
 3. Give minimum of 24 hours notice to all inspectors.
 4. Furnish or arrange for use of electrical energy, steam, water, diesel fuel, or gas required for tests.
- B. Repair or replace equipment and systems found inoperative or defective and retest.
1. If equipment or system fails retest, replace it with products conforming to Contract Documents.
 2. Continue remedial measures and retests until satisfactory results are obtained.
- C. Test equipment and systems as indicated for each item, unless otherwise recommended by manufacturer.

3.8 SYSTEMS OPERATIONAL TESTS

- A. Prior to the time of substantial completion, an acceptance test, witnessed by a representative of the A/E and Owner, shall be held of each system comprising the total electronic system to determine full compliance with the contract drawings. Provide all personnel, equipment, instrumentation and communication equipment and include all costs of testing in the contract.
- B. It shall be the responsibility of the Integrator to submit for the A/E's approval, a proposed "SECS Check-List" for use in final acceptance testing. This checklist shall consist of a list of individual tasks on a device-by-device basis, organized into logical groups per system being supplied; the check-list shall list each device and its associated function with a "comment" box for further description or clarification. The checklist shall be submitted not later than 90 days prior to the scheduled start of acceptance testing. Acceptance testing may not begin until the A/E has approved the form and content of the acceptance checklist.
- C. Not less than 2 weeks prior to the scheduled acceptance test, the installer/integrator shall certify in writing that the systems are installed in compliance with the manufacturer's recommendations, comply with the requirements of the contract documents and are operating correctly. The contractor shall completely fill out the A/E approved SECS Check-List that all devices and equipment have been tested and are operating correctly. These written certifications shall be

submitted to the A/E and shall signify that the total electronic system is operationally tested and ready for final acceptance testing by the A/E.

- D. Final acceptance tests of the total electronic systems shall be conducted as directed by the A/E but generally described as follows:
 - 1. Locking system shall be tested by operation of each individual locking device with status visual display observed.
 - 2. Remote control and emergency release of locking systems shall also be tested.
 - 3. Emergency lock-down shall be performed.
 - 4. Intercom system shall be tested by operation of all individual features and stations.
 - 5. Each individual alarm system and each group of alarm systems operating both individually and collectively shall be tested for alarm signal initiation, tamper signal initiation and loss of power signal initiation as directed by the A/E.
- E. The Contractor shall schedule and perform a system wide acceptance test of all access control system and security camera system components with Denton County before the project will be approved as complete.

3.9 ADJUST AND CLEAN

- A. Inspect all equipment and put in good working order.
- B. Clean all exposed and concealed items.
- C. All equipment shall be clean and dust free.

3.10 PUTTING SYSTEMS IN OPERATION - START UP

- A. Put all systems into satisfactory operation prior to final acceptance, at time agreed to by Owner and Architect.
- B. Operate all systems in good working order for period of 5 working days.

3.11 DEVICE MOUNTING SCHEDULE

- A. Dimensions are to center of device unless otherwise indicated. Coordinate outlet locations with all architectural millwork, hollow metal and/or casework elevations. Coordinate device mounting height with wainscoting where provided. Where top of wainscot or counters and device mounting height overlaps, shift device down to provide 2 IN gap between top of device and top of wainscot.

3.12 LABELING

- A. Labeling:
 - 1. Engraved phenolic nameplates for security equipment cabinets, and enclosures.
 - 2. Label all junction boxes using black permanent ink with type of system wiring installed in junction box, i.e., door controls, intercom, CCTV, etc...

3.13 EXTRA PARTS

- A. All parts that are packaged with installed devices and not used during the installation and manufacturer installation and operation instruction sheets and templates shall be saved and turned over to Denton County at the completion of the project.

END OF SECTION

SECTION 28 05 05
UNINTERRUPTIBLE POWER SUPPLY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of Drawings, General and Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

- A. Provide UPS power for all security equipment identified in the Division 28 Security Sections.
- B. Related work:
 - 1. Basic Material and Methods for Electronic Systems: Section 28 05 00.

1.3 SUBMITTALS (SEE SECTION 28 05 00)

- A. Shop drawings:
 - 1. Calculations for sizing UPS
 - 2. System tie-in details / diagrams
 - 3. Equipment location elevations indicating required NEC clearances and caster mobility
 - 4. Coordination with Division 26
- B. Product data: All components provided.

1.4 OPERATING AND MAINTENANCE DATA (SEE SECTION 28 05 00)

1.5 QUALITY ASSURANCE (SEE SECTION 28 05 00)

1.6 OWNER'S TRAINING (SEE SECTION 28 05 00)

1.7 EXTRA MATERIALS (SEE SECTION 28 05 00)

- A. Power module: (1) of each type used
- B. Battery module: (2) of each type used
- C. Panelboard breaker: (2) of each type used

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Uninterruptible power supply (Equipment Room):
 - a. Base: APC
 - b. Or approved equal
 - 2. Uninterruptible power supply (Control Room):
 - a. Base: APC
 - b. Or approved equal
 - 3. Other manufacturers desiring approval comply with Section 00 26 00.
- B. System rating:
 - 1. Size each UPS unit based on 80% of the connected load that UPS unit serves. Provide sizing calculations.
 - 2. Size each UPS system to maintain connected load for 30 minutes.

- C. Electrical characteristics:
 - 1. System input:
 - a. Voltage: 208 volts AC, 1 phase, 3 wire plus ground.
 - b. Frequency: 60 Hz.
 - c. Power factor: Unity to 0.85 lagging with full load at nominal input voltage and normal float voltage on battery.
 - 2. System output:
 - a. 120/208 volts AC, 1 phase, 4 wire plus ground.
 - 3. Output voltage regulation: The steady-state output voltage shall not deviate by more than plus/minus 3 percent from no load to full load.
 - 4. Output frequency regulation: Make UPS be capable of providing 60 Hz plus/minus 0.5 percent free running.
 - 5. System overload: Make inverter capable of supplying regulated output during overloads of 110 percent of the system rating for a period of 10 minutes or 150 percent for 30 seconds.
 - 6. System efficiency: Make over all efficiency, input to output, at least 90 percent with the battery fully charged and the inverter supplying full-rated load.
 - 7. Make Before Break (MBB) Maintenance Bypass: Provided for each UPS system for all servicing of the UPS. Make before break (MBB) bypass switch shall be provided. Transfer time to and from any internal bypass shall be no-break.
- D. Battery charger: 5 amp.
- E. Inverter:
 - 1. Low frequency PWM type using gate turn off thyristors.
 - 2. Harmonic distortion:
 - a. The inverter shall provide harmonic neutralization and filtering necessary to limit the total harmonic distortion in the output voltage to 5 percent and single harmonics to 3 percent over the entire linear load range.
 - 3. Overload:
 - a. Make inverter capable of supplying currents and regulated voltage for overloads up to 125 percent of full load current for a selected period. Make audible alarm indicate overload operation.
 - 4. Fault clearing and current limit:
 - a. Make inverter capable of supplying an overload current of 150 percent of its full load rating for 30 seconds. For greater currents or longer time duration, provide inverter with current limiting protection to prevent damage to components.
 - 5. Output circuit breaker:
 - a. Make inverter mechanically connected and disconnected from the critical load by a system automatic or non-automatic circuit breaker located inside the UPS module.
 - 6. Overcurrent protection:
 - a. Protect inverter from excessive overloads, including faults and reverse currents, by fast acting fuses to prevent damage to power SCR's.
- F. System status and control:
 - 1. General:
 - a. Provide UPS with a system status panel to provide monitoring and control of the complete system.
 - 2. System metering: Meter accuracy 2 percent or better: Provide with the capability of monitoring the following system functions:
 - a. AC input voltage
 - b. DC current
 - c. AC output voltage, each phase
 - d. AC output current, each phase
 - e. AC output frequency
 - 3. Event log: Provide event logging for power outage and alarms indicating time, date and duration.

4. System controls. Provide following controls for the system:
 - a. Bypass transfer switch
 - b. Battery circuit breaker or fuse
 - c. Alarm test/reset pushbutton
 - d. Audio alarm reset pushbutton
 - e. Emergency power off (EPO) pushbutton
 5. System alarms (latching type):
 - a. Visual alarms: Provide following system operating conditions with visual and audible alarm annunciation:
 - 1) UPS On-Line (System operating on UPS Power)
 - 2) Overload.
 - 3) Over temperature
 - 4) Low battery
 - 5) DC overvoltage
 - 6) Input power failed
 - 7) Output over voltage
- G. Enclosures:
1. House UPS and battery in free-standing, dead-front enclosures with a welded steel framework
- H. Bypass isolation switch:
1. Provide external bypass isolation switch arrangement to bypass unit and place load on utility for maintenance of UPS unit. Bypass shall be make before break configuration only.
- I. Provide either serial/Ethernet communications or hard wired (dry contacts) on status of UPS.
- J. UPS battery system:
1. Type and capacity:
 - a. Use sealed no maintenance, high-rate type batteries as the stored energy source for the UPS. Size battery system to support the inverter at rated load or the kilowatt load specified for the protection time specified.
 2. Construction:
 - a. Make each cell of the sealed, 10-year life type, assembled in heat-resistant, shock-absorbing, plastic containers with covers cemented in place to form a permanent leak-proof seal. Seal cell post and cover against creepage of electrolyte for the life of the battery. Fit covers with explosion-resistant vent caps. Equip cell terminal posts with connector bolts having acid resistant nuts. Provide sufficient sediment space so that the battery will not have to be cleaned out during its normal life.
 3. Accessories, Supply the following accessories:
 - a. Intercell, interunit, intertier, end-to-end interrack and back-to-back interrack connections
 - b. Anti-corrosion compound
 - c. Connector nuts and bolts
 4. Battery circuit breaker:
 - a. Provide UPS with a circuit breaker to disconnect the DC circuit between the battery and the inverter input.
 - b. Include a positive visible means of isolation of the battery from the rest of the system for maintenance or due to fault in the battery system.
- K. Environmental conditions: Make UPS capable of withstanding any combination of the following environmental conditions in which it must operate without mechanical or electrical damage, or degradation of operating characteristics.
1. Ambient temperature:
 - a. Operating: Plus 10 degC to plus 40 degC.
 - b. Non-operating and storage: Minus 20 degC to plus 60 degC.

2. Relative humidity:
 - a. Operating: 0 to 95 percent for temperature from plus 10 degC to plus 40 degC, excluding condensation due to temperature change.
 - b. Non-operating and storage: 0 to 95 percent, excluding condensation due to temperature change.
 3. Barometric pressure:
 - a. Operating: From sea level to 5,000 FT above sea level.
- L. Audible noise: Not greater than 51 dB.

2.2 CONTROL ROOM UPS

- A. Electrical characteristics:
 1. System input:
 - a. Voltage: 120 volts AC, Frequency: 60 Hz.
 2. System output:
 - a. Voltage: 120 volts AC, 1 phase, 2 wire, plus ground.
- B. Size UPS for a minimum 30 minute runtime. Computer, Monitor(s) and all peripherals must be connected to UPS.
- C. Locate one UPS beneath millwork at each control location.

2.3 OPERATION

- A. System definition:
 1. Make UPS automatically effect continuity of electric power within specified tolerances, without interruption, upon failure or deterioration of the normal power supply. Maintain continuity of electric power to load for an emergency period with inverters supplied by the batteries, up to the specified maximum time or until restoration of the normal power supply.
 2. A dry-contact alarm shall be transmitted to the PLC and annunciated on the associated control station upon any UPS event.

2.4 LOAD CENTER PANELBOARD

- A. Provide separate load center panelboard, 18pole Square D NQ Type Panelboard or approved equal, with main circuit breaker and branch circuit breakers for each UPS unit.
- B. Panelboard shall comply with requirements of Division 26.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install as indicated and in accord with manufacturer's recommendations and instructions.
- B. Division 26 provides connection to load side of UPS.
- C. Connect all detention electronics equipment of Division 28 to UPS system, and all controlled doors and/or devices to UPS system.
- D. Provide wiring from output of UPS to its load. Wiring to conform to NEC requirements and Division 26 requirements. Provide 20 amp red duplex receptacles where indicated and required.
- E. Provide wiring from output of UPS through MBB bypass switch to load center panelboard and from load center panelboard to loads. Wiring to conform to NEC requirements and Division 26 requirements. Provide 20 amp red duplex receptacles where indicated and/or required for power to Division 28 equipment.

END OF SECTION

SECTION 28 05 10
DETENTION AREA INTERCOM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of Drawings, General and Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

- A. The intercom system provides a means of voice communications between remote intercom and the master intercom stations, communications between master stations, as well as communication between the new housing unit and the existing intercom stations in the existing buildings. The intercom system shall integrate to the Programmable Logic Controller for annunciation and control at the security monitoring touchscreens.
- B. Related sections:
 - 1. Basic Materials and Methods for Electronic Systems: Section 28 05 00.
 - 2. Uninterruptible Power Supply System: Section 28 05 05.
 - 3. Detention Door Control System: Section 28 05 15.

1.3 SUBMITTALS (SEE SECTION 28 05 00)

1.4 WARRANTY (SEE DIVISION 01)

1.5 OPERATING AND MAINTENANCE DATA (SEE SECTION 28 05 00)

1.6 QUALITY ASSURANCE (SEE SECTION 28 05 00)

1.7 OWNER'S TRAINING (SEE SECTION 28 05 00)

PART 2 - PRODUCTS

2.1 GENERAL

- A. Acceptable manufacturers: All systems by same manufacturer, having authorized installer and service organization:
 - 1. Detention audio communication system:
 - a. Base: Tech Works
 - b. Optional: Quam, Dukane
 - 2. Detention intercom master station:
 - a. Base: Tech Works
 - b. Optional: Quam, Rauland
 - 3. Detention Speakers, backboxes and grilles:
 - a. Base: Atlas Sound
 - b. Optional: Quam, Bogen
 - 4. Detention intercom station:
 - a. Base: Quam.
 - b. Optional: Atlas Sound, Rauland
 - 5. Standalone Intercom System:
 - a. Base: Aiphone AX-Series
 - b. Optional: Commend CP 800-Series, Stentofon ACE 9400-Series

6. Wire and Cable:
 - a. Base: West Penn.
 - b. Optional: Belden or approved equal.
 7. Other manufacturers desiring approval comply with Division 01.
- B. Systems: Manufacturer factory designed and catalogued systems, designed to operate as complete, coordinated systems, including interfaces to other Division 28 systems.
1. Speaker and transformer assemblies with grilles and backboxes
 2. Power amplifiers
 3. Mixers - preamplifiers.
 4. Program input facilities.
 5. Other accessories required for specified operation of system.
 6. Include all wire, cable, conduit and fittings.

2.2 OPERATION

- A. General:
1. Provide call origination capabilities where and as specified.
 2. Provide auxiliary relays as required for paging.
 3. Provide interface to Detention Door Control System and touch screen for operational features indicated.
 4. Provide interface to video surveillance system for camera call up on intercom selection.
- B. Operation:
1. Provide incoming call annunciation as follows:
 - a. At touch screen provide tone and flashing symbol.
 2. Provide call answer as follows:
 - a. At touch screen activate intercom station selection icon causing selection icon to change state and opening talk path to the intercom station allowing listening to sound at the remote intercom station. Use of "TALK" button allows speaking to remote intercom station. At the end of conversation, resetting station selection icon causes icon to resume normal state and resets intercom.
 3. If intercom station is viewable by a camera or cameras (both sides of control doors), video shall be called up to the appropriate monitor(s) at the control station.
 4. Provide paging to and monitoring of selected areas as indicated. Page area as follows:
 - a. At touch screen activate paging selection icon causing selection icon to change state and opening talk path to the paging. Use of "TALK" button allows speaking to remote paging speakers. At the end of conversation or change of screen view to a different area, resetting station selection icon causes icon to resume normal state and resets system
 - b. Provide all page and individual zone page where indicated and at touch screen control stations. Individual zone paging shall also have group paging for the following Page Groups:
 - 1) Inmate – Zones TBD
 - 2) Staff (Non-Inmate Areas) – Zones TBD
 - 3) Public – Zone TBD
 - c. Provide zone monitoring at the touchscreen for two-way speakers shown in the contract documents.

2.3 INTERCOM-PAGING SYSTEM

- A. Detention audio amplifier:
1. EIA/TIA 19" rack mounted.
 2. The unit shall include all switching and logic control for push to talk (PTT) operation.
 3. An integral privacy tone shall be available and jumper selectable to alert the remote party that they are being monitored.
 4. All logic and control connections shall be fully PLC compatible ground sensing.
 5. Microphone inputs shall be 1000 ohms balanced, -80dBm, with phantom power.

6. The Remote Speaker Power Amplifier shall deliver 20 watts continuous power into 25 Volt loads at less than 1% total harmonic distortion.
 7. Model: Tech Works ICA-202D or approved equal.
- B. Detention audio relay board:
1. EIA/TIA 19 IN rack mounted.
 2. All logic and control connections shall be fully PLC compatible ground sensing.
 3. The unit shall have a minimum of (16) 2A DPDT relays rated to transmit 25V audio.
 4. Board shall be rated to handle 50W audio at 25V.
 5. Field device connections shall be spring clamp terminal or screw terminal type. Specialty connectors requiring a specialty tool are not acceptable.
 6. Model: Tech Works ICR-116 or approved equal.
- C. Detention intercom master station:
1. Provide a detention grade intercom master station at each SECS control station location.
 2. Vandal resistant metal enclosure including a gooseneck microphone, an integral speaker and a "push to talk" control push buttons.
 3. The console shall have a powder coated metal base with a stainless steel faceplate. The face shall be Laser Engraved to prevent wear and destruction of labeling.
 4. The microphone shall be a wide-range condenser type with unidirectional polar pattern and 12 inch gooseneck. The microphone shall operate on any 9V to 52V DC phantom power source.
 5. The speaker shall be a 3 inch water resistant 45 ohm general purpose device with ceramic magnet and a frequency response of 150 Hz- 10K Hz.
 6. Model: Tech Works DODC-1 or approved equal.
- D. Security intercom stations:
1. Speaker/microphone: 3 IN dynamic impregnated cone speaker. Waterproof and puncture resistant construction. 2.5 OZ ceramic magnet. 8 ohm voice coil impedance with 25 volt matching transformer tapped at 1/2, 1 and 2 watts.
 2. Provide 11 gauge stainless steel faceplate with three offset metal plates in front of speaker.
 3. Pushbutton switch: A single pole, single throw, momentary dry contact, moisture and damage proof with mechanical stop to protect electric switch.
 4. Provide watertight gasket and stainless steel fasteners for mounting intercom stations in outside areas as indicated on drawings.
 5. Model: Quam CIS4/25 or approved equal.
- E. VP-77 Replacement Security intercom stations:
1. Speaker/microphone: 3 IN dynamic impregnated cone speaker. Waterproof and puncture resistant construction. 2.5 OZ ceramic magnet. 8 ohm voice coil impedance with 25 volt matching transformer tapped at 1/2, 1 and 2 watts.
 2. Provide approximately 5-1/2"W x 6-1/4"H 11 gauge stainless steel faceplate with standard 2-gang cut-out and tapped screw holes for mounting of new 2-gang intercom station. Coordinate the exact plate size and mounting hole locations with the existing conditions, it is solely the contractors responsibility to ensure the replacement intercom assembly fully covers the existing hole and is mounted to vandal proof standards.
 3. Pushbutton switch: A single pole, single throw, momentary dry contact, moisture and damage proof with mechanical stop to protect electric switch.
 4. Provide watertight gasket and stainless steel fasteners for mounting intercom stations in outside areas as indicated on drawings.
 5. Model: Custom stainless steel replacement panel with Quam CIS4/25 or approved equal.
- F. Stand-alone Detention intercom stations:
1. Speaker/microphone: 3 IN dynamic impregnated cone speaker. Waterproof and puncture resistant construction. 2.5 OZ ceramic magnet. 8 ohm voice coil impedance with 25 volt matching transformer tapped at 1/2, 1 and 2 watts.
 2. Provide 11 gauge stainless steel faceplate with three offset metal plates in front of speaker.

3. Pushbutton switch: A single pole, single throw, momentary dry contact, moisture and damage proof with mechanical stop to protect electric switch.
4. Provide watertight gasket and stainless steel fasteners for mounting intercom stations in outside areas as indicated on drawings.
5. Model: Aiphone SS-series or approved equal.

2.4 PAGING SYSTEM

- A. Power amplifiers: With silicon transistors exclusively with output at less than 5 percent distortion:
 1. Frequency response 40 to 15,000 Hz plus/minus 1.5dB.
 2. Noise level 84dB below rated output.
 3. Input 400 microvolt - microphone, 0.3 volt auxiliary.
 4. Balanced or single-ended 25 volt and 70 volt outputs at a screw terminal strip.
 5. Output regulation within 2dB from no load to full load.
 6. Auxiliary voltage of 28 volts DC, lamp minimum.
 7. Unit rated 105-130 volt, 50-60 Hz.
 8. Provide 600 ohm input from paging control.
 9. Provide paging control relay to operate control zones.
 10. Size amplifiers for load requirements.
- B. Speakers:
 1. 8 IN, seamless cone type.
 2. Frequency range: 30-17,000 Hz.
 3. Power rating: 10 watt normal.
 4. Voice coil: .75 IN diameter.
 5. Impedance: 8 OHM.
 6. Transformer: Preassembled with speaker, taps of 1/2, 1, 2; insertion loss 1.0 dB.
 7. Model: Atlas Sound SD72 Series.
- C. Horns:
 1. Provide horn of weatherproof all metal construction.
 2. Provide integral switch selectable line transformer.
 3. Provide heavy gauge wire cage around outdoor speakers in recreation/exercise yards.
 4. Frequency response 375-14,000 Hz.
 5. Power rating: 15 watts.
 6. Model: Atlas Sound AP-15 Series.
- D. Speaker enclosures:
 1. Recessed enclosures:
 - a. Use in suspended ceilings and where indicated.
 - b. Non-secure areas: Atlas Sound 198-8-5.
 - c. Secure areas: Atlas Sound 193-8-5.
 2. Surface mount enclosures:
 - a. Exterior finish: Baked white enamel.
 - b. 16 GA cold rolled steel, 10-5/6 IN square.
 - c. Atlas Sound SE161-R.
 3. Grilles:
 - a. Non-Secure areas: Atlas Sound 161-8.
 - b. Secure areas: Atlas Sound VP161-white.
 4. Provide mounting hardware to secure speaker to grill and grill to back box.
 5. Attach with security fasteners. See Section 28 05 00.

2.5 WIRE AND CABLE

- A. Provide wire and cable for operation described. Provide separate cable for each intercom station.
- B. Intercom with Call-In: Minimum 22 GA.; one shielded pair/one unshielded pair.
- C. Call-In: Minimum 22 GA.; one shielded pair.
- D. Paging: 22 GA.; one shielded pair.

PART 3 - EXECUTION

3.1 INSTALLATION (SEE SECTION 28 05 00)

- A. Connect to UPS system.
- B. Install in accordance with manufacturer's instructions.
- C. Install all wiring in metallic conduit, minimum 3/4 IN, dedicated for intercom and paging, speaker wiring only. Wiring shall be installed without splices.
- D. Install intercom and call-in stations at +48 IN above finished floor.
- E. Adjust all amplifier controls for optional performance as determined by the Owner's representative.
- F. Provide all necessary interfacing to the Touchscreen and PLC Control Systems.

3.2 TESTING (SEE SECTION 28 05 00)

END OF SECTION

Denton County
Kitchen & Laundry Addition
DETENTION AREA INTERCOM SYSTEM
28 05 10 - 5

SECTION 28 05 15
DETENTION DOOR CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of Drawings, General and Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

- A. Related sections:
1. Door Hardware: Division 08.
 2. Detention Hardware and Equipment: Section 11 19 00.
 3. Basic Material and Methods for Electronic Systems: Section 28 05 00.
 4. Uninterruptible Power Supply System: Section 28 05 05
 5. Detention Intercom System: Section 28 05 10.
 6. Video Surveillance System: Section 28 23 13.
 7. Lighting Control: Division 26
 8. Plumbing Water Control: Division 22.
- B. The touchscreen control system integrator shall provide training of operational, administrative and maintenance functions for the touchscreen control system through the Electronic Systems Integrator.
- C. Operational training shall be provided to Owner/User staff on the Demonstration Station and include multiple preprogrammed scenarios to train and test each function of the operational system.
- D. Administrative training shall be provided to Owner/User staff in all functions and responsibilities assigned to the Administrative Station of the touchscreen control system. Full written documentation shall be provided for back up support.
- E. Maintenance training shall be provided to Owner/User staff in all maintenance of hardware and software. The maintenance staff shall participate in both operational and administrative staff training prior to maintenance training.

1.3 SUBMITTALS (SEE SECTION 28 05 00)

- A. Shop drawings:
1. Complete wiring diagrams of components.
 2. Prior to preparation of shop drawings for control wiring and locking control review electrical requirements of all electric operated security devices, i.e., electric locks, position switches, and door operators to be installed on this project.
 3. Submit, with shop drawings, written certification that control wiring and locking system control have been coordinated with security hardware (Section 11 19 00) and Door Hardware (Section 08 71 00) and the existing security hardware. Certification letter shall read as follows: "(Integrator/Contractor's name) has reviewed all electrical characteristics and control wiring requirements of all electric operated security devices, i.e., electric locks, electric sliders, position switches, door operators, lighting controls, intercom controls, etc., to be installed and/or integrated in this project and has incorporated all modifications and revisions required to provide a completely coordinated control system."
 4. No submittal review will be conducted until receipt of certification.
 5. Security Electronics Control System (SECS):

- a. A meeting shall be arranged at the Owner's site to discuss operational and functional issues relating to the design of the Graphics prior to creating the maps for the submittal process outlined below.
- b. Shop drawings: (Submittal Review Meeting):
 - 1) Full size layout of each graphic map
 - 2) List of system integrator suggested modifications to graphic maps.
 - 3) List of system integrator suggested system enhancement.
- c. Demonstration:
 - 1) Upon preliminary approval of the graphic maps, the Electronic Systems Integrator shall fabricate and program a fully functional control station demonstration unit with all maps, icons, and functions as required by these contract documents.
 - 2) A/E demonstration: The Electronic Systems Integrator shall provide a fully functional control station demonstration unit to the A/E which fully demonstrates the operational capabilities of the system. The A/E shall have a review period of at least two weeks to review the functionality. At the end of the review period, the A/E will provide the Electronic Systems Integrator with a listing of modifications and/or adjustments deemed appropriate for the proper operation of the unit.
 - 3) Upon completion of the A/E review, the Electronics Systems Integrator shall make all modifications and/or adjustments listed by the A/E at no additional cost to Owner and update the control station unit for re-test by A/E.
 - 4) Owner review: Upon completion of the modifications and/or adjustments listed by the A/E and re-test, the Electronic Systems Integrator shall set up the demonstration unit at the offices of the Owner and demonstrate the operational capabilities. The unit shall remain at the offices of the Owner for a review period of 20 days. At the end of the review period, the A/E will provide the Electronic Systems Integrator with a listing of modifications and/or adjustments deemed appropriate for the proper operation of the unit.
 - 5) Upon completion of the Owner review, the Electronic Systems Integrator shall make all modifications and/or adjustments listed by the A/E and update the demonstration station with software and hardware as required at no additional cost to the Owner. The demonstration station shall remain at the offices of the Owner until the time of substantial completion to be used in staff training.
 - 6) Upon substantial completion, the demonstration unit shall be installed in the facility for the purpose of training. The station shall be connected as an additional station on the system. Control from the training station shall be inhibited, that is no devices can be operated from this station. All other functions shall be fully emulated.

B. Any deviation from this specification must be submitted as a substitution request.

C. Project information:

- 1. Where word logic or multiple instructions are used, an example shall be shown for the individual function.
- 2. Communications diagrams and programming shall be provided for review.
- 3. The proposed interface to the touchscreen computers shall be described in detail. Programming interfaces to the touchscreen and all ancillary devices shall be identified and approved.
- 4. Communication protocols, commands and interfaces between computers and the PLC network shall be fully explained and documented.

1.4 QUALITY ASSURANCE (SEE SECTION 28 05 00)

1.5 WARRANTY (SEE DIVISION 01)

1.6 OPERATING AND MAINTENANCE DATA (SEE SECTION 28 05 00)

1.7 OWNER'S TRAINING (SEE SECTION 28 05 00)

- A. Provide training of Owner personnel in proper operation, maintenance, and installation of touchscreens, devices and PLC programming.

1.8 EXTRA MATERIALS (SEE SECTION 28 05 00)

- A. Deliver spare parts in protective wrapping and packaging for proper storage.
- B. Provide the following spare parts:
 - 1. PLC input modules: (2) of each type used.
 - 2. PLC output modules: (2) of each type used.
 - 3. All software: (1) full backup.
 - 4. Relays: (25) of each type used.
 - 5. Fuses: (25) of each type used.
 - 6. Power supply: (2) of each type used.
 - 7. Specialty boards or components: (2) of each type used.
 - 8. PLC controller CPU with back-up disc: (1) of each type used.
 - 9. Complete Control Station: (1) complete control station including all software, hardware, monitors, cables, and any other peripheral devices necessary.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Acceptable integrators for the security electronics control system (SECS) with integrated programmable logic control system:
 - 1. SECS integrators:
 - a. MCS (Argyle Security Group), San Antonio, TX.
 - b. Trentech (Cornerstone Electronics), Montgomery, AL.
 - c. Com-Tec, Appleton, WI.
 - d. Engineered Control Systems, Spokane, WA
 - 2. Programmable logic controller (PLC):
 - a. Base: Omron.
 - b. Optional: Allen-Bradley, Schneider/Modicon
 - 3. Server:
 - a. Base: Dell
 - b. Optional: HP, no exceptions.
 - 4. Control Station:
 - a. Base: Dell
 - b. Optional: HP, no exceptions.
 - 5. Control station Security Electronics Control System (SECS) Software:
 - a. Base: Wonderware
 - b. Optional: Indusoft, no exceptions.
 - 6. Systems Equipment Cabinets (SEC):
 - a. Base: Middle Atlantic
 - b. Optional: Home Inc., Lowell
 - 7. Relays:
 - a. Base: Finder
 - b. Optional: Omron, IDEC
- B. Other manufacturers desiring approval comply with substitution procedures.

2.2 TOUCHSCREEN CONTROL SYSTEM

- A. General description and system overview:
1. Provide a complete integrated control and monitoring system for human machine interface at locations indicated on the drawings utilizing control stations integrated with programmable logic control system. System configuration shall be such that failure of a single component shall not render the system inoperative. Provide all labor, equipment, materials and supervision to install, calibrate, adjust, document and test the total system as required herein and as indicated on the drawings.
 2. The control station shall be connected to the network of the programmable logic controllers for high speed throughput for security systems operation.
 3. The control station system shall be a Windows based Wonderware system. The software shall be programmed and tailored to the specified functions and features described herein and shown on the drawings including existing functions. The SECS integrated control and monitoring system shall be compatible with the electronic control system and function in conjunction with all electronic security systems to display, control and monitor all devices and functions. The control station is for operator interface only; all other standard functions of the operating system platform shall be inhibited. All control functions are to be controlled by the PLC.
 4. Control station graphic displays shall be created to match the existing Jail Tower icons/color schemes and display all areas of the facility/site. The contractor should not assume electronic files of building floor plans are available. Displays shall include but not be limited to the following:
 - a. Communications systems: Intercom call-up, audio select/reset, audio monitor.
 - b. Security control systems: Open/stop/close, lock/ unlock, group assign/unassign, group release, emergency release, door alarms, local control alarm/enable/disable, duress alarms.
 - c. Video surveillance systems: Video select, automatic or manual video taping, selection of full or quad scenes where quad displays are used, setup of sequences.
 - d. Utility Functions: Power and lighting control
 - e. System alarms: UPS alarm, PLC trouble, PLC alarm (See UPS Specification for detailed Alarm capabilities.
 - f. Each building floor level and site plan to a designated scale. All floorplan graphics shall be displayed at the same scale.
 - g. The function bar, intercom queue and alarm queue shall be located at the bottom of each map (not on the side).
 - h. Special function maps shall be developed for life safety and emergency egress operations. Identification of smoke zones and paths of egress shall be identified on a series of maps. Control and monitoring of doors in the paths of egress shall be available from this screen.
 - i. Page zones shall be color-coded shaded floorplan areas of the rooms or areas that will be included in the given page zone.
 - j. Utility control icons shall be available on map at all times.
 - k. CCTV monitor output selection shall be available at all times in the function bar, the user will be able to choose which available monitor camera selection will be routed to.
 5. Maps for functional areas shall be designed in order to minimize the quantity of maps and display as much of the functional area as possible on a single map.
 6. Background of display, Graphic floorplan display, text and icons shall match existing Jail Tower color schemes, or as otherwise confirmed by A/E.
 7. All control icons (switch functions) used shall be of size that will facilitate a positive selection point. The minimum size shall be 0.5 IN square. All status indicators shall be a minimum of 0.1875 IN in diameter, or equivalent square or rectangle.
 8. Coordinate map orientation with user position at touchscreen station.
 9. Control of functions shall be by the touching of icons on the graphic display. Each icon shall be distinct for its assigned function and consist of distinct symbols and colors. Each change of status shall include that for both selection (confirmation of touch input) and verification

(confirmation from controlled device). Touching of an icon shall initiate an audible tone for confirmation.

10. Any change in status or state of an icon shall be indicated by a different color, for example, control station icons status on a common network shall show gray when logged off, green when logged on, yellow when taken over, and red when in duress. This is typical for all icons.
 11. Selection of any icon shall initiate an audible tone for selection confirmation.
 12. Graphic map hierarchy and access shall be both operator and event driven. The system shall allow the operator to move between functional area maps via the floor, building or site maps, and move between maps within a functional group by touching the area of the functional map that is desired. The system shall also allow events to drive the map movement when the event is acknowledged by the operator.
 13. Icons for activation or access to global functions shall be selectable on each map. Upon selection, these functions shall be displayed in a window over a portion of the displayed map, or a separate display with automatic return to the previous map upon selection of the global function. Global functions shall include, but not be limited to:
 - a. Interlock override
 - b. Emergency release
 - c. Emergency lockdown
 - d. Group cell release
 - e. Alarm silence/reset
 - f. Control Area duress
 - g. Paging
 - h. Camera selection
 14. The system shall allow the operator to move between functional area maps via the floor, building or site maps, and move between maps within a functional group by selecting the area of the map that is desired. Left/Right, and Up/Down arrows shall be placed on each map to allow movement through the facility. The system shall also allow events to drive the map movement when the event is acknowledged by the operator.
 15. The interaction time between system input at the control station and the activation of a field device shall not exceed one-half (0.5) second. Similarly, the interaction time between field input device and display on the control station shall not exceed one-half (0.5) second.
 16. No increase in reaction time for the system shall be acceptable due to multiple screens on line or due to combination of functional areas.
 17. The software shall provide on-line utilities, accessed through the system utilities function icon. These utilities shall provide the operator with the ability to edit and update required data bases, system operating variables, report configuration and generation, alarm tags and point descriptions, etc. These utilities shall be protected by security levels and password requirements.
 18. Integrator's Company name/Logo can only appear once on start-up screen. All other screens shall not have any logo or company name displayed.
 19. Home screen and screen saver shall include facility name and an Owner provided logo.
- B. All applicable components shall meet FCC Class B Computing Device standards and be UL and C.S.A. listed.
- C. All touchscreen equipment and software shall be non-proprietary in nature and readily available for purchase directly from multiple sources.

D. System configuration:

1. The interactive touch screen control system consists of touch screen operator interface console which shall be connected to each other via a fiber optic local area network. The programmable logic control system shall communicate with the touch screen operator

interface consoles via direct connection to its local touch screen operator interface console. The programmable logic control system shall have its own communication circuit linking all of the PLC's together.

- a. Touch screen operator interface consoles (TIC): The TIC shall serve as the graphic based operator interface between the corrections officer and the facility's locking controls system and the security subsystems as specified herein.
 - b. Programmable logic control system (PLC): The PLC shall provide all necessary logic transactions required to implement the functions and features of the locking control system and the security subsystem as specified herein. The PLC shall be distributive in nature and a standard product of one manufacture.
 - c. A dedicated file server shall be utilized to control the TIC local area network.
2. Server minimum hardware requirements:
 - a. Processor: Intel Pentium 1403 v2 2.60GHz, 6M Cache, 2C, 80W, Max Mem 1333MHz
 - b. Memory: 4GB RDIMM, 1600 MT/s, Low Volt, Single Rank, x8 Data Width
 - c. Hard Drive: 500GB 7.2K RPM SATA 3Gbps 3.5in Cabled Hard Drive
 - d. Size: 1RU
 - e. NIC: LAN speed 1000 Base T.
 - f. Misc: All necessary boards for integration to local area network, PLC's, mouse, control station, Ethernet, etc., shall be provided.
 - g. Server: Dell PowerEdge R320 or A/E approved equal
 - h. KVM: Aten CL1000M or A/E approved equal
 3. The touchscreen operator interface console (TIC) shall consist of the following minimum requirements. Provide a TIC that meets these requirements, as well as the minimum requirements as specified by the manufacturer of the software utilized on the TIC:
 - a. Processor: Intel Core i5-3470 Processor (Quad Core, 6MB Cache, 3.20GHz w/HD2500 Graphics)
 - b. Operating System: Windows 7 Professional English 64bit
 - c. Memory: 4GB1 DDR3 SDRAM at 1600MHz
 - d. Hard Drive: 500GB 3.5 6.0Gb/s SATA with 16MB DataBurst Cache
 - e. NIC: LAN speed 1000 Base T.
 - f. Misc: All necessary boards for integration to local area network, PLC's, mouse, control station, Ethernet, etc., shall be provided.
 - g. Computer: Dell OptiPlex 7010 Desktop or A/E approved equal
 - h. Monitor: ELO 24" 2401LM Monitor or A/E approved equal
 - i. Soundbar: Dell Stereo Soundbar AX510 or A/E approved equal
 4. Surface wave touchscreen overlay (SAW):
 - a. The SAW shall utilize a single glass panel design with no front layers or coating. The
 - b. The SAW shall have a minimum activation force of 2-3 OZ.
 5. LAN type:
 - 1) See Division 27 specifications for communications wiring details.
- E. Software License requirements:
1. All software licenses shall be transferred to the Owner at completion of the project. This shall include but not be limited to all original installation disks, software manuals, software development packages, runtime licenses, equipment manuals, etc.; all project specific application software shall be provided as part of the O&M manuals.
 2. Any modifications made to the software during the warranty period shall be updated and provided to the owner at the end of warranty period. All passwords to include "master" or "Super User" Passwords shall be provided to the owner at the completion of the project.
- F. Minimum software base requirements:
1. The software shall be an off-the-shelf package available through a distributor network. The off-the-shelf software shall be programmed and tailored to the specified functions and features described herein and shown on the drawings. Custom or proprietary software code will not be approved.

2. The software shall provide on-line utilities, accessed through the system utilities function icon. These utilities shall provide the operator with the ability to edit and update required data bases, system operating variables, report configuration and generation, alarm tags and point descriptions, etc. These utilities shall be protected by security levels and password requirements.
 3. The software shall automatically align and adjust the SAW during the boot-up sequence of the TIC without interaction of the correctional officer.
 4. All software licenses shall be transferred to the Owner at completion of the project. This shall include but not be limited to all original installation disks, software manuals, software development packages, runtime licenses, equipment manuals, etc.; all project specific application software shall be transferred at the end of warranty period.
- G. Additional programming: The Electronic Systems Integrator shall include all associated costs for forty (40) hours of site specific program changes to the system. Integrator shall also provide unit price for additional eight (8) hour block of on-site programming time. Integrator personnel shall be on site for 25 percent of this programming time.

2.3 TOUCHSCREEN SYSTEM FUNCTIONS

A. General:

1. All touches of the screen and calls for events shall be annunciated by both visual and audible means.
2. Each icon shall be distinct for its assigned function and consist of symbols and colors. Each change of status shall include that for both selection (confirmation of touch input) and verification (confirmation from controlled device).
3. Window for global and auxiliary functions shall be displayed in a location on the screen that shall not impede the viewing of the underlying map.
4. A date and time function shall be displayed continuously on the screen. Reset of date and time shall be accomplished globally from the Administrative Station.
5. All system actions shall be logged to the operations log with the following minimum information:
 - a. Time and date of action
 - b. Action point name
 - c. Operator performing action
6. Alarms and events shall be stacked in a queue by order of receipt and priority level.

B. Communication systems:

1. Communication with remote intercom stations shall be simplex with use of a push-to-talk button, or icon, to control direction of speech.
2. A call from a remote intercom station shall cause an event to be displayed on the touchscreen display. Acknowledgment of that event shall cause the map for the area of the call to be displayed and the associated icon to be identified. Touching the icon shall open the audio channel to a listen mode and cause the camera(s) viewing the area to be displayed on adjacent video monitors. Reset of the communications path shall be accomplished by touching the icon a second time, response to another event, or movement to another map.
3. Intercom calls shall be stacked in a queue by order of receipt. Intercom calls from station with a higher priority level assignment shall precede those of a lower priority level when received and be placed in the top of the queue stack.
4. Paging shall be accomplished by moving to the selected map, screen or window. Touching the icon shall open the audio channel. Communication to the paging speakers shall be accomplished by activating the push-to-talk button and speaking into the microphone. Reset of the communications path shall be accomplished by touching the icon a second time, response to another event, or movement to another map.

C. Control systems:

1. Normal operation of detention swing door(s) or full function sliding door(s) with electric locking device(s) shall be such that selecting the icon shall initiate an unlock command. The locking device(s) shall be controlled to withdraw the lock bolt and hold withdrawn for a

preset period of time (set at three seconds) and then released. Motor operated devices shall use the half cycle switch function of the lock to accomplish the hold back position.

2. Group release operation of cell doors shall cause all selected cell doors within a selected group to unlock and remain unlocked until the cell door is opened, at which time the lock bolt shall be extended for re-locking upon closing of cell door. If cell group selection is deactivated or individual cell is removed from selected group, cell unlocking function shall return to individual door unlocking requirements.
3. Emergency release operation shall be configured as a release per housing pod to release the cell doors only in that pod. Cell swing and sliding door(s) shall be such that simultaneously selecting a combination of icons (at least two) shall initiate an unlock command. The locking device(s) shall be controlled to withdraw the lock bolt and hold withdrawn until the icon is selected a second time. Motor operated devices shall use the half cycle switch function of the lock to accomplish the hold back position. Emergency release of a group of doors total operation time for the group shall not exceed ten (10) seconds. Emergency release function shall not cause locks to continuously cycle.
4. Normal and emergency egress operation of full electric sliding devices shall be such that selecting the "open" icon associated with a door will cause the door to stop momentarily (if moving) and then open. Selecting the icon while the door is in movement shall cause the door to stop. Selecting the "close" icon when the door is not secure shall cause the door to stop momentarily (if moving) and then close to a secure condition.
5. High-security doors shall be user defined doors (such as maximum security cell doors) that will require additional confirmation and privileged user access to open. When a door that is categorized as "High-Security" is unlocked a secondary confirmation window will be displayed with a yes or no icon. If yes is selected the door will be unlocked.
6. Monitoring of the status of selected doors shall be displayed on the applicable map. The open contact position of the lock bolt switch or the door position switch shall indicate an unsecured status. The closed contact position of the lock switch and the door position switch shall indicate secure status. Any door left ajar after its assigned time delay shall report as an event requiring operator acknowledgment.
7. Provide interlock function for all sallyport/vestibules with controlled and/or monitored doors. Through the control station system, provide an interlock alert and override function. When an attempt is made to open an interlocked door while another door of the interlock group is non-secure, a message shall be displayed indicating interlock is engaged. An interlock override function shall be accessible from the screen that will allow defeat of the interlock. A user must have privilege to override an interlock. When interlocks are overridden a record of time, date and operator shall be made to logging database.
8. Doors shall have a user level controlled shunt function associated with the alarm to "shunt" or inhibit the alarm on from annunciation on the control station.
9. Control of devices of other systems such as lighting, water, receptacles, phone, and other circuits shall be accomplished with icons assigned for such functions. Touching the icon shall alternately turn on/off the circuit.
 - a. Water Control shall be provided via interface to Division 22 Water Control System.
 - b. Furnish lighting control panel interface in accordance with the Division 26 lighting control panel manufacturers requirements.
10. Door timers shall be user settable/adjustable via a user-friendly timer adjustment screen. The privileged access user shall have the ability to adjust timers individually or universally for unlock/open, door prop, and other special timer features.

D. Staff alarm systems:

1. Upon activation of a personal alarm device (i.e., panic button, duress, personal alarm) an event shall be indicated at the control station. Upon acknowledgment at the master control station, the associated map shall display. Where video surveillance is provided for the affected area, the video image shall be displayed on the spot incident monitor and start video taping of scene.
2. Provide alarm silence/reset functions.
3. Duress-panic alarms shall annunciate via PLC system to control stations.

4. Each Control Station shall have a red "Duress" button available from every graphic map including welcome screen and log on map.
- E. Video surveillance system:
 1. Icons for cameras shall be located on the graphic in their approximate location and/or in a location that will support the operation of a remote device (i.e., intercom, door). Touching the icon shall cause the video image to be displayed on the spot monitor.
 2. Provide camera controls for pan, tilt, zoom, quad split display, and video taping shall be available in a window on the screen when called by the operator.
 3. Provide graphic depicting camera locations for the entire facility. Touching the camera icon shall cause that particular camera to be displayed.
- F. System alarms:
 1. Annunciation of UPS alarms (i.e., on-line, trouble, battery low) shall be provided.
 2. Annunciation of electronic control system alarms (i.e., PLC failure, processor failure, communications failure, low battery, network, etc.) shall be provided.
- G. Provide "Clean Screen" icon which when activated will clear screen (except for this icon) to allow cleaning of screen. Selecting icon a second time will bring screen back on line.
- H. Provide "Help" icon which when activated will bring dialog boxes up to explain use of each icon and what it represents.

2.4 PROGRAMMABLE LOGIC CONTROLLER (PLC)

- A. The PLC shall control all input/output functions of the TICs and associated remote control devices. The PLC shall provide interface between the TIC's and related systems.
 1. PLC shall be capable of expansion for future housing unit door controls. Expansion capability shall be unlimited.
- B. The PLC shall be general purpose in nature and not custom designed for specific application. The PLC shall become location and operation specific upon installation of input/output modules and programming.
- C. Except as otherwise specified herein, the equipment and materials of this section shall be product(s) of a single manufacturer engaged in the production of logic control systems for industrial applications for a minimum of ten (10) years.
- D. General: Logic control system shall be programmable controllers, which shall control building input/output functions in addition to interfacing with TICs.
- E. All programmable logic controllers shall be the products of a single manufacturer.
 1. All controllers shall meet the requirements of this section.
 2. All controllers shall utilize the same instruction codes and commands.
 3. Touchscreens shall directly communicate to the controller via communications port.
- F. Controller construction:
 1. The programmable logic controller, power supply and I/O modules shall be of modular construction, enclosed in a protective housing, which is capable of being rack mounted or back mounted.
 2. Each I/O module shall be a self contained unit housed within proper placement and polarity. All identical function modules shall be coded alike.
 3. The controller shall be constructed to withstand as a minimum, the following climatic conditions, without the need for special enclosures or additional environmental control equipment such as fans or air conditioning.
 - a. Temperature: 0 to 60 C.
 - b. Storage Temperature: -40 to 70 C.
 - c. Humidity: 10-90 percent relative humidity (non-condensing).

4. All controllers and I/O structures of a single manufacturer shall be capable of being mounted on the same size fixing center to allow for larger capacity controllers to be installed in the future should the facility require an expansion beyond the limits specified in the original contract documents.
 5. All input/output modules and racks must be of a standard type and be fully interchangeable with all size controllers.
 6. All controllers shall have built-in comprehensive self-test and self-diagnostic capabilities.
 7. All controllers shall be equipped with built-in "watchdog" relay contacts. These contacts shall be normally open dry contact, which will remain closed during normal controller operation and open in the event of a controller fault, sensed by the controller's built-in self diagnostics.
 8. All controllers shall be equipped with built-in status indication of the following information:
 - a. Power applied to the system
 - b. DC power valid (+5, +15, -15 VDC)
 - c. Watchdog contacts healthy
 - d. Serial port(s) active
 - e. Ram battery failure
 - f. EEPROM program failure
 9. All I/O cards shall be 24V dc and each card shall have as minimum thirty two (64) discrete circuits. No direct wiring to the front of the module should be required. A separate wiring harness should be available with a D-type connector on one end (for connection to the I/O module) and a "fan-tail" on the other for screw down connection. Each PLC output shall be fused.
 10. At each location that I/O is installed provide a minimum of 25 percent spare input points and 25 percent spare output points.
 11. Controllers must be capable of driving local I/O, where local is defined as up to fifty (50) FT from the control unit, without the need for further intelligent interface modules.
 12. When required, the system must be capable of controlling remote I/O up to a distance of ten thousand (10,000) FT from the controller, using high speed links with a minimum data rate of one hundred and eighty (180) Kbaud. Communications over this link shall be accomplished using twisted pair wires with an overall shield.
- G. The controller CPU's shall communicate to and from the I/O interface boards.
1. Provide spare PLC controller CPU which shall be rack mounted.
- H. Functional requirements:
1. The system software shall be stored in EEPROM and the operating software and all data bases shall be stored in battery backed RAM.
 2. Memory shall be expandable in segments up to 512K words. Each memory segment shall be field expandable up to the maximum amount of RAM allowed in the programmable controller. Memory battery back-up shall be for a minimum period of twelve (12) months in the event of a power failure.
 3. The controllers shall provide all necessary logic functions, timing functions, input points, output points, memory, communication capabilities and software for the operating features shown in the contract documents.
 4. Functions shall include, but not be limited to, the following, which can be implemented in bit logic, word logic or a mixture of both bit and word logic sufficient levels, variations and quantities to provide the operating features shown in the contract documents.
 - a. Logical AND, OR, XOR, INVERT
 - b. On/Off delay
 - c. Counters
 - d. Timers
 - e. Sequencers
 - f. Four function math (add, subtract, multiply, divide)
 - g. BCD inputs and outputs
 - h. Contacts
 - i. Coils

- j. Block instructions (conditional jumps)
 - k. Group logic functions
 - l. Array math functions
 - m. ASCII and control structures
5. All data can be displayed in either binary, hexadecimal, decimal, or ASCII forms.
 6. Communication capability shall be provided in logic controllers to allow serial communications between distributed control systems. Serial communications shall be RS232, RS422, or 20ma and shall operate at selectable speeds from 110 to 9600 baud. Communication ports shall be configurable as a data link between controllers, encoders, a VDU port or printer port. As a minimum, two communications ports shall be available as in-built to each controller selected.
 7. Provide real time clock.
- I. Provide all necessary power supplies to power all components of PLC system. PLC power supplies shall be dedicated to the PLC and supplied by UPS. Include battery back-up power to maintain random access memory (RAM) in the processor.

2.5 POWER SUPPLIES

- A. Provide power supplies as required for power locks, control indication functions and all equipment associated with Division 11 detention hardware. Power supplies shall conform to requirements of NEC Article 725. Provide overcurrent protection of primary and distribute secondary overcurrent protection for secondary wiring circuits.
 1. Class 1 power supplies shall be provided with overcurrent protection as required by NEC Article 725. Provide overcurrent protection for all conductors in accordance with ampere rating. Minimum conductor size served by a Class 1 power supply shall be 14 GA.
 2. Class 2 power supplies shall be power limited and/or overcurrent protected in accordance with NEC Article 725. Nameplate rating of power supply shall not exceed limits indicated In NEC Article 725. Minimum conductor size served by a Class 2 power supply shall be 20 GA.
- B. Power source (120 VAC) for equipment shall be provided by uninterruptible power supply (UPS). Provide terminals for all incoming circuits provided. Distribute load equally among all circuits provided.
- C. All door locks and sliders shall be powered from the UPS system.

2.6 SYSTEMS EQUIPMENT CABINETS (SEC)

- A. Install all components of electronic systems in systems equipment cabinets with hinged door(s), handle and key lock. All enclosures keyed alike.
- B. Install engraved nameplate on each enclosure with system designation.
- C. Equipment Racks:
 1. EIA compliant 19" gangable equipment rack fully welded construction shall provide a static load capacity of 10,000 lbs. and a UL Listed 2,500 lb. weight capacity.
 2. Top and bottom construction: 14 GA steel.
 3. Side panels and horizontal braces: 16 GA steel.
 4. Rackrails: 11 GA steel with tapped 10-32 mounting holes in universal EIA spacing.
 5. Doors: 16 GA, flush mount; plain or louvered, flush pulls.
 6. Panels: 16 GA, flush mount; plain or louvered, quick removal.
 7. Colors: Black or White only.
 8. Use space and locations as intended and allocated on drawings.
 9. Equipment racks in equipment and control rooms:
 - a. 84-0 IN tall; 25 IN wide; 28 IN deep; quantity as required to accommodate contractors equipment in A/E designated equipment area.
 - b. Provide keyed front hinged flush door for access.
 - c. Provide louvered back plates for cabinets mounted against wall.
 - d. Provide rear hinged flush door for access when back of cabinet is exposed.

- e. Provide casters as designated on the plans.
 - f. Provide ventilation fan and fluorescent light in top panel.
 - g. Provide Middle Atlantic WRK series or A/E approved equal
10. Provide doors, blank plates, side plates, back plates, and trims needed to fill in and complete the cabinets.
- D. Provide louvers and thermostatically controlled fans at all control consoles and equipment racks/enclosures
- E. Provide electrical plug strip(s) to power 120 volt equipment as required by equipment in each cabinet.
- F. Provide florescent work lights in each cabinet.
- G. Provide cabinets completely assembled with all equipment and tested prior to shipment to job site.

2.7 NETWORK GIGABIT SWITCH

- A. All PLC, Touchscreen and video surveillance network switches will be provided by Denton County.

2.8 RELAY INTERFACE

- A. Provide relay interface between control system and all controlled devices where controlled device current exceeds capability of PLC output devices.
- B. Relays:
 - 1. Contact rating to be equal to or greater than inrush rating of motor or solenoid.
- C. Label all relays and terminations with designations to match installation and maintenance drawings.
- D. Provide individual fuse for each relay to protect relay and other circuitry from a short circuit failure at the lock or controlled device.
- E. Provide intermediate relay interface for control of all devices indicated above located in dayrooms.

2.9 REMOTE ACCESS AND SERVICE

- A. Remote access network switch:
 - 1. Base: Electro Standards Laboratories
 - 2. Optional: approved equal
- B. Located at each SECS server location to allow access from the WAN to local security LAN via switching all 8 pins of the RJ45 interface eliminating the need to plug and unplug cables and transparent to data speed and format certified for Cat6A compliance.
- C. Switching shall be accomplished locally via a front-panel pushbutton. A remotely controlled port shall be provided to accept RS232 Serial Data ASCII commands for switch management.
- D. Provide front-panel LED's to display switch position and power status.
- E. Upon power loss the switch shall retain the last switch position and continue to pass data.

PART 3 - EXECUTION

3.1 INSTALLATION (SEE SECTION 28 05 00)

- A. Connect all field wiring to terminal blocks provided. Verify all labeling and coordinate with record documents.

- B. Provide complete programming of PLC and touchscreen system to meet requirements of contract documents. EEPROM burn to occur after final acceptance.
- C. Provide ventilation for equipment. Where equipment is mounted in millwork cabinets provide ventilating fan in millwork to circulate room air into cabinet space.

END OF SECTION

SECTION 28 13 13
CARD ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of Drawings, General and Supplementary Conditions and Division 1 apply to this Section.

1.2 SUMMARY

- A. Related sections:
 - 1. Basic Materials and Methods for Electronic Systems: Section 28 05 00
 - 2. Detention Door Control System: 28 05 15
 - 3. Video Surveillance System: Section 28 23 13

1.3 SUBMITTALS (SEE SECTION 28 05 00)

- A. Product data:
 - 1. Technical data on each product, including finishes
 - 2. Description of system operation
 - 3. Riser diagrams and system data
 - 4. Equipment design considerations for future expansion, when indicated
 - 5. Materials list and backbox schedule (including unique backboxes)
 - 6. Spreadsheet for MAC addresses, numbering, and ID of devices
- B. Access control contractor shall schedule a pre-construction meeting with at least the Denton County Department of Technology Services, the General Contractor, Electrical Contractor, Door hardware contractor the architect and all other trades having coordination responsibility to review and coordinate the installation of the access control system and to review and understand the Specifications, Prints and Scope of Work.
- C. System design and layout of components, including but not limited to, access control modules, power supplies, connections, and cabling shall be approved by Denton County Department of Technology Services before installation begins.

1.4 QUALITY ASSURANCE (SEE SECTION 28 05 00)

1.5 WARRANTY (SEE DIVISION 1)

- A. General: Provide a warranty with the following minimum provisions:
 - 1. Conditions: The warranty shall cover any defects in materials and workmanship including installation and programming which shall be found during the term. This shall include any deficiencies in installation standards vis-a-vis the Specifications.
 - 2. Response: The contractor shall respond to calls for warranty service within 8 working hours. Emergency service shall be obtainable within 4 hours of notification by the Owner. Emergency service shall be obtainable on a 24 hours basis, 7 days per week.
 - 3. Qualifications: The contractor shall utilize factory trained technicians located within 100 miles of the jobsite.

1.6 OPERATION AND MAINTENANCE DATA (SEE DIVISION 1)

- A. As-built drawings shall show the cable paths, layout of the enclosures, access control modules, power supplies, and connections as well as a floor plan showing the location of all access controlled doors, card readers, access control hardware, door release buttons, and all other access control system components.

1.7 OWNER'S TRAINING (SEE SECTION 28 05 00)

PART 2 - PRODUCTS

2.1 GENERAL

- A. Acceptable manufacturer:
 - 1. Security access system:
 - a. Base:
 - 1) Lenel (To Match Existing County infrastructure)
- B. System description: Access control and monitoring system for security of building spaces, programmable for individual access cards for status level and time interval access control. System to include but not be limited to the following:
 - 1. Controller
 - 2. Card readers
 - 3. Reader terminals
 - 4. Power supplies
- C. Provide interface to the existing Lenel On-Guard access control system in use by Denton County. The contractor shall verify the current version.
- D. Denton County Department of Technology Services shall be responsible for Lenel System programming for adding access control panels to the system, card readers, access levels, time zones, and monitor zones.
- E. The contractor shall be responsible for programming all Lenel LNL-2220 Intelligent Dual Reader Control Modules with the IP address, subnet mask, default gateway, DNS servers, userids, and passwords prior to installation. Installer shall obtain IP address, subnet mask, default gateway, DNS servers, user ID's, and passwords from the Denton County Department of Technology Services. The installer shall properly configure the Lenel LNL-2220 Modules according to the manufacturer's installation instructions. In addition the contractor is responsible for programming and coordinating the local input/output functions, global input/output functions, elevator controls, alarm panels, auxiliary inputs, and auxiliary outputs.

2.2 BASIC SYSTEM CAPABILITIES

- A. Access Control
- B. Intrusion Detection
- C. Door/Gate Control
- D. Elevator Control
- E. Alarm Assessment (Instructions)
- F. Guard Tour
- G. Response Dispatch and Management
- H. Database Reports
- I. Maps displaying alarm points
- J. If/Then Functions
- K. Scheduled Events
- L. Mouse oriented operation
- M. Network alarm and access control functions
- N. Company segregated data

- O. External data interface to import initial cardholder database and export cardholder data; as well as the transactions. Utilizes ASCII flat file.

2.3 HARDWARE SPECIFICATIONS

- A. See Appendix A for Manufacturer and model numbers for components. Components listed are base manufacturer and model number. Substitutions must be submitted and approved by Denton County Department of Technology Services.
- B. Card Reader Interface Modules:
 - 1. Reader interface modules shall be dual reader LNL-1320 units as a minimum.
 - 2. Lenel Single Interface Reader Modules shall not be utilized for any access control system application without written authorization from the Denton County Department of Technology Services.
- C. Provide LNL-2220 Controllers one per building/per floor as indicated on the contract documents.
- D. Card Readers:
 - 1. Basic Card Reader with Pin Pad:
 - a. All door control card readers shall be HID iClass SE 921 NTN NEK 0002K.
 - b. Door frame, Window Frame or Mullion mounts shall NOT be used unless no other option exists (the part to be used shall be approved by Denton County Department of Technology Services prior to installation).
 - c. Reader cable through holes on exterior surfaces shall be sealed using a low odor.
 - d. HID iCLASS card readers shall be connected such that the status LED is red when the door is in locked mode and green when the door is in unlocked mode
- E. Enclosures for Lenel System components shall be Unity Manufacturing. The color shall be gray. Enclosures shall be sized appropriately for the project. All enclosures shall remain consistent in size per floor/building. See Appendix B for Enclosure details.
- F. All enclosures shall be pre-approved by Denton County Department of Technology Services and use Altronix lock #002 (p/n: LNL-Cam1) or CH751.
- G. The access control panels shall contain a battery backup system. Backup low voltage batteries shall be 12 volt DC, 12 Amp/Hour and shall be installed in the Altronix power supply enclosure. All Lenel access control modules shall be securely fastened with mechanical fasteners or plastic mounting rail “snap trap” as approved by Denton County; no double stick tape or equivalent may be used. Lenel access control modules shall be installed vertically and not horizontally in the enclosures and shall not be mounted on enclosure doors.
- H. The Lenel access control module boards shall not be mounted more than one deep (no stacking).
- G. All wire management in enclosures shall be gray Panduit duct wire management. Panduit width for duct shall be 1.0 IN, 1.5 IN, and/or 3.0 IN. The depth of the Panduit duct wire management shall be 3.0 IN. The covers for the Panduit duct works shall be cut and neatly trimmed to provide a close fit to the enclosure side walls and with other Panduit duct covers.
- I. AC-fail application on all power supplies shall be deployed and wired in series (normally-closed) to the Lenel LNL-2220 controller input for power fail notification.
- J. Battery-fail application on all power supplies shall be deployed and wired in series (normally-closed) to the Lenel LNL-2220 controller input for battery fail notification.
- K. Altronix PD8 power distribution devices shall be used to distribute power to all Lenel access control modules. Power to Lenel modules or Altronix ACM8 devices may not be electrically wired in series or daisy chained.
- L. Altronix ACM8 Access Control Module devices shall be used to distribute power to all door hardware and other access control system applications requiring 24-volt DC power, including but not limited to, PIR motion detectors, local sounder alarms, emergency exit devices (glass break), and relay switch devices. No access control power applications may be electrically wired

in series. Each access control system device and application shall have a separately fused power source.

- M. A terminal block shall be installed in the Altronix power supply enclosure and used to distribute power from the power supply/charger to the power distribution devices (Altronix PD8 and ACM8). Terminal "Strips" shall not be deployed for this application.
- N. The Altronix ACM8 access power controller device shall be used for fire alarm system, if required.
- O. Power distribution outputs for both Altronix ACM8 and PD8 devices shall be labeled to identify connections. The wiring to and from these devices shall also be labeled.
- P. The access control panels shall contain a battery backup system. Backup low voltage batteries shall be 12 volt DC, 12 Amp/Hour and shall be installed in the Altronix power supply enclosure.
- Q. Power Distribution Devices shall be installed in the Main Lenel Control Enclosure. Power distribution wiring from the power supply to the terminal block, and from the terminal block to the Altronix power distribution devices shall be 16-AWG plenum, 2-conductor wiring
- R. Enclosure Tamper Switches:
 - 1. Furnish magnetic tamper switches for all security system enclosures and equipment cabinets that are not equipped with a tamper switch from the enclosure manufacturer. All tamper switches shall be terminated to a Lenel input on the Lenel 2220 Controller Module, and monitored by the Lenel card access control system.
 - a. Securely fasten the switch and magnet to the enclosure using screw hardware. Adhesives of any type shall not be permitted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be provided by a Lenel Authorized contractor.
- B. Install all devices in locations as shown on the drawings in accordance with the standards set forth herein and in accordance with standard industry practice.
- C. Access control system head-end equipment shall not be installed into communications rooms or any other locations until the rooms have the plywood sheathing on the walls, the walls are painted (final coat), the flooring has been installed and sealed, the network data racks and ladder racks have been installed, all conduit work has been installed, all electrical work and HVAC work is complete, fire rated cable pass-through devices have been installed into wall partitions for the rooms, and a serviceable and lockable door has been installed. These requirements shall be in place to provide for cleanliness and security of all access control equipment being deployed.
- D. Remove and vacuum drywall particles, wire fragments, unused spade lugs and other debris from all J-boxes, enclosures and boxes.
- E. Readers shall be installed on the controlled side of the door in close proximity to the door handle.
- F. Readers shall be installed in compliance with ADA requirements.
- G. Door frame, Window Frame or Mullion mounts shall NOT be used.
- H. Electrified access control door hardware wiring for all electronic access control door hardware devices shall be installed and terminated by a Lenel Authorized contractor. The door hardware contractor shall initially install the electronic access control door hardware devices.

- I. Conduits for access control devices shall be routed to a small enclosure (minimum of 8 IN x 8 IN) located on the secure side of the door for doors that do not have a false ceiling space such as doors in communication rooms, equipment rooms, electrical rooms with tilt-wall construction, rooms with cinder-block wall construction and or/other types of hardened wall construction.
- J. Pre-drill all holes for work performed on wood doors, plywood, cabinets, built-in furniture, and wood-like material applications.
- K. Sheetrock anchors shall be metal. No plastic anchors are allowed for drywall installations.
- L. Metal toggle bolts shall be used for mounting devices in ceiling tiles.
- M. Greenlee Manufacturing concrete anchors shall be used for installation of card readers and any other access control devices on concrete, stone, cinder block, or brick.
- N. Metal mud rings shall be used for any installation application where a single gang drywall cut out is required.
- O. Utilize a stud finder to avoid installing parts and equipment over metal studs.
- P. Cabling penetrations through interior walls above the ceiling shall use a fire rated sleeve.
- Q. Service loops shall be installed at both ends of all cable runs.
- R. All non-terminated wiring shall be neatly coiled into enclosures and electrical boxes and/or recessed into the door frames.
- S. Plenum rated cable shall be used. Weather resistant or direct burial cabling shall be used for all exterior cable installations.
- T. The automatic door opening system contractor shall make all wiring terminations involving access control system wiring that integrates with the automatic door opening system.
- U. Multiple access control devices and applications at the door may not be electrically wired in series with the exception of the door position switches and/or other normally closed applications. Normally open applications shall be electrically wired in parallel all the way back to the access control panel and terminated at the access control panel. Power applications shall not be electrically wired in series at the door. Power applications shall be electrically wired in parallel at an appropriate point in the access control panel.
- V. Provide 24 Volt DC 10 Amp power suppliers as required. Power supplies shall be installed next to or under the access control panels, each power supply shall have it's own enclosure.
- W. Conduits shall be routed to a small enclosure (minimum of 8 IN x 8 IN) located on the secure side of the door for doors that do not have a false ceiling space such as doors in communication rooms. Conduit paths are required for, but not limited to, card readers, door position switches, door locking hardware, and request to exit switches.
- X. The color of the door position monitor switches shall match the frame they are being installed into.
- Y. The exposed magnetic part of any door position monitor switch shall not come into contact with any metal part of a door, door frame, or any other metal structure.
- Z. For doors that have a recessed top channel at the top of a door with a door position monitor switch being installed at the top of the door and door frame, recessed steel door contacts with top channel mounting magnets or rare earth door magnets shall be installed for the magnetic contact part of the door position monitor switch.
- AA. No Impact / Power Drivers (Tools) On Any Security or Door Hardware Installation Applications.

3.2 WIRING (SEE SECTION 28 05 00)

- A. 120 volt AC pig tail wiring with ground shall be 14 or 12 AWG.

- B. All 120 volt AC applications shall be grounded between the electrical system and the enclosures.
- C. The access control system shall only utilize parts and components that operate on 24-volt D.C. low voltage electrical power. 12-volt D.C. low voltage electrical power applications are not acceptable unless approved in writing by Denton County and will only be accepted for access control applications where 24-volt D.C. electrical power options are not available.
- D. Provide and install the necessary quantity of 24 volt D.C., 10-Amp Altronix power supplies with battery backup. Power supplies shall be installed under the access control panel. Each power supply shall have its own separate Altronix enclosure with the "J" designation for a size of 14.5 IN W x 18IN H X 4.625 IN D.
- E. All access control applications shall incorporate separately jacketed cabling for each access control system device/application that is being deployed. Multiple conductor cables shall not be split open for separate applications unless specifically approved in writing by Denton County. No "banana peel" cables are allowed.
- F. Denton County utilizes 802.11a/b/g/n wireless access points (2.4GHZ and 5 GHZ). Any wireless devices installed shall not interfere with the County's existing wireless frequency use.
- G. Power distribution wiring from the power supply to the Altronix PD8 devices shall be 16 AWG plenum, 2 conductor.
- H. Access panel wiring shall not be unjacketed over two inches within the Panduit duct for any application.
- I. Access Control cabling shall be grouped together and enter the communications rooms through a dedicated fire rated penetration. Maintain 40 % fill ratio within 3M fire rated penetrations.
- J. All conductors that have been exposed outside of the cabling jacket shall be wrapped with electrical tape.
- K. No wiring shall be located behind any power supply, power distribution boards, or any other enclosure device.
- L. All cable management mounts and fasteners shall be secured using an appropriate wood or metal fastener.
- M. The network cabling shall be installed as part of the facility's structured data cabling system by the County's contracted TE Connectivity cabling contractor or the contracted TE Connectivity cabling contractor associated with the project. The access control contractor is not responsible for any network data cabling related to the access control system.
- N. Denton County shall be responsible for providing network switches and PoE to Lenel controllers. (PoE, IEEE 802.3af power over Ethernet)
- O. Coordinate the work with the other trades to assure that where this work interfaces to other trades, those interfaces are provided, complete and functional.

3.3 DOOR RELEASE

- A. Wiring for accessory devices such as door release switches shall be continuous from the device to the access control panel. Each accessory access control device or application shall have its own separate dedicated cable. Accessory access control devices may not be electronically wired "in series," they must be electronically wired "in parallel."
- B. The wiring for door release switches shall enter the wall through properly sized holes in a single gang plastic cover plate. The plastic cover plate shall be secured to an electrical box or metal mud ring. Wiring shall be neatly dressed and secure from the wall to the device. Small metal straps secured with small screws shall be utilized for dressing and securing the door release switch device wiring to cabinetry, furniture, or the mounting surface. Pre-drilled pilot holes are required for installing wood screws in any wood or other surface material accommodating screws. Fastening with sticky-back tape is not acceptable.

3.4 TRAINING (SEE SECTION 28 05 00)

- A. General: Present, review and clarify all materials to the Owner and Owner's operating personnel and fully demonstrate the operation and maintenance of the systems, equipment and devices specified herein.
- B. Duration: Provide training to designated representatives of the Owner at a location convenient to the Owner. At the end of training, Owners personnel shall be able to competently use and understand the system.

END OF SECTION

APPENDIX 'A'

Manufacturer	Description	Part Number
Lenel	Intelligent Dual Reader Control Module	LNL-2220
	Dual Reader Interface Module	LNL-1320
Unity Manufacturing	Enclosure - Gray Powder Coated with Perforated Back	Type 3R CT

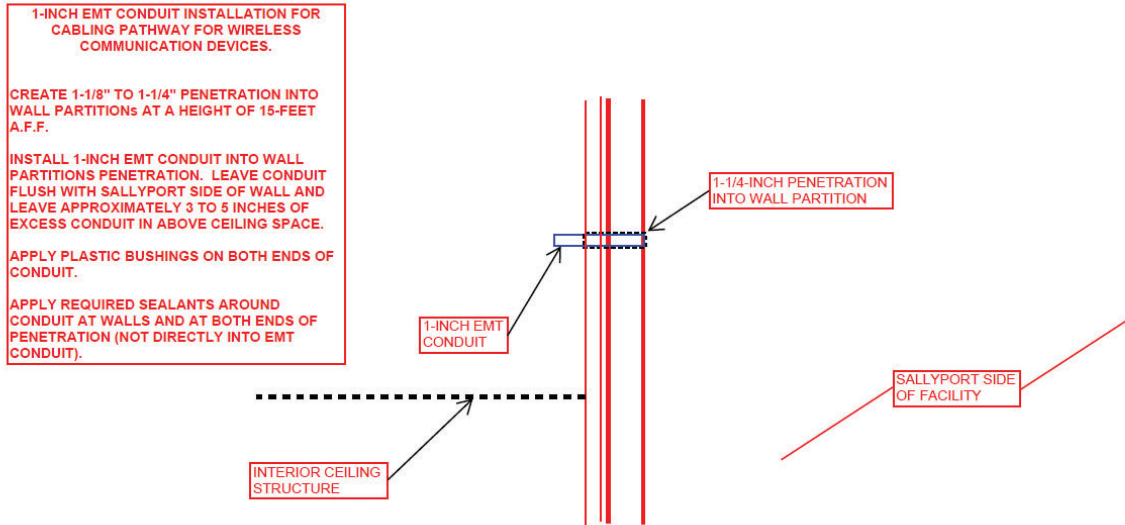
	Panel 36 IN W x 48 IN H x 10 IN D with 33 IN W x 45 IN H Back Panel with locking t-handle	
Altronix	10 AMP, 24 volt DC power supply / charger	AL1024ULX
	ACM8 Access Power Controller	ACM8
	PD8 Power Distribution Module	PD8
	BC600G Enclosure 18 IN H x 14.5 IN W x 4.625 IN D	BC600G
	"J" Designated Enclosure 18 IN H x 14.5 IN W x 4.625 IN D	
	Din Rail Bracket 10-Inch	D10
Panduit	1 IN x 3 IN PVC Ductwork Light Gray Color, Type G with slot wiring duct	G1X3LG6
	1.5 IN x 3 IN PVC Ductwork Light Gray Color, Type G with slot wiring duct	G1.5X3LG6
	2 IN x 3 IN PVC Ductwork Light Gray Color, Type G with slot wiring duct	G2X3LG6
	3 IN x 3 IN PVC Ductwork Light Gray Color, Type G with slot wiring duct	G3X3LG6
	1 IN PVC Duct Cover Light Gray Color, Type G	C1LG6
	1 IN PVC Duct Cover Light Gray Color, Type G	C1.5LG6
	1 IN PVC Duct Cover Light Gray Color, Type G	C2LG6
	1 IN PVC Duct Cover Light Gray Color, Type G	C3LG6
Page Electric	Paige Manufacturing Access Control All-In-One/Composite Cable	454932AYW
Belden	Shielded 18 AWG, 6 conductor with drain wire, plenum	
	Shielded 18 AWG, 4 conductor with drain wire, plenum	
	Shielded 18 AWG, 2 conductor with drain wire, plenum	
	Shielded 20 AWG, 2 conductor with drain wire, plenum	
	Shielded 22 AWG, 2 conductor with drain wire, plenum	
	Shielded 24 AWG, 2 conductor with drain wire, plenum	82841 or 89841
	Unshielded 16 AWG, 2 conductor, plenum	
	Unshielded 18 AWG, 2 conductor, plenum	
	Unshielded 18 AWG, 4 conductor, plenum	
3M	3M Fire Barrier Pass-Through Device - Square	98-0400-55XX-X
	3M Fire Barrier Pass-Through Device Mounting Bracket – Single, Triplex, Sixplex	98-0400-55XX-X
Manufacturer	Description	Part Number
Rutherford Controls	Door Release Button	RCI-909S
HID	iCLASS Card Reader with Keypad	HID iClass SE 921 NTN NEK 0002K
GE Security	Recessed Pin Plunger - Closed Loop, Clip Mount, White	3012-N SecurIT

	Double-Pole, Double-Throw 3/4-Inch Door Position Monitoring Switch.	1076-CD-N
	Recessed Steel Door Contacts with Top Channel Mounting Magnet.	R1078 Series
	Rare Earth Magnet for Steel Doors, 1-5/8-Inch Diameter x 5/8-Inch Long.	1840-N
	Recessed Steel Door Contact w/Wire Leads, 3/4-Inch Diameter, Closed Loop, Grey, 3/4-Inch Gap Size.	1078CW-G
	Recessed Steel Door Contact w/Wire Leads, 3/4-Inch Diameter, Closed Loop, Brown, 3/4-Inch Gap Size.	1078CW-M
	Recessed Steel Door Contact w/Wire Leads, 3/4-Inch Diameter, Closed Loop, White, 3/4-Inch Gap Size.	1078CW-N
TYCO TE	Snap-Track (For mounting module boards to the access control enclosure perforated back panel)	4TK2 Panel Mount--- 48-Inch Split-Apart
WEIDMULLER W Series	Terminal Block---End Anchors	1061200000
	Terminal Block---Main Component WDU4	1020100000
	Terminal Block---Partitions	1050180000
	Terminal Block---4-Pole Cross Connectors	1054660000
	Terminal Block---10-Pole Cross Connectors	1052060000
	DIN Rail (2-Meter Length)	051450000

END OF APPENDIX 'A'

APPENDIX "B"

EMT CONDUIT INSTALLATION DETAIL FOR CABLING PATHWAY FOR WIRELESS COMMUNICATION DEVICES



NETWORK DATA CABLING HUB ENCLOSURE SYSTEM INSTALLATION DETAIL

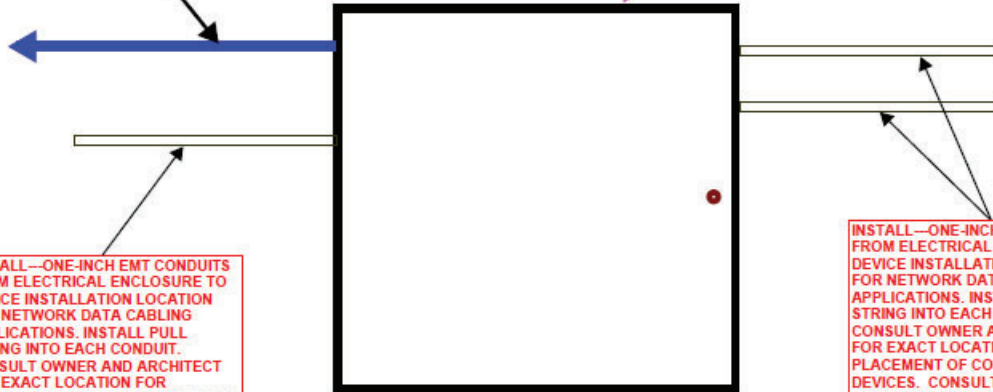
—GENERAL NOTES—

1. CONSULT APPROPRIATE "ET" SHEETS FOR NETWORK DATA CABLING DETAILS FOR CAMERAS.
2. CONSULT APPROPRIATE "EY" SHEETS FOR SECURITY CAMERA MOUNTING LOCATION DETAILS.
3. CONSULT SECURITY SURVEILLANCE CAMERA SCHEDULE IN SPECIFICATIONS SECTION 28 FOR CAMERA MOUNTING INSTALLATION DETAILS.

16" H X 16" W X 6" D NEMA RATED METAL ELECTRICAL ENCLOSURE WITH 3/4" AND 1" KNOCKOUTS AND WITH AN ENCLOSURE PANEL DOOR SECURED WITH A KEYED CABINET LOCK, TO SERVE AS A HUB FOR NETWORK DATA CABLING APPLICATIONS, INCLUDING BUT NOT LIMITED TO SECURITY SURVEILLANCE CAMERAS AND WIRELESS ACCESS POINT DEVICES.

CONSULT OWNER AND ARCHITECT FOR EXACT MOUNTING LOCATION AND MOUNTING HEIGHT OF ELECTRICAL ENCLOSURES, AS WELL AS CONSULT OWNER FOR APPROVAL OF ALL DEVICES BEING SERVED BY THE PARTICULAR NETWORK DATA CABLING CONSOLIDATION POINT ENCLOSURE.

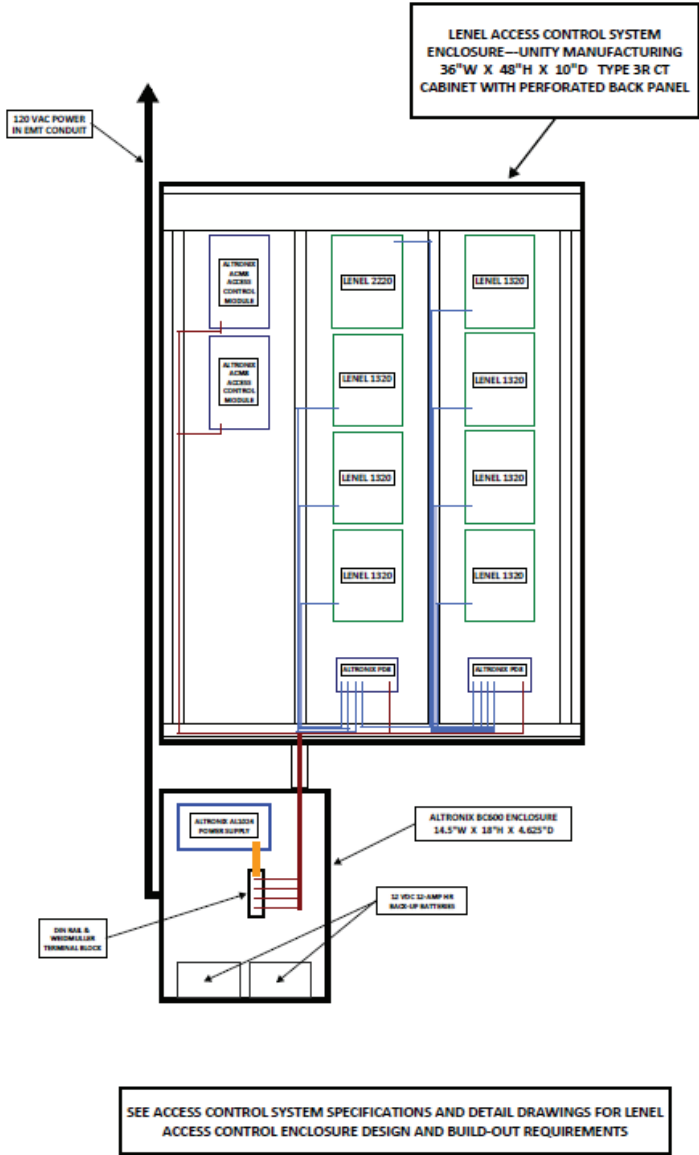
INSTALL—1—ONE-INCH EMT CONDUIT HOME RUN FROM ENCLOSURE TO THE NEAREST CABLE TRAY OR ABOVE CEILING PLENUM SPACE, TO SERVE AS A PATHWAY FROM THE ENCLOSURE FOR NETWORK DATA CABLING. INSTALL PULL STRING INTO CONDUIT.



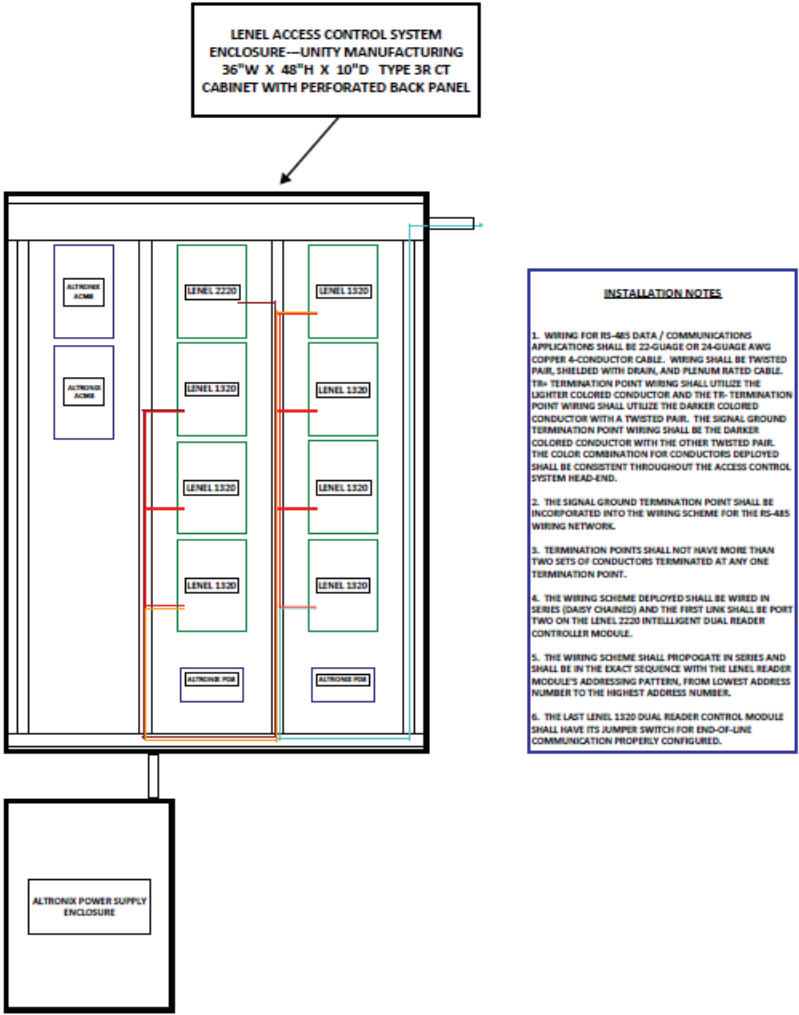
INSTALL—ONE-INCH EMT CONDUITS FROM ELECTRICAL ENCLOSURE TO DEVICE INSTALLATION LOCATION FOR NETWORK DATA CABLING APPLICATIONS. INSTALL PULL STRING INTO EACH CONDUIT. CONSULT OWNER AND ARCHITECT FOR EXACT LOCATION FOR PLACEMENT OF CONDUIT PATH FOR DEVICES. CONSULT SECURITY SURVEILLANCE CAMERA SCHEDULE IN SPECIFICATIONS SECTION 28 FOR EXACT LOCATION OF CONDUIT ENDPOINT FOR SECURITY CAMERAS. EACH DEVICE SHALL HAVE ITS OWN DEDICATED CONDUIT PATHWAY.

INSTALL—ONE-INCH EMT CONDUITS FROM ELECTRICAL ENCLOSURE TO DEVICE INSTALLATION LOCATION FOR NETWORK DATA CABLING APPLICATIONS. INSTALL PULL STRING INTO EACH CONDUIT. CONSULT OWNER AND ARCHITECT FOR EXACT LOCATION FOR PLACEMENT OF CONDUIT PATH FOR DEVICES. CONSULT SECURITY SURVEILLANCE CAMERA SCHEDULE IN SPECIFICATIONS SECTION 28 FOR EXACT LOCATION OF CONDUIT ENDPOINT FOR SECURITY CAMERAS. EACH DEVICE SHALL HAVE ITS OWN DEDICATED CONDUIT PATHWAY.

DENTON COUNTY PRE-TRIAL JAIL FACILITY
BOOK-IN ADDITIONS AND RENOVATIONS CONSTRUCTION PROJECT
LENEL ACCESS CONTROL SYSTEM ENCLOSURE---
TYPICAL LOW VOLTAGE POWER DISTRIBUTION DESIGN / LAYOUT

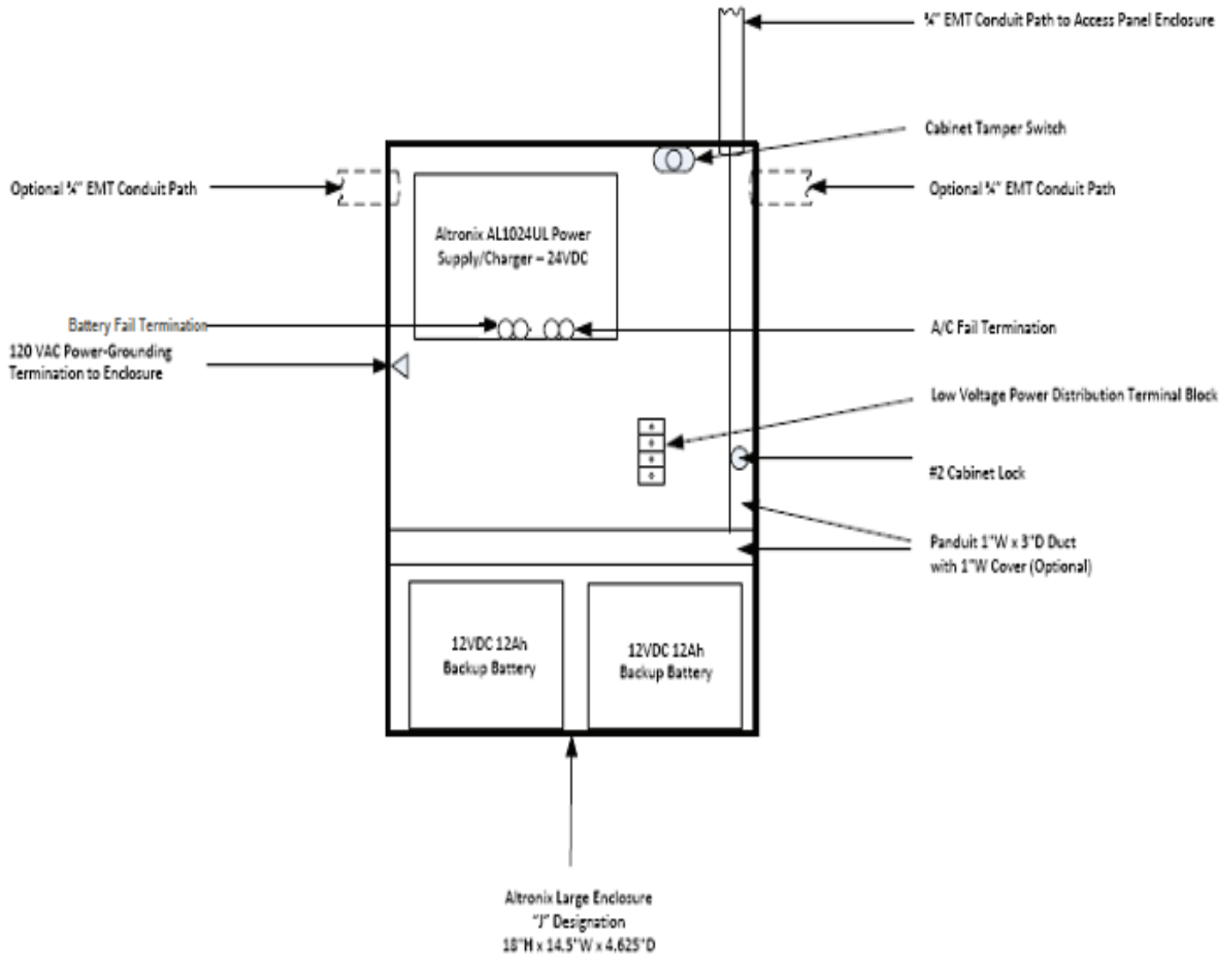


DENTON COUNTY PRE-TRIAL JAIL FACILITY
BOOK-IN ADDITIONS AND RENOVATIONS CONSTRUCTION PROJECT
LENEL ACCESS CONTROL SYSTEM ENCLOSURE---
TYPICAL RS-485 DATA / COMMUNICATION WIRING DESIGN / LAYOUT



SEE ACCESS CONTROL SYSTEM SPECIFICATIONS AND DETAIL DRAWINGS FOR LENEL ACCESS CONTROL ENCLOSURE DESIGN AND BUILD-OUT REQUIREMENTS

Access Control System Panel Power Supply Configuration



END OF APPENDIX 'B'

SECTION 28 23 13
VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of Drawings, General and Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

- A. Basic Material and Methods for Electronic Systems: Section 28 05 00
- B. Uninterruptible Power Supply System: Section 28 05 05
- C. Detention Intercom and Paging System: Section 28 05 10
- D. Detention Door Control System: Section 28 05 15
- E. Card Access Control System: Section 28 13 13

1.3 SUBMITTALS (SEE SECTION 28 05 00)

- A. Shop drawings:
 - 1. System diagram
 - 2. Description of system operation to include exact locations of cameras with field of view and lens sizes shown. Field of view to be indicated both horizontally and vertically. Provide on scaled floor plans with scale of 1/4 IN = 1 FT.
 - 3. Security surveillance cameras shall be labeled "C###" where ### is a unique number identifying the camera. All documentation, drawings, and labels shall identify cameras using this unique identifier.
 - 4. Product data:
 - 5. Technical data on all equipment and devices used
 - 6. Follow the numbering identification format utilized on the architectural drawings for the project
 - 7. Prepare a spreadsheet that incorporates all camera equipment installed device's MAC addresses, and match that data with the camera schedule.

1.4 QUALITY ASSURANCE (SEE SECTION 28 05 00)

- A. System standards:
 - 1. NFPA 70, National Electrical Code (Latest edition).

1.5 WARRANTY (SEE DIVISION 01)

1.6 OPERATING AND MAINTENANCE DATA (SEE SECTION 28 05 00)

1.7 OWNER'S TRAINING (SEE SECTION 28 05 00)

- A. Provide technical and maintenance training for Owner personnel.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Acceptable manufacturers:
 - 1. Camera/Recording System:
 - a. Base: Genetec Omnicast Enterprise

2. Video surveillance equipment:
 - a. Base: Axis
3. Mounts:
 - a. Base: Axis
4. Wire and cable:
 - a. Base: Belden.
5. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 GENERAL DESCRIPTION

- A. The county's security surveillance camera system is entirely network based, consisting of a structured network data cabling system that incorporates both fiber optics and copper cabling, network switches that provide Power over Ethernet, I.P. network cameras, and an enterprise video software management system.
- B. The network cabling for these cameras shall be installed as part of the facility's structured data cabling system by the county's contracted TE Connectivity cabling contractor or the contracted TE Connectivity cabling contractor associated with the construction project.
- C. Video Surveillance workstation specs:
 1. Dell Precision Tower 5810 685W TPM Chassis
 2. Intel Xeon Processor E5-1650 v3 (6C, 3.5GHz, Turbo, HT, 15M, 140W)
 3. Windows 7 Professional 64-bit English
 4. Dual NVidia Quadro K2200 4GB (2DP, DL-DVI-I) (2 DP to SL-DVI adapter)
 5. 16GB Memory (4x4GB) 2133MHz DDR4 RDIMM ECC
 6. Integrated Intel AHCI chipset SATA controller (6x6.0Gb/s) - SW RAID 0/1/5/10
 7. 512GB 2.5" Serial-ATA Solid State Drive
 8. DVD+/-RW Drive
 9. US English keyboard
 10. Dell USB Laser 6-button mouse
 11. Dell 4 year hardware service with Onsite service after remote diagnosis
 12. Qty 2 - Dell Ultrasharp U3015 Monitor
- D. Denton County shall be responsible for providing server and storage hardware and Genetec camera licenses.

2.3 CAMERAS AND ACCESSORIES

- A. Fixed interior cameras shall be AXIS P-3365-VE and P-3367-VE Fixed Dome, Outdoor Network Camera
- B. Fixed Exterior cameras shall be AXIS P-3365-VE and P-3367-VE Fixed Dome, Outdoor Network Camera

2.4 VIDEO WIRING SYSTEMS

- A. Video signal cable: Category 6. Camera cabling shall be provided by the Division 27 network data cabling contractor. All cameras shall be routed to Comm/Security Room #151. See Section 27 05 32.
- B. All patch cables shall be installed with the factory label end connected to the termination point that is traveling in the direction closest to the network switch

PART 3 - EXECUTION

3.1 INSTALLATION (SEE SECTION 28 05 00)

- A. Install all equipment in accordance with manufacturer's recommendations.
- B. Make all connections to video equipment with approved connectors for cable used.

- C. All CAT6 cabling relocations, extensions, and repositions due to camera relocations or repositions shall be performed by the contracted AMP ND&I cabling installer. The security contractor shall coordinate the move of the CAT6 cabling with the contracted AMP ND&I cabling installer.
- D. Assign Camera Number per Architectural Drawings and Camera Schedule to each camera part box before installation begins. Camera Boxes, Camera Housings, and Cameras must be assigned a unique camera number/identifier based on the camera schedule. The Camera Numbers shall remain on the devices throughout the installation process.
- E. Substantial Coordination is required by all responsible parties involved with the installation of security cameras and related equipment. Coordinate the installation with the architect, the general contractor, the Denton County Construction Management Team, the Denton County Department of Technology Services, the Denton County Sheriff's Department, the electrical contractor, and any other organization that would require involvement or consultation on the project
- F. A pre-installation meeting consisting of the contractor, the architect, the general contractor, the Denton County Construction Management Team, the Denton County Department of Technology Services, the Denton County Sheriff's Department, the electrical contractor, and any other entity that would require involvement or consultation on the project shall occur prior to the installation of any cameras.
- G. Security escorts may be required for the installation of security cameras. The Denton County Sheriff's Department shall coordinate security escorts if escorts are required for an installation. Participate in any such coordination with security escorts that is required.

3.2 CAMERA INSTALLATION

- A. Installation instruction sheets and templates and all parts that are packaged with installed devices and not used during the installation shall be saved and turned over to Denton County at the completion of the project.
- B. Camera installation work shall be of exceptional quality, meeting and exceeding security industry standards.
- C. The manufacturer's installation instructions shall be read, understood, and adhered to for all camera and camera system components installed.
- D. Follow all design details for camera installations presented in the detail drawing sheets of the architectural plans. Several different types of design scenarios are presented and shall be followed.
- E. Cameras shall be mounted securely to the mounting surface and shall be installed in a manner where all cameras and camera system components are water-proof.
- F. Impact-driven power tools shall not be used for the installation of any screw type fasteners. Electric power drills and electric screw-driver tools shall not be utilized for the installation of any machine threaded, wood, or drywall screw-type fasteners.
- G. All conduit cabling paths for exterior cameras require holes that are one-inch in diameter, unless otherwise specifically noted.
- H. Installers shall use marking tape and/or camera installation templates for pre-marking for the placement of camera mounting brackets for cameras.
- I. For camera installations onto brick, cinderblock, concrete, concrete tilt wall, or any other hardened surface, installer shall create a cabling pathway in the hardened material using a hammer drill and concrete drill bit. Installer shall drill a small starter hole all the way through the wall first before using the larger size concrete drill bits for the final hole.

- J. For camera installations onto brick, cinderblock, concrete, concrete tilt wall, or any other hardened surface, installer shall use an appropriate concrete fastener or anchor to mount the camera to the structure. Greenlee Manufacturing concrete anchors are preferred.
- K. The installation of gooseneck mounts or parapet mounts shall require the utilization of an appropriate fastener device to properly secure the camera mount.
- L. For camera installations onto metal siding, self-tapping screws shall only be utilized if the screws can be firmly secured without stripping the threads created in the metal siding material. Either metal toggle bolts or a system of threaded screws with nuts and lock-nut washers shall be used to mount cameras for installations involving any metal siding material.
- M. For camera installations onto wood or any man-made wood-like material, screws shall only be utilized if the screws may be firmly secured to the mounting surface without stripping the threads created in the material. Pre-drilled pilot holes shall be required for the utilization of wood screws for fastening cameras to any wood or wood-like material. Either metal toggle bolts or a system of threaded screws with nuts and lock-nut washers shall be used to mount cameras for installations involving any wood or wood-like material.
- N. For camera installations into drywall or any drywall-like material, metal sheetrock anchors shall be used. Plastic anchors shall not be used for any camera installations into drywall or any drywall-like material. Metal toggle bolts shall be used if it is determined that the weight of the camera or camera system will exceed the holding force capacity of metal sheetrock anchors.
- O. For camera installations into ceiling tiles or any ceiling tile-like material, metal toggle bolts shall be used. Plastic anchors or metal sheetrock anchors shall not be used for any camera installations into ceiling tiles or any ceiling tile-like material.
- P. Use a metal hole-punch marking tool for indenting the surface for drill bit pilot holes.
- Q. Installer shall apply a coating of silicone caulk or another latex-based caulk to any penetrations that extend into the camera's housing, with the exception of cabling penetrations.
- R. For exterior camera installations onto a building's exterior wall or any vertical structure, installer shall apply a coating of silicone caulk or another latex-based caulk between the camera and the surface the camera is being mounted to. Caulk shall be applied a total radius of 270 degrees, 135 degrees on each side of the camera from the camera's center point located at the top of the camera.
- S. Interior building penetrations may be required to establish patch cable pathways from the camera to the camera's network data cabling port. Installer shall create penetrations using the appropriate tools necessary for the material that will contain the penetration.
- T. EMT conduit shall be installed for all interior building penetrations that are established for patch cable pathways. The EMT conduit shall be 1/2-inch or 3/4-inch in diameter minimum, sized to accommodate the quantity and size of the cables served, plus extra capacity to comply with the NEC and Division 26. The EMT conduit shall have appropriate bushings installed at both ends and be de-burred at both ends. The conduit shall be stable and secure within the penetration and have caulk applied between the conduit and the material containing the penetration.
- U. All penetrations into interior and exterior wall partitions that are designated fire-rated wall partitions shall be sealed using a special fire-rated caulk.
- V. Any patch cable penetrations that will pass through any type of metal material such as a metal stud top plate shall require the installation of rubber or plastic bushings or grommets. This application shall be required to protect all cabling from damage that could arise from coming in contact with any sharp or ragged metal materials.
- W. For camera installations in and around areas that are highly sensitive to dust, dirt, and debris, installer shall make every effort to keep those work areas clean and free of dust, dirt, and debris that may be generated by the installation work. Installer shall immediately clean and remove any dust, dirt, and debris that is generated when performing installations in and around areas that

are highly sensitive to particulate matter. This shall also include the practice of removing ceiling tiles that need to be cut and transporting such ceiling tiles to a different location for cutting where the generation of dust, dirt, and debris does not present a hazard. Boxes or other containers that can effectively catch and contain dust, dirt, and debris shall also be utilized during the installation.

- X. The cabling path from all exterior camera housing backplate mounting brackets to the interior of a building shall consist of a water-proof passage utilizing seal-tight flex conduit (liquid, gray) with the properly sized fitting for attachment to the camera housing backplate mounting bracket.
- Y. The seal-tight flex conduit shall extend from the camera housing with a length that is sufficient to protect the patch cable from any hazards that may exist and enable the flex conduit to be sealed at the building's interior end using silicone caulk or another latex based caulk.
- Z. If only a flex connector is used for the install, installer shall apply caulk to the inside of the flex connector and surround the patch cable with caulk. Installer shall insert a solid filler material (plastic, foam, paper) into the flex conduit first to provide a dam at the other end of the flex connector to prevent caulk from running and spreading throughout the connector part and accumulating on the inside of the camera's housing unit. This will seal off the inside of the camera housing and prevent the transfer of air, moisture, dirt, insects, and other unwanted materials into the interior camera housing unit.

3.3 PATCH CABLE INSTALLATION

- A. All security cameras shall be connected to the nearest network data outlet installed specifically for that camera using the specified patch cable for the project.
- B. Denton County utilizes CommScope Netconnect Category 6 patch cables. No other brand of patch cable shall be installed for any network data application at Denton County without the expressed written authorization from the Denton County Department of Technology Services. Patch cables that come with the camera shall not be used.
- C. All network data patch cables shall be installed with the factory label end terminated at the insertion point that is closest to the network data switch. The unlabeled end shall be terminated at/toward the device being installed.
- D. Installer shall make a written or electronic note indicating which network data cable port number patch cables are installed at, and deliver that information to the Denton County Department of Technology Services.
- E. The Denton County Department of Technology Services shall be responsible for installing patch cables at the County's network communications rooms for the purpose of networking the newly installed cameras with the network switch.
- F. When installing patch cables, installer shall strap a piece of electrical tape onto both ends of the patch cable before performing any functions with the patch cable. This requirement is for the protection of the patch cable and the data port terminals during the installation.
- G. Installer shall carefully observe data cabling bend radius specifications when installing and dressing the patch cables. Bends in patch cables shall not be more than 4 times the diameter of the cable.
- H. Patch cables shall not be cut and re-terminated. The factory terminated ends to patch cables shall always be utilized.
- I. Patch cables shall be properly and securely dressed from the camera to the network data connection port. The use of Velcro is the preferred procedure for dressing patch cables. Standard zip cable ties shall be used only if the cable ties are not strapped on too tight.
- J. Patch cables shall be kept off of and away from all piping, HVAC works, electrical fixtures, infrastructure, and equipment, and any objects that might present a problem with electrical interference or pose a damaging hazard to the patch cable.

- K. Installer shall leave some loose slack at both ends with the patch cable installation
- L. Special tools for installing and fishing patch cables shall be utilized by the installer if such equipment is necessary to properly install the patch cables.

3.4 NETWORK DROP MODIFICATIONS

- A. The repositioning of the network data cabling ports for cameras shall be done only if it is deemed necessary to bring the network data cabling ports closer to the camera installation location. Any such repositioning of any network data cabling must be approved by Denton County prior to the cabling being moved.
- B. Installers shall follow all network data cabling installation standards and specifications if the network data cabling is repositioned anywhere at any time.

3.5 AXIS CAMERA SPECIFIC APPLICATION REQUIREMENTS

- A. Unless otherwise stated, installers shall mount the AXIS Vandal Guard Cover Plate for all AXIS P 3365-VE and P3367-VE Cameras Installed.
- B. Installer shall carefully apply silicone or a latex based caulk to the back of the camera mounting backplate to account for any locations where water could enter the camera's housing.
- C. Installer shall make sure that all water-proof plugs are properly installed.
- D. Installer shall place a strip of white electrical tape across the top seam of the camera covering approximately 240 degrees of the housing seam, thereby providing an extra layer of water-proofing to the camera housing, for any camera installed in an exterior environment.

3.6 SITE RESTORATION AND CLEAN UP

- A. Installer shall properly replace all ceiling tiles that have been displaced during the installation. Installer shall leave the location in the state it was before the installation work began, including but not limited to the following actions: the repositioning of any furniture or other objects moved during the install, the closure of access hatch doors opened, or any other action taken during the installation work.
- B. For camera installations at existing buildings, the installer shall thoroughly clean the work area and, if necessary, use a vacuum cleaner and/or wet towels to remove dust, dirt, and debris.
- C. Schedule and perform a security surveillance camera system acceptance test with the Denton County Department of Technology Services and the Denton County Sheriff's Department.
- D. All parts, tools, screws, and patch cables that are packaged with cameras and camera devices and components that are not used during the installation shall be saved and turned over to Denton County at the completion of the project. Manufacturer installation and operation instruction sheets and installation templates shall be saved and turned over to Denton County at the completion of the project.
- E. All dust, debris, and fillings created or encountered during the installation process shall be removed from camera housings, holes, and wiring paths prior to the installation of camera devices and components.

3.7 TESTING (SEE SECTION 28 05 00)

- A. Test all system components and connections using methods as recommended by manufacturer.

END OF SECTION

SECTION 28 31 00
FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Description of system: Existing Siemens automatic and manual, zoned, non-coded general alarm, supervised, 24 volt DC fire detection and alarm system to be expanded as required for the additions. Each initiation device and supervisory device to be individually addressable.
- B. Provide "CP" rated cabling for all circuits from the new FATC to the existing FACP in the existing master control. The contractor shall provide all hardware and software including programming at existing panel required to fully integrate the new devices in this expansion to the existing system.
- C. Wiring/signal transmission:
 - 1. Transmission shall be hard-wired using addressable signal transmission, dedicated to fire alarm service only.
 - 2. System connections for initiating device circuits shall be Class A.
 - 3. Signaling line circuits and notification appliance circuits shall be Class A.
 - 4. Circuit supervision: Circuit faults shall be indicated by trouble signal at FACP. Provide distinctive indicating audible tone and alphanumeric annunciation.
- D. Provide components including but not limited to following.
 - 1. Remote transponders.
 - 2. Notification Appliance Panels (NAC).
 - 3. Remote zone annunciators.
 - 4. Addressable non-coded general alarm manual stations.
 - 5. Analog addressable automatic heat detectors.
 - 6. Analog addressable automatic smoke detectors.
 - 7. Analog addressable ductwork automatic smoke detectors.
 - 8. Analog addressable automatic smoke detectors with auxiliary relays.
 - 9. Addressable sprinkler and standpipe flow switch and main waterflow detector circuits.
 - 10. Addressable O, S & Y sprinkler valve tamper switch circuits.
 - 11. Kitchen hood connections.
 - 12. Circuiting to fire alarm activated door closers.
 - 13. Fan control relays.
 - 14. Dry contact closures for access control interface.
 - 15. General alarm audible notification devices.
 - 16. Flashing general alarm visual notification appliances.
 - 17. Combination audible and visual notification devices.
 - 18. Fire alarm system wire, with all wiring in conduit.
 - 19. Security guards for devices as indicated on plans.

1.2 QUALITY ASSURANCE

- A. System standards:
 - 1. NFPA-72, Adopted edition.
 - 2. NFPA-90A, Adopted edition.
 - 3. Control Panel shall be listed under UL Standard 864 (Control Units and Accessories for Fire Alarm Systems).
 - 4. NFPA-101, Adopted edition.
 - 5. National Electrical Code Article 760, Adopted edition.
 - 6. International Building Code (IBC), Adopted edition.

- B. Design criteria:
 - 1. Comply with all system standards.
 - 2. Meet all requirements of fire authorities having jurisdiction.
 - 3. Complete fire detection and alarm system design, wiring diagrams, interphase wiring diagrams, and operational details by system manufacturer or authorized technical representative.
- C. Service organization qualifications:
 - 1. Offer an annual maintenance contract including complete service and equipment costs for maintenance of complete system.
 - 2. Ten years experience minimum serving fire alarm systems.
 - 3. Provide for 24 hour emergency service.
 - 4. Factory trained NICET Level III certified technicians.
- D. Field quality control:
 - 1. Manufacturer's field services: Provide services of factory-authorized certified service representative to supervise field assembly and connection of components and pre-testing, testing, and adjustment of system.
 - 2. Service personnel shall be qualified and experienced in inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall include but not be limited to individuals with following qualifications:
 - a. Factory trained and certified.
 - b. National Institute for Certification in Engineering Technologies (NICET Level III) fire alarm certified.
 - c. International Municipal Signal Association (IMSA) fire alarm certified.
 - d. Certified by state or local authority.
 - e. Trained and qualified personnel employed by organization listed by national recognized testing laboratory for servicing of fire alarm systems.
 - 3. Pre-testing: Determine, through pre-testing, conformance of system to requirements of drawings and specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
 - 4. Inspection:
 - a. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 - b. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- E. Authority Having Jurisdiction (AHJ) review:
 - 1. Concurrent or prior to submission to Architect, submit shop drawing and product data to Authority Having Jurisdiction (AHJ). Upon receipt of comments from AHJ, make resubmissions, if required, to make clarifications or revisions to obtain approval.

1.3 SUBMITTALS (SEE DIVISION 1)

- A. Shop drawings:
 - 1. Entire system approved by AHJ:
 - a. Wiring diagrams and riser diagrams.
 - b. Technical data indicating exact types and quantity of all fire alarm devices. High-light or otherwise identify specific components on catalog cut sheets.
 - c. Optional manufacturers shall indicate in submittals any specific points of system operation that differ from specified operation.
- B. Product data:
 - 1. Name of local service organization, and written evidence of city fire prevention bureau's approval for servicing fire alarm systems which have automatic connection to city fire headquarters.
- C. Samples: Not required for Architect review.

- D. Project information: Not required for Architect review.
- E. Contract Closeout Information:
 - 1. The Fire Alarm Asbuilt Drawings and Operation and Maintenance Documents shall be digitally stored within 6ft of each FACP panel on the project. A Space Age Electronics eFAD shall be installed in an IGB series single gang electrical back box with a red Décor plate cover. The unit will be permanently marked "Fire Alarm Documents" and will not be able to be removed from the surface. The unit will install like an electrical device and be securely fastened. The eFAD unit shall have a minimum capacity of 4GB's of digital storage. The access will be an USB type B connector on the front faceplate.
 - 2. Record of Completion form utilizing NFPA 72 (2010) Record of Completion Form.
 - 3. Fire Alarm Test reports.
 - a. Voice Intelligibility test report.
 - b. EIR Documentation in excel format
 - 4. Operating and maintenance data.
 - a. Include data for each type product, including all features and operating sequences, both automatic and manual.
 - 5. Owner instruction report.
 - 6. Pro rata warranty for batteries.
 - 7. Fire Alarm Program Source Disc.
- F. Spare parts:
 - 1. The Fire Alarm spare parts shall be stored within 6ft of the master FACP panel on the project. A Space Age Electronics RPB Spare Parts and Battery Box shall be installed (sized accordingly to accommodate spares). The enclosure shall be UL Listed, constructed of 16 gauge cold rolled steel. It shall have a red powder coat epoxy finish. The access door shall be locked with a 3/4" barrel lock and a lift away hinge with a grounding Strap. The enclosure will supply 4 mounting holes and a grounding lug. Inside the enclosure will accommodate standard 8 1/2 x 11 manuals and loose document records that will be protected within the enclosure. The enclosure shall also provide 2 key ring holders with a location to mount standard business type cards for key contact personnel.
 - 2. Extra materials shall be packaged with protective covering for storage, and identified with labels clearly describing contents as follows:
 - a. Notification Appliances: Furnish quantity equal to 5 percent of each type and number of units installed, but not less than one of each type.
 - b. Automatic initiation devices including but not limited to smoke sensors and heat sensors: Furnish quantity equal to 5 percent of each type and number of units installed but not less than one of each type.
 - c. Detector or Sensor Bases: Furnish quantity equal to 5 percent of each type and number of units installed but not less than one of each type.
 - d. Speaker and Speaker Strobes: Furnish quantity equal to 5 percent of each type and number of units installed but not less than one of each type.
 - e. Printer cartridges: Furnish 6 spare printer cartridges.

PART 2 - PRODUCTS

2.1 FIRE ALARM SYSTEM

- A. Acceptable manufacturers:
 - 1. Manufacturer must have local service organization.
 - 2. Fire alarm system:
 - a. Base:
 - 1) Siemens
 - a) Provide necessary miscellaneous devices, accessories and connections required to produce a complete and functioning system.

- B. All equipment:

1. UL listed as a product of a single manufacturer under appropriate category.
 2. Equipment shall not be modified or installed to alter or void UL label or listing.
 3. FM approved.
- C. Connect the fire alarm system into the existing fire alarm system. Modify the existing annunciators to incorporate the new construction.

2.2 FIRE ALARM SYSTEM OPERATION

- A. Activation of any signal initiating device shall cause the following:
1. General audible and visual notification devices shall be activated.
 2. Specific zone message at remote zone annunciator(s) shall illuminate and audible alarm shall sound.
 3. Specific zone light at control panel shall illuminate and audible alarm shall sound.
 4. Refer to Fire Alarm I/O matrix in drawings.
- B. Alarm light and trouble signal operate until alarm condition is corrected and FACP is manually reset.
- C. All fire alarm signals are automatically locked in at control panel and remote annunciators until manually reset at control panel and originating device is returned to normal.
1. Audible alarm signals shall be silenceable from control panel allowing for re-initiation following a subsequent alarm. Silencing of alarm signals shall not impair ability of system to continue to perform as specified.
- D. Operate fan control relays to energize or de-energize certain air-handling equipment and smoke purge exhaust fans, upon operation of certain alarm initiating devices.
1. Refer to specification section 25 50 00 for sequence of operation of all air-handling equipment and smoke purge exhaust fans.
- E. FACP shall automatically transmit trouble and alarm indications to following location.
1. Fire department headquarters.
- F. Activation of any initiation device in a smoke zone that contains Fire Curtain(s) shall cause all Fire Curtains in that smoke zone to close.
- G. Activation of any system trouble shall initiate the following:
1. Common audible trouble signal shall sound and common trouble light shall illuminate CPU. Also a specific zone display shall be provided at CPU to indicate specific zone, device or circuit.
- H. Audible trouble signal shall be silenceable by switch. Visual trouble indication remains until trouble condition is corrected. A subsequent trouble condition received after manually silencing shall cause audible trouble signal to resound. Restoration of system to normal causes audible trouble signal until silencing switch is returned to normal position. Trouble signal will be initiated under following conditions:
1. Open on an initiation or alarm indicating circuit.
 2. Open in wiring to remote zone light annunciator(s).
 3. Ground fault condition.
 4. Auxiliary manual control switch out of normal position.
 5. Loss of 120 volt operating power to CPU.
 6. Main sprinkler valve is closed.
 7. Post indicator valve is closed.
 8. Any sprinkler or standpipe O, S & Y valve is closed.

2.3 SIGNAL INITIATING DEVICES

- A. Addressable manual fire alarm stations: (if provided)
1. Pull-type equipped with tensile spring and key lock or similar device so that they may be operated for test purposes and designed so that once operated they cannot be restored to normal except by turning key lock or similar device.

2. High impact red Lexan or cast metal with operating directions in white letters, semi-flush mounted at 4 FT above floor level.
 3. Stations shall be keyed alike with CPU.
 4. In unfinished rooms, use surface mount back box.
 5. Match existing.
- B. Addressable automatic heat detectors: Fixed temperature type or combination rate-of-rise and fixed temperature type.
1. Rated at 135 degF for ordinary areas where normal ceiling temperatures do not exceed 100 degF, or rated 190 degF for up to 150 degF ceiling temperatures.
 2. Detectors using non-restoring elements: Provide visual indication.
- C. Automatic smoke detectors: Addressable photoelectric type, UL listed to Standard 268.
1. Low voltage, solid-state design incorporating threaded removable detector chamber; twice-lock, plug-in head assembly; and recessed, easily accessible sensitivity adjustment screw.
 2. Addressable detector base: Molded construction equipped with terminal screws for all wiring connections, designed for mounting on any standard 4 IN square outlet box for concealed wiring, or special box for surface raceway.
 3. Design to produce TROUBLE signal if detector head is removed from its mounting base and ALARM signal if detection chamber is removed.
 4. Operating power supplied from the basic 24 volt DC zone circuit.
 5. Normal projection: 1.875 IN from mounting box.
 6. Provide addressable auxiliary relays in smoke detectors to provide local control of equipment as described under system operation. Provide separate 24 volt supply to detectors with auxiliary relays to guarantee that sufficient power will be available to operate relays.
 7. Detectors shall be UL listed for open area protection per UL Standard 268.
 8. Smoke detectors either side of fire rated shutters, elevator doors, etc., shall have auxiliary contacts wired to signal motor operator to close counter shutter. Provide 24 volt signal from nearest bell or chime circuit wired in series with auxiliary contact to activate shutter electro-thermal link and drop shutter after time delay should motor operator be inoperable.
 9. Detectors shall be addressed by DIP switch in detector base.
- D. Automatic smoke detectors for ductwork: Addressable photoelectric type, with appropriate air duct accessory for installation in ducts.
1. Duct accessories: Metal construction, with pre-cut keyed air sampling tubes, suitable for mounting detector either perpendicular or parallel to ducts.
 2. Provide recessed adjustable screw to permit regulation of air flow, designed to allow easy detector removal for cleaning or service without removing entire unit from duct.
 3. Provide red alarm lamp on ceiling for detectors above ceilings.
 4. Make wiring connections to all duct units with flex conduit to standard 4 IN octagonal outlet box mounted on base of detector.
 5. Provide 8 IN square access door with rubber gasket in duct approximately 2 FT upstream from smoke detector for testing and servicing.
- E. Main sprinkler waterflow detector (See Division 15): Provide alarm wiring circuit and make connections from switch terminals to fire alarm system. Provide individual addressable monitor zone for main sprinkler waterflow detector.
- F. Sprinkler and standpipe flow alarm switches (see Division 15): Provide alarm wiring circuit and connections from switch terminals to fire alarm system. Provide an individual addressable monitor zone for each flow alarm switch.
- G. Main sprinkler water valve and post indicator valve tamper switches (see Division 15): Provide supervision wiring circuit and connections from switch terminals to fire alarm system.
1. O, S & Y valve tamper switches (for sprinkler and stand pipe valves, see Division 15). Provide supervision wiring circuit and connections from switch terminals to fire alarm system. Tamper switch shall annunciate as trouble signal on associated flow alarm zone.

2.4 AUTOMATIC CONTROL DEVICES

- A. Fan control relays: Compatible with unit being controlled.
 - 1. Industrial grade relays shall be furnished.
 - 2. Provide enclosures suitable for environment.
 - 3. Provide engraved phenolic nameplate on enclosure identifying fan or air handling unit being controlled.
 - 4. Coil voltage as required.
- B. Automatic door equipment: Automatic doors in rated and exterior walls shall be connected to fire alarm system to interrupt power to door operator upon:
 - 1. Initiation of any alarm in facility.

2.5 ALARM SIGNAL DEVICES

- A. General audible notification appliances: Match existing.
 - 1. Finish: Red baked enamel.
 - 2. Minimum sound level of 92 dBA at 10 FT.
 - 3. Provide as indicated.
- B. General visual notification appliances: Wall-mounted, semi-flush, 24 volt DC, with xenon lamps, with FIRE imprinted in red. Match existing devices.
 - 1. Meet ADA requirements.
 - 2. Tamper resistant lens.
 - 3. Provide as indicated.

2.6 FIRE DEVICE WIRE GUARDS

- A. Provide UL Listed 9-gauge red coated steel wire guards with tamper resistant screws and hardware fasteners for all devices within an inmate accessible area.
- B. Product shall be STI-96 or 97 series or equal.

2.7 POWER SUPPLY TO CONTROL

- A. Power supply: 120/208 volt, single phase AC, 3 wire emergency circuit.
- B. Provide an approved earth ground connection.
- C. Provide in same location as FATC.

2.8 WIRING

- A. Conduit: 3/4 IN minimum; see Section 26 05 33.
- B. Conductors:
 - 1. 120 VAC and power supply connections: 12 GA, minimum.
 - 2. Low-voltage general alarm circuits: 12 GA, minimum.
 - 3. Low-voltage signal initiating circuits: 18 GA, minimum.
 - 4. Annunciator and data communication circuits: As required by manufacturer, UL listed.
 - 5. Use larger wire sizes when recommended by equipment manufacturer.
- C. Extend properly sized empty conduit to serve future areas.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all wiring in conduit.
- B. Install all components as indicated and in accordance with manufacturer's wiring diagrams, instructions and recommendations.

- C. Install all wiring in accordance with local and national codes and NFPA 72.
- D. Make all fire alarm wiring continuous from terminal to terminal or from terminal to device pigtail lead.
 - 1. Circuit splices not permitted.
 - 2. Wiring joints, only when required at device pigtail leads shall utilize Scotchlok insulate conical spring connector.
- E. Color code all wiring by type of device. Coordinate colors with Owner and Section 26 00 10.
- F. Installation of equipment and devices that pertain to other work in contract shall be closely coordinated with appropriate subcontractors.
- G. Cover all smoke detection devices with plastic bags immediately after installation to maintain cleanliness.
- H. Class A circuiting:
 - 1. All Class A circuits shall have outgoing circuit from FACU and return circuit to FACU that shall be routed to FACU via different paths as practicable. Outgoing and return circuit shall be separated by at least 10 FT within 10 FT of leaving FACU and 10 FT or greater separation shall be maintained for remainder of circuit.
- I. Label all devices to indicate node number, map net number, and device number. Label style to match existing in Facility.
- J. Installation of system devices and wiring shall be completed by NICET Level II personnel. Final system programming testing completed by NICET Level III technicians.

3.2 TESTING

- A. Obtain services of a factory trained representative of system manufacturer to supervise installation and its progress, supervise final connections to equipment and provide testing to assure that system is in proper operating condition, and is in compliance with all applicable regulations.
- B. Entire system shall test free from opens, grounds, and short circuits.
- C. Test system to satisfaction of Engineer and State and local fire authorities.
- D. Manufacturer shall provide an authorized representative to instruct and train Fire Department personnel and Owner's personnel in operation of system.
- E. Acceptance Operational Tests:
 - 1. Perform operational system tests to verify conformance with specifications:
 - a. Each alarm initiating device installed shall be operationally tested.
 - b. Each device shall be tested for alarm and trouble conditions.
 - c. Contractor shall submit written certification that Fire Alarm System installation is complete including all punch-list items.
 - d. Test battery operated emergency power supply. Test emergency power supply to minimum durations specified.
 - e. Test supervising station signal transmitter. Coordinate testing with supervising station monitoring firm/entity.
 - f. Test each notification appliance installed for proper operation. Submit written report indicating sound pressure levels at specified distances.
 - g. Test FACP and remote annunciator(s).
 - 2. Provide minimum 10 days notice of acceptance test performance schedule to Owner, and local Authority Having Jurisdiction (AHJ).
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by system test that total system meets Specifications and complies with applicable standards.

- G. Report of Tests and Inspections: Provide written record of inspections, tests, and detailed test results in form of test log. Use NFPA 72 Forms for documentation.
- H. Final Test, Record of Completion, and Certificate of Occupancy:
 - 1. Test system as required by Authority Having Jurisdiction in order to obtain certificate of occupancy. Provide completed NFPA 72 Record of Completion form to Owner and AHJ.

3.3 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris from all devices and equipment panels. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of substantial completion, provide on-site assistance in adjusting sound pressure levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to site for this purpose at no cost to the Owner.

3.4 TRAINING

- A. Provide services of factory-authorized service representative to demonstrate system and train Owner's maintenance personnel as specified below.
 - 1. Train Owner's maintenance personnel in procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of system.
 - 2. Provide minimum of 8 hours' training.
 - 3. Schedule training with Owner at least 2 weeks in advance.
 - 4. Fill out Owner instruction reports.

END OF SECTION



DIVISION 31

EARTHWORK



SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Site Clearing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Perform work in accordance with OSHA and EPA requirements and state and local requirements.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PROTECTION

- A. Provide barricades, coverings, and other protection necessary to prevent damage to existing improvements to remain.
 - 1. Protect improvements on adjoining properties as well as those on Owner's property.
 - 2. Restore improvements damaged by this work to original condition, as acceptable to Owner, other parties, and authorities having jurisdiction.
- B. Protect existing trees and other vegetation to remain against damage.
 - 1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
 - 2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
 - 3. Provide temporary protection per City of Denton requirements.
- C. Repair or replace trees damaged by construction operations.
 - 1. Repair to be performed by a qualified tree surgeon.
 - 2. Remove trees which cannot be repaired and restored to full-growth status.
 - 3. Replace with new trees of minimum 4 IN caliper.

3.2 IMPROVEMENTS ON ADJOINING PROPERTY

- A. Owner will obtain authority for performing removal and alteration work on adjoining property.

3.3 SALVAGEABLE ITEMS

- A. Carefully remove items to be salvaged.
- B. Store as indicated.

3.4 SITE CLEARING - GENERAL

- A. Remove trees, shrubs and other vegetation, improvements, or obstructions that interfere with new construction.
 - 1. Removal includes stumps of trees and their roots.
 - 2. Carefully cut and protect roots and branches of trees indicated to remain, where they are affected by new construction.

- B. Remove other items when specifically indicated.

3.5 TOPSOIL SALVAGE

- A. Definitions:
 - 1. Topsoil: Friable clay loam surface soil found in depth of not less than 4 IN and reasonably free of subsoil, objects over 2 IN in any dimension, weeds, and roots.
- B. Strip topsoil to whatever depths encountered.
 - 1. Strip to prevent intermingling with underlying subsoil or objectionable material.
 - 2. Where trees are indicated to remain, stop topsoil stripping a sufficient distance from such trees to prevent damage to main root system.
- C. Stockpile topsoil as directed.
 - 1. Construct storage piles to freely drain surface water.
 - 2. Seed or cover storage piles to prevent erosion.
- D. Strip topsoil in areas where grading occurs.

3.6 CLEARING AND GRUBBING

- A. Clear trees and shrubs not indicated to remain, brush, downed timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, and debris.
- B. Grubbing (remove):
 - 1. Under areas to be paved: Remove stumps, roots, root mats, buried logs and other debris.
 - 2. In lawn areas:
 - a. In cut areas, totally grub.
 - b. In fill areas where fill is less than 3 FT, totally grub ground.
 - c. Where fill is 3 FT or more in depth, stumps may be left no higher than 6 IN above existing ground surface.

3.7 REMOVAL OF IMPROVEMENTS

- A. Remove surfacing and pavements, including bases, concrete slabs, concrete curb and gutter, valve boxes, concrete and masonry walls, posts, poles, fences, manhole frames and covers, catch basins and grates and other items indicated.
- B. Remove foundations, footings, walls, cisterns, septic tanks, underground storm pipe and other items indicated.

3.8 DISPOSAL OF WASTE MATERIALS

- A. Do not burn combustible materials on site.
- B. Remove waste materials from site.
- C. Do not bury organic matter on site.
- D. Remove rock, concrete and masonry from site.

END OF SECTION

SECTION 31 22 00
SITE EXCAVATION AND ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Site Excavation and Rough Grading, as indicated, in accordance with provisions of Contract Documents.
- B. Definitions:
 - 1. Unsuitable material: Debris and/or soil material judged unsuitable by Engineer for support of slabs or other site improvements.
 - 2. Engineer: Soils Engineer employed by Owner, empowered to conduct inspections and make approvals.
- C. Completely coordinate with work of other trades.

1.2 EXTRA WORK

- A. Removal and replacement of unsuitable material below design elevations will be paid for as extra work.
 - 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 - 2. Recorded quantity will be basis for payment.
 - 3. Include unit price per cubic yard on Bid Form.

1.3 QUALITY ASSURANCE

- A. Compaction density test:
 - 1. Standard Proctor, ASTM-D698
- B. Layout work by Surveyor or Civil Engineer registered in the State of Texas.
- C. Owner will hire an independent soils laboratory to conduct in place moisture and density tests.
 - 1. Contractor to pay for retests of material not passing initial tests.
- D. Tolerances of sub-grade:
 - 1. Un-surfaced areas: Plus/minus 0.20 FT from required elevations.
 - 2. Paved areas: Plus/minus 0.10 FT from required elevations.

1.4 JOB CONDITIONS

- A. Protect existing facilities, utilities (overhead and underground), sidewalks, pavement.
 - 1. Repair damaged items.
 - 2. Cost of repair to items not indicated paid by Owner.
 - 3. Notify Owner and make emergency repair as directed.
- B. Protect graded areas against erosion.
 - 1. Re-establish grade where settlement or washing occurs at no extra cost.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fill materials:
 - 1. Reasonably free of roots, organic material, trash, frozen matter, and stones larger than 6 IN.
 - 2. Add water to dry material, as required.
 - 3. Allow wet material to dry, as required.
 - 4. Borrow or fill can be obtained on site where removed from excavating and grading and as indicated.
 - 5. Restore borrow/fill areas to condition which is visually acceptable to Architect and does not adversely affect drainage.
- B. Surplus material:
 - 1. Remove from site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Layout units, structures, piping, roads, parking areas and walks and establish their elevations.
- B. Perform other layout work required.
- C. Replace property corner markers to original location if disturbed or destroyed.
- D. Preparation for embankments and fills:
 - 1. Before fill is started, scarify to a minimum depth of 6 IN under new roads, parking lots, or streets.
 - 2. Bring to optimum moisture content
 - 3. Compact to a minimum 98 percent
 - 4. In areas where existing ground surface is steeper than one vertical to four horizontal, bench surface in order to spread fill horizontally so that fill material will bond with existing surface.

3.2 GENERAL

- A. Excavate and grade materials to design elevations.
- B. If rock is encountered, remove as directed by Engineer.
 - 1. Dispose of as "surplus material."
- C. Excavate and grade site to subgrades of paved and unpaved areas as indicated.
- D. Excavate for miscellaneous footings, slabs, walks and other structures.
- E. Cut and fill as required to bring existing grades to rough grades.
- F. Furnish and place additional approved material required to bring subgrade to proper line and grade.
- G. During construction, shape and drain embankments and excavation.
- H. Maintain ditches and drains to provide drainage.
- I. Provide pumping if required.
- J. Do not fill under footings. If excavation is deeper than necessary, fill with concrete of same strength as footing concrete.

- K. Remove unsuitable materials which cannot be compacted as specified and replace with suitable material.
 - 1. Dispose material off site as directed.
- L. Remove materials unsuitable to receive fill and replace with suitable material.

3.3 CONSTRUCTION OF EMBANKMENTS AND FILLS

- A. Construct embankments and fills to lines and grades.
- B. Make completed fill correspond to shape of typical cross section or contour indicated regardless of method used to indicate shape, size, and extent of line and grade of work.
- C. Insure that cobbles larger than 4 IN, are not placed in upper 6 IN of fill or embankment.
- D. Place material in lifts, maximum 8 IN loose thickness.
- E. Place layers horizontally and compact each layer to specified density prior to placing additional fill.
- F. Compact using suitable equipment:
 - 1. Control moisture to meet requirements of compaction.
 - 2. Place materials as indicated in geotechnical report.
- G. Under roadways and parking areas and extending 1 FT beyond proposed curb line measured perpendicular from centerline, compact as indicated in geotechnical report.
- H. Under walk paving, compact as indicated in geotechnical report.
- I. For other embankments and fills not listed, compact as indicated in geotechnical report.
- J. Under proposed building and structures, compact to density as specified in Section 31 23 00.

3.4 LAYOUT FOR ROUGH GRADING

- A. Install grading stakes for checking rough and finished grade throughout area to be graded.
 - 1. Set at 50 FT grid intervals, and as required to reflect grading variations.
 - 2. Stakes: 1 x 2 x 24 IN, sound wood.
 - 3. Set securely so that minimum of 6 IN is above rough grade.
 - 4. Mark each stake to indicate design finished grade.

END OF SECTION

SECTION 31 22 19
TOPSOILING AND FINISHED GRADING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Topsoiling and Finished Grading, as indicated, in accordance with provisions of Contract Documents.
- B. Location of work:
 - 1. Areas within limits of grading and areas outside limits of grading which are disturbed in course of work.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Finish grading tolerance:
 - 1. 0.1 FT plus/minus from required elevations.

1.3 JOB CONDITIONS

- A. Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil:
 - 1. Original fertile, friable surface soil typical of area, capable of supporting native plant growth, reasonable free of subsoil, clay, weeds, roots, and stones larger than 1 IN.
 - a. Use existing topsoil stockpiled under Section 31 10 00.
 - b. If amount of topsoil stockpiled is less than amount necessary for work, furnish additional topsoil required.

PART 3 - EXECUTION

3.1 ROUGH GRADE REVIEW

- A. Rough grading reviewed by Architect in Section 31 22 00.

3.2 PREPARATION

- A. Correct, adjust and repair rough graded areas.
 - 1. Cut off mounds and ridges.
 - 2. Fill gullies and depressions.
 - 3. Perform other necessary repairs.
 - 4. Bring sub-grades to specified contours, even and properly compacted.
- B. Loosen surface to depth of minimum 2 IN.
- C. Remove stones and debris over 1 IN in any dimension.

3.3 PLACING TOPSOIL

- A. Do not place topsoil when subgrade is wet or frozen enough to cause clodding.
- B. Spread topsoil to minimum compacted depth of 4 IN for disturbed earth areas.
- C. Make finished surface free of stones, sticks, or other material 1 IN or more in any dimension.
- D. Make finished surface smooth and true to required grades.
- E. Restore areas occupied by stockpiles to condition of rest of finished work.

3.4 ACCEPTANCE

- A. Upon completion of topsoiling, obtain Architect's acceptance of grade and surface.
- B. Make test holes as directed, to verify proper placement and thickness of topsoil.

END OF SECTION

SECTION 31 23 33

TRENCHING, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Trenching, Backfilling and Compacting for Utilities, as indicated, in accordance with provisions of Contract Documents.
- B. Definitions:
 - 1. Unsuitable material:
 - a. Debris and/or soil material judged unsuitable by Engineer for support of slabs or other site improvements.
 - 2. Engineer:
 - a. Soils Engineer employed by Owner and empowered to undertake necessary inspections and approvals.
 - 3. Rock excavation:
 - a. Excavation of rock material which is sufficiently solid and of such strength that it cannot be loosened or broken down in a single pass with following equipment:
 - 1) Late model tractor mounted hydraulic ripper equipped with single digging point sized to use with and propelled by crawler type tractor rated at a minimum 200 net flywheel horsepower, operating in low gear.
 - 2) A 3/4 cubic yard hydraulic backhoe with a rock tooth.
- C. Completely coordinate with work of other trades.

1.2 EXTRA WORK

- A. Removal and replacement of unsuitable material will be paid for as extra work.
 - 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 - 2. Recorded quantity will be basis for payment.
 - 3. Include unit price per cubic yard on Bid Form.
- B. Rock excavation will be paid for as extra work.
 - 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 - 2. Recorded quantity will be basis for payment.
 - 3. Include unit price on Bid Form.

1.3 QUALITY ASSURANCE

- A. Compaction Density Test:
 - 1. Standard Proctor, ASTM D698.
- B. Owner will hire an independent soils laboratory to conduct in place moisture and density tests.
 - 1. Contractor to pay for retests of material not passing initial tests.
 - 2. Notify Owner at least 2 weeks prior to anticipated date of testing.
 - 3. Contractor to pay additional costs if work is delayed due to Contractor's failure to notify party as specified above.
- C. Comply with aspects of "Safety Rules and Regulations for Excavation" as promulgated by State law for state in which excavation will occur.

1.4 JOB CONDITIONS

- A. Verify location and existence of underground utilities.
 - 1. Omission or inclusion of located utility items on drawings does not constitute non-existence or definite location.
 - 2. Secure and examine local utility surveyor records for available location data.

- B. Protect existing utilities from damage.
 - 1. Repair damages to utility items.
- C. Avoid overloading.
- D. Keep surcharge sufficient distance back from edge of excavation to prevent slides or caving.
- E. Maintain and trim excavated materials in such a manner to be as little inconvenience as possible to public and adjoining property owners.
- F. Provide full access to public and private premises, to fire hydrants, at street crossings, sidewalks and other points as designated by Engineer to prevent serious interruption of travel.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Backfill Material:
 - 1. As approved by Engineer.
 - 2. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
 - 3. Moisture content at time of placement:
 - a. Within 3 PCT of optimum moisture content.
 - b. Wet dry material, as required.
 - c. Dry wet material, as required or:
 - d. Furnish off site material at no additional cost to Owner.

PART 3 - EXECUTION

3.1 GENERAL

- A. Remove and dispose materials Engineer finds unsuitable.
- B. Trench, backfill and compact for underground utilities.

3.2 TRENCH EXCAVATION

- A. Excavate trenches by open cut method to depth indicated and necessary to accommodate work.
 - 1. Permission may be granted for tunnel work for crossing under crosswalks, driveways or existing utility lines.
 - 2. Such tunnels are limited to 10 FT in length.
- B. Open no more than 300 LF of trench at one time, or less, as required by Engineer.
- C. Failure to comply may necessitate shutdown of entire project until backfilling is performed.
- D. Carry rock excavations minimum of 12 IN below indicated invert elevations.
- E. Do not excavate below indicated grades unless required to remove unsuitable material.
- F. Backfill overexcavations in maximum 8 IN lifts compacted to specified density.
- G. Trench size:
 - 1. Excavate only sufficient width to accommodate free working space.
 - 2. Cut trench walls vertically from bottom of trench to top of pipe, conduit, or utility service.
 - 3. Trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than following dimensions:

Overall Diameter of Utility Service	Excess Dimension
33 IN and less	16 IN
more than 33 IN	24 IN

- H. Keep trenches free of water.
- I. Brace and sheet trenches as soil conditions dictate.
- J. Do not remove until backfilling has progressed to a stage that no damage to piping, utility service, or conduit will result due to removal.

3.3 PREPARATION FOR PIPE LAYING

- A. See drawings and specific pipe material sections for embedment requirements.
- B. When discrepancy exists between those requirements and these specifications, provide type of embedment which provides greatest load factor.
- C. Types of Embedment:
 - 1. Class A: Concrete cradle.
 - a. Load factors:
 - 1) 2.2 - Lightly Tamped.
 - 2) 2.8 - Carefully tamped.
 - 3) 3.4 - Reinforced Concrete with p=0.4 PCT.
 - 2. Class 4: Concrete arch type bedding.
 - a. Load factors:
 - 1) 2.8 - Plain Concrete.
 - 2) 3.4 - Reinforced Concrete with p=0.4 PCT.
 - 3) 4.8 - Reinforced Concrete with p=1.0 PCT.
 - 3. Class B: First-class bedding.
 - a. Shaped bottom with tamped backfill, or:
 - b. Compacted granular bedding with tamped backfill.
 - c. Load factor:
 - 1) 1.9 - Carefully compacted backfill.
 - 4. Class C: Ordinary bedding.
 - a. Granular bedding with tamped backfill.
 - b. Load factor:
 - 1) 1.5 - Lightly compacted backfill.
- D. Form bell holes in trenches such that only barrel of pipe is firmly supported by bedding material.

3.4 BACKFILLING

- A. Do not backfill until tests are performed on system, and system complies with specified requirements.
- B. Hand or pneumatic tamp backfill around and over pipe in lifts not exceeding 8 IN loose thickness.
- C. Compact to specified density.
- D. Exercise care in backfilling operations to avoid displacing pipe joints either horizontally or vertically and to avoid breaking pipe.
- E. Do not water flush or puddle to consolidate backfill.

3.5 COMPACTION

- A. Compact trench backfill in areas under paved roads, parking areas, sidewalks and other structures as directed by Engineer to at least 95 PCT of maximum dry density.
- B. In locations where trench will not be under paved areas, compact backfill to minimum 90 PCT of maximum dry density.

3.6 CLEANUP

- A. Cleanup debris resulting from work.

END OF SECTION

SECTION 31 25 00
SOIL EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Identify, design, document, implement, and manage storm water pollution prevention measures required to minimize the negative effects of erosion and minimize the amount of sediment from entering streams or other bodies of water.
 - 1. Erosion caused by water.
 - 2. Erosion caused by wind.
- B. Conform to the requirements of the National Pollution Discharge Elimination System (NPDES) and other Federal, State, and local requirements in effect.
- C. Conform to the requirements of the City of Denton. Discrepancies between the Contract Documents and the requirements of the City of Denton are the responsibility of the General Contractor, are included in the cost of the Work and are not subject for additional compensation.

1.2 GENERAL REQUIREMENTS

- A. Minimize storm water pollution and damage that may occur as the result of construction operations. Comply with applicable Federal, State, and local environmental laws and regulations. Delays and their consequences resulting from failure to comply with applicable environmental laws and regulations are the sole responsibility of the Contractor.
- B. Conduct work so that soil, fuels, oils, bituminous materials, chemicals, sanitary sewage, and other potentially harmful materials resulting from construction operations are confined within the limits of construction, and generally prevented from entering storm drainage systems, water courses, rivers, lakes, reservoirs, ground water, or other waters under the jurisdiction of the United States of America- Clean Water Act, 33 CFR 328.
- C. Strip vegetation, grade, and perform other soil disturbance in a manner which minimizes soil erosion.
- D. Retain and protect existing vegetation as much as is feasible. Minimize areas which are exposed and free of vegetation.
- E. Insure compliance with this section by subcontractors, vendors, and suppliers.
- F. No separate payment will be made for work covered under this Section. Include costs in the bid or proposal price. The Contractor shall be responsible for payment of fees associated with required environmental permits, applications, and/or notices.
- G. The Contractor shall be responsible for payment of all fines/fees for violation of, or non-compliance with, applicable Federal, State, and local laws and regulations.
- H. No statement or requirement in this Section shall be construed as relieving the Contractor from conformance with applicable Federal, State, and local environmental laws and regulations. The Contractor is responsible for identifying, designing, documenting, submitting for approval, implementing, and managing storm water pollution prevention measures required.

1.3 QUALITY ASSURANCE

- A. Storm Water Pollution Prevention Resources:
 - 1. United States - Environmental Protection Agency (EPA)
 - a. National Pollutant Discharge Elimination System (NPDES) - Storm Water Management for Construction Activities, latest edition; as amended to date.

- b. 2003 EPA Construction General Permit
2. EPA Office of Compliance: 'Managing Your Environmental Responsibilities: A Planning Guide for Construction and Development', April 2005; as amended to date.

1.4 SUBMITTALS

- A. Project Information Submittals:
 1. Schedule of Proposed Submittal / Implementation Dates: Submit schedule indicating dates of submittal for the following documents, as applicable to the project:
 - a. Notice of Intent (NOI)
 - b. Storm Water Pollution Prevention Plan (SWPPP)
 - c. Notice of Termination (NOT)
 - d. Applications of Waiver or Exemption
 - e. Other documents required.
 2. Contractor's Monthly Inspection Report Form.
 3. Document implementation of the erosion and sedimentation control plan through date-stamped photos taken at three different times throughout the project.

1.5 STORM WATER POLLUTION PREVENTION

- A. Pollution prevention procedures and devices the Contractor shall implement may include but are not necessarily limited to the following:
 1. Silt fences
 2. Storm drain inlet protection
 3. Temporary seeding
 4. Protection of trees
 5. Preservation of mature vegetation
 6. Straw bales
 7. Sediment traps
 8. Diversion dikes
 9. Drainage swales
 10. Sediment basins
 11. Erosion control mats
 12. Mulching
 13. Geotextiles
 14. Sod stabilization
 15. Vegetative buffer strips
 16. Rock outlet protection
 17. Check dams
 18. Subsurface drains
 19. Pipe Slope drains
 20. Reinforced soil retaining systems
 21. Gabions
 22. Level spreaders.
 23. Chemical stabilization.
- B. The Contractor is responsible for evaluating and selecting procedures and devices best suited for preventing storm water pollution in conformance with applicable Federal, State, and local environmental protection laws and regulations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Silt Fence:

1. Fence Fabric: Non- woven geotextile composed of minimum 85 percent (by weight) polyolefins, polyesters, or polyamides; in compliance with AASHTO M-288; minimum 36 IN wide
 - a. Performance Criteria:

Property	Test Method	Minimum Average Roll Value (English)	Minimum Average Roll Value (Metric)
Grab Tensile	ASTM-D-4632	90 lb	0.400 kN
Grab Elongation	ASTM-D-4632	50 %	50 %
Mullen Burst	ASTM-D-3786	185 psi	1270 kPa
Puncture	ASTM-D-4833	55 lb	0.240 kN
Trapezoidal Tear	ASTM-D-4533	40 lb	0.175 kN
UV Resistance	ASTM-D-4355	70 % at 500 hrs	70 % at 500 hrs
Apparent Opening Size (AOS)	ASTM-D-4751	70 sieve	0.212 mm
Permittivity	ASTM-D-4491	2.1 sec ⁻¹	2.1 sec ⁻¹
Flow Rate	ASTM-D-4491	155 gal/min/ft ²	6300 L/min/m ²

All numerical values above (except AOS) represent minimum average roll value (i.e., average of test results from any sampled roll in a lot shall meet or exceed the minimum values in the table) in the weaker principal direction. Values for AOS represent maximum average roll values. Lot sampled according to ASTM D-4354, "Practice for Sampling Geosynthetics for Testing".

2. Stakes:
 - a. Steel; "U", "T", or "L" shaped; minimum weight 0.75 lb/lf; minimum 48 IN long.
 - b. Wood: 1 IN x 2 IN, hardwood, minimum 48 IN long.
 3. Woven Wire Support Mesh: Electro-galvanized (ASTM A-591), 2 IN. sq. x 0.1055 IN diameter.
 4. At Contractor's option, provide integrally- supported fence fabric equivalent to specified assembly.
- B. Storm Drain Inlet Protection:
1. Concrete Masonry Units: Modular units complying with ASTM-C90.
 2. Wood Frames and Diverters:
 - a. DOC PS 20. Provide dressed lumber, S4S, unless otherwise indicated.
 - b. Preservative Treatment: AWWPA C2.
 - 1) Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - c. Member Sizes: As indicated or, if not indicated, as directed by Architect.
 3. Aggregate Drainage Medium: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D-448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
 4. Wire Mesh: Electro- galvanized (ASTM A-591), 1/2 IN. sq. x 0.063 IN diameter.
- C. Construction Tracking Pad:
1. Aggregate: ASTM D-448; size as indicated.
 2. Filter Fabric: Roadway geotextile, Type B.

- D. Grass:
1. Grass:
 - a. Fresh, clean, new crop seed.
 - b. Species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified.
 - c. Provide following grass seed:

Common and Botanical Name	Minimum percent Germ	Minimum percent Purity	Maximum percent Weed Seed
Common Bermuda	85	95.0	none

- E. Mulch:
1. Clean, seed free, threshed straw of oats, wheat, barley, rye, beans, peanuts or other locally available mulch material.
 2. Do not use mulch containing a quantity of matured noxious weed seeds or other species that will be detrimental to seeding, or provide a menace to surrounding land.
 3. Do not use mulch material which is fresh or excessively brittle, or which is decomposed and will smother or retard growth of grass.
- F. Erosion Control Mats:
1. Permanent Type
 - a. Propex Landlok 450, green, or approved equal.
 - b. Install per manufacturers recommendations and where noted on plans or details.
 2. Degradable Type
 - a. Propex Landlok S2 or approved equal.
 - b. Install per manufacturers recommendations and where noted on plans or details.
- G. Fertilizer:
1. Commercial fertilizer of 4-1-2 analysis, meeting applicable requirements of State and Federal Law.
 2. Do not use cyanamic compounds or hydrated lime.
- H. Asphalt binder:
1. Emulsified asphalt per State Specifications.

PART 3 - EXECUTION

3.1 APPLICATIONS AND NOTICES

- A. Submit required applications, drawings, notices, inspection reports, and other documents to authorities having jurisdiction. Submit documents in a timely manner, in compliance with Schedule of Proposed Submittal / Implementation Dates.
- B. For every submittal, provide one (1) copy of each submitted document, for information only, to Owner and Architect.
- C. **Compliance with local regulatory agencies is required.**

~~C. No construction shall commence until the SWPPP has been approved by the City of Denton.~~

3.2 INSTALLATION - GENERAL

- A. Provide pollution prevention devices at locations where indicated in the drawings and as otherwise required by authorities having jurisdiction.
- B. Locate and maintain devices to contain surface drainage and minimize amounts of sediment leaving confines of project site.

- C. Pollution prevention materials and devices indicated in this Specification (and on the drawings) are representative, but not necessarily all-inclusive of Best Management Practices (BMPs) available to the Contractor for providing effective pollution prevention on the project site. Contractor shall supplement representative devices as required for compliance with requirements.

3.3 SILT FENCE

- A. Comply with ASTM D-6462 “Standard Practice for Silt Fence Installation” unless otherwise amended by drawings, specifications, and authorities having jurisdiction.
- B. Where possible, locate silt fence on level contour, no closer than 3 FT from toe of any slope on upslope side of fence. Allow sufficient area behind fence for ponding and runoff.
- C. Excavate trench minimum 6 IN deep by 6 IN wide along proposed fence line.
- D. Set stakes at maximum spacing of 6 FT-0 IN unless otherwise indicated. Embed stake ends no less than 12 IN below bottom of trench, or deeper to provide required lateral support.
- E. Place support mesh and attach securely to each stake with staples, wire ties or other appropriate fastener. Extend lower 3 IN of mesh below top of trench.
- F. Place fence fabric. Key in to trench no less than 12 IN. Attach to each stake at 6 IN centers. Attach at 6 IN centers to support mesh midway between stakes.
- G. Provide double stakes with fabric overlapped minimum 6 IN at fence splices.
- H. Over-backfill trench and mechanically compact level with undisturbed soil.

3.4 STORM DRAIN INLET PROTECTION

- A. Curb-Type Inlets:
 - 1. Place concrete masonry units lengthwise around perimeter of inlet with open top and bottom of units parallel to ground (not facing up). Place treated wood framing members through concrete masonry unit openings as required to maintain location and alignment of units. Maintain 1 IN wide slot between units and inlet opening for overflow.
 - 2. Wrap wire mesh continuous around outward-facing opening of concrete masonry units with sufficient overlap to hold securely in place.
 - 3. Backfill against wire mesh with aggregate drainage medium to full height of concrete masonry units and 12 – 24 IN laterally around outer perimeter of concrete masonry units.
- B. Catch Basins:
 - 1. Place wire mesh on grate inlet.
 - 2. Construct perimeter wood frame of treated 2x10s. Size frame so members will bear on grate inlet frame.
 - 3. Place wood frame on grate inlet frame. Turn up wire mesh and fasten securely to wood frame at sides or top.
 - 4. Fill wood frame with aggregate drainage medium.

3.5 CONSTRUCTION TRACKING PAD

- A. Place filter fabric on compacted grade. Fabric should be sized to extend 6 inches beyond limits of pad aggregate.
- B. Place aggregate over filter fabric to depth and dimensions indicated, but in no case less than as required for use by heaviest vehicles or equipment anticipated.

3.6 SEEDING

- A. Do not use seed which is wet, moldy or otherwise damaged.
- B. Use approved mechanical power driven drills or seeders, or mechanical hand seeders, or other approved equipment.

- C. Distribute seed evenly over entire area at minimum 1-1/2 LB/1000 SF; 50 percent sown in one direction, remainder at right angles to first sowing.
- D. Lightly rake seed into soil followed by light rolling or cultipacking.
- E. Immediately protect seeded areas against erosion by mulching or erosion control mats.
 - 1. Spread mulch in a continuous blanket using 1-1/2 TON/ACRE to depth of 4 or 5 straws.
 - 2. Immediately following spreading mulch, secure with evenly distributed asphalt binder at rate of 200 GAL/ACRE.
 - 3. Use appropriate shields to protect adjacent curbs, walks, etc.
 - 4. Protect seeded slopes against erosion with erosion mats.

3.7 MAINTENANCE

- A. Maintain storm water pollution prevention devices in good and effective condition such that performance is as intended and not compromised by missing, damaged, or defective devices.
- B. Perform maintenance on a regular basis throughout project duration.
- C. Remove accumulated sediment periodically as required.
 - 1. Silt Fence: Remove sediment at an accumulated depth of 6 IN or 1/3 the height of the adjacent silt fence, whichever is less.
 - 2. Storm Drain Inlet Protection: Remove and replace aggregate drainage medium when saturated with sediment and inlet flow is reduced.

3.8 INSPECTIONS

- A. Conduct inspections as required by authorities having jurisdiction, but no less frequently than once each week. Conduct additional inspections no more than 24 hours after the termination of rains, storms, or other natural or manmade events that affect storm drainage at the project site.
 - 1. Inspect all storm water pollution prevention systems and devices.
 - 2. For each inspection, prepare a written inspection report:
 - a. Provide a summary of the scope of the inspection. Include observations of the overall condition of each pollution prevention device in place. Itemize damaged or non-functional devices and include a repair or replacement schedule.
 - b. Include, at a minimum, dates and times, person(s) conducting and attending the inspection, conditions and problems as observed, and recommendations and actions taken.
 - c. Provide one (1) copy of each inspection report, for information only, to Owner and Architect.
 - d. Maintain copies of all reports at project site.

END OF SECTION

SECTION 31 63 29
DRILLED PIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Drilled Piers, as indicated, in accordance with provisions of Contract Documents.
- B. Definitions:
 - 1. Geotech: Representative of soils and foundation consultant hired by Owner to inspect pier installation.
 - 2. Obstruction: Unanticipated, unnatural, man made object projecting within pier shaft, greater than 1 CU FT in size, which cannot be drilled by use of normal earth drilling techniques and tools; an obstruction does not include cobbles, boulders, bedrock seams or naturally deposited material which may require a rock auger for removal.
 - 3. Caisson: Terms caisson and drilled pier are intended to mean one and the same and may be used interchangeably herein.
 - 4. Bearing strata:
 - a. Bearing layer, material or zone identified in soils report as capable of providing stated bearing capacities.
 - b. Geotech is sole judge as to when bearing strata is reached.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Subsurface soils investigations have been made at project site:
 - 1. Soils information was obtained for use in preparing foundation design.
 - 2. Availability of soils information is indicated in specifications.
 - 3. Examine site and soils report and determine character of materials to be encountered.
 - 4. Additional test borings and other exploratory operations may be made, provided such operations are acceptable to Architect.
- B. Installer qualifications: Minimum of 3 years' experience in drilled pier work, including experience with similar work and similar sub-surface conditions.
- C. Layout and measurement of piers, required for work and for specified reports, performed by a licensed surveyor employed by Contractor.
- D. Facilitate inspection by Geotech of pier excavation prior to concrete placement.
- E. Minimum bearing value of material at bottom of piers and bearing stratum as defined on the drawings.
- F. Testing:
 - 1. Routine testing of concrete for compliance with Contract Documents will be performed at no cost to Contractor.
 - 2. Pay for testing by independent testing agency necessary to secure initial materials and mix design approval.
 - 3. Provide sufficient notification of concrete placement, access for testing agency, concrete for testing and adequate storage facilities for test cylinders.
 - 4. Pay for additional testing required by Architect in order to evaluate piers failing to meet requirements of Contract Documents.
- G. Tolerances:
 - 1. Plumbness: Measured from center of hole: Not more than 1 PCT of shaft length, or 12-1/2 PCT of shaft diameter, whichever is less.

2. Location of shaft at cut-off elevation: Not more than 2 IN.
3. Cut-off elevation; plus 25 MM 1 IN minus 75 MM 3 IN from design elevation
4. Diameter: Not less than specified.

1.3 SUBMITTALS

- A. Shop Drawings:
 1. Reinforcing drawings per section 03 20 00 Concrete Reinforcement
- B. Product Data:
 1. Concrete Mix Designs per section 03 31 00 Concrete Materials and Proportioning
 2. Material certificates for permanent casing materials
- C. Project Information:
 1. Names of three past successful installations under similar conditions.
 2. Concrete: Comply with Section 03 31 00.
 3. Report for each pier:
 - a. Pier location by column grid lines.
 - b. Date and time of starting and completing excavation noting periods of delay for obstructions.
 - c. Bottom elevation of pier.
 - d. Cut-off elevation of pier.
 - e. Total length of pier from bottom to cut-off elevation.
 - f. Depth drilled into bearing stratum.
 - g. Diameter of pier shaft including variations from design.
 - h. Diameter and height of bell including variations from design.
 - i. Pier location at top and bottom of shaft, and verification of plumbness and location tolerances.
 - j. Description of soil materials and bearing capacity
 - k. Signature of Geotech that excavation was inspected and approved for concrete placement.
 - l. Corresponding concrete test cylinder numbers (obtain from testing agency).
 - m. Unusual conditions encountered including but not limited to;
 - 1) Groundwater conditions and infiltration rate depth and pumping.
 - 2) Descriptions, locations and dimensions of obstructions and removal thereof.
 - 3) Properties of slurry and slurry tests at time of slurry placement per ACI 336.1 should slurry be required.

1.4 BASE BID PRICE ADJUSTMENT

- A. Adjustment of contract price will be made on basis of unit prices included on proposal form times variation between total accumulated installed length and base bid length of piers as scheduled for each diameter and material.
- B. No adjustments will be made for variation in lengths of individual piers.
- C. Base bid shall anticipate and include drilling required above top of caisson elevation.
- D. No adjustment of contract price will be made for variations in type or length of material encountered above top of caisson.
- E. No adjustment of contract price will be made for frequency of auger and bit changes required for changes in material.
- F. Measurement of length:
 1. Measure lengths between bottom and top of caisson as detailed and defined on plans.
 2. Measure length of rock drilling and earth drilling as identified herein and established by Engineer in field.
 3. Do not include volume resulting from overdrilling.
 4. Do not include rejected piers.
 5. Include obstructed piers and replacement piers for obstructed piers.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete:
 - 1. Conform to Section 03 31 00.
 - 2. Do not use concrete which has had water added more than one hour before placement.
- B. Reinforcing Steel:
 - 1. Conform to Section 03 20 00.
 - 2. Dimensions as indicated.
- C. Concrete Admixtures:
 - 1. As permitted in Section 03 31 00.
- D. Casings, when required:
 - 1. Steel cylinders.
 - 2. Wall thickness as required for loads.
 - 3. Weld sections together, watertight.
 - 4. Loose section for cleaning and inspection of pier bottom.
 - 5. Extend to bottom of straight pier or to top of bell, unless otherwise approved.

PART 3 - EXECUTION

3.1 LAYOUT

- A. Locate piers as indicated.

3.2 INSTALLATION

- A. Perform both excavation and concrete placement for a pier on same day.
- B. Perform work with Hughes LDH or equivalent heavy duty pier drilling rig, maintained in satisfactory working condition, operated by competent and experienced person.
 - 1. Provide qualified, experienced, and direct supervision in field for pier drilling, and concrete filling of piers.
 - 2. Use loose safety casing whenever man is in hole.
 - 3. Provide other required safety procedures.
- C. Provide piers with straight shaft with or without belled bottoms as indicated.
 - 1. Size and cut to accurate dimensions according to sizes and elevations indicated.
 - 2. Ability to form an adequate bell in encountered materials may be limited.
 - 3. If machine bell is not possible, hand excavate bells.
 - 4. Hand clean bell or shaft to satisfaction of soils consultant.
 - 5. Cover excavation between operations.
 - 6. Remove foreign and loose material from approved excavation.
- D. Install a 2 IN diameter pneumatically drilled probe hole for inspection of rock continuity in each caisson after potential bearing strata is reached.
- E. Depth of probe hole smaller than 1.5 times caisson diameter or 10 FT.
- F. Approximate pier bottom elevations may be indicated as a guide for Contractor.
- G. Actual depth of pier determined at time of drilling by Geotech.
- H. Report underground obstructions to Geotech.
 - 1. When directed by Geotech, remove obstruction as extra work.
 - 2. Fill shaft with concrete when Geotech determines obstruction cannot be removed.
 - 3. Provide replacement pier or piers as directed by Geotech.
- I. At no additional cost, case pier shafts as necessary, to prevent caving and to shut off flow of ground water.

- J. Belling in a dry shaft below casing.
- K. Maintain excavations in essentially dry condition, using pumps where necessary.
- L. Have pier inspected by Geotech prior to placing concrete.
- M. Provide safety casing for cleaning and inspection.

3.3 REINFORCEMENT

- A. Place steel reinforcing cage in pier hole after inspection and approval of excavation and subgrade.
- B. Adequately support reinforcement to assure concentric alignment and adequate concrete cover over reinforcing.
- C. Place dowels and/or anchor bolts extending from top of pier immediately after concrete shaft has been fully placed.

3.4 CONCRETE PLACEMENT

- A. After approval and placement of reinforcing steel, place concrete as soon as possible.
- B. Place in manner to preclude segregation, infiltration of water, or other occurrence which would tend to decrease strength of concrete or supporting capacity of finished pier.
- C. Place concrete in such a manner so as to limit free fall to 4 FT, unless it can be satisfactorily demonstrated that concrete may free fall without segregation and/or striking sides of excavation or reinforcing.
 - 1. If excavation contains more than 6 IN of water, use tremie method to place concrete.
 - 2. Use tremie between 8 and 12 IN diameter.
 - 3. Provide positive control to insure that bottom of tremie pipe is at all times at or below concrete surface.

3.5 WITHDRAWAL OF CASING

- A. When pulling casing, maintain level of concrete above bottom of casing greater or equal to level of ground water.
 - 1. Keep bottom of liner at least 10 FT below top of concrete.
 - 2. Prevent insitu materials from falling into and mixing with concrete.
- B. Pull casing in short slow vertical lifts (essentially continuous), maintaining plumb, and sufficient head of concrete.
- C. Allow continuous observation of interior level of concrete.
- D. If reinforcing is not required, vibrate only top 15 FT of concrete.
- E. If reinforcing steel is used, vibrate full height of reinforcing or 15 FT, whichever is greater.

3.6 REJECTED PIERS

- A. Replace rejected piers.
- B. Piers may be rejected for following reasons:
 - 1. Concrete not reaching minimum 28 day design strength.
 - 2. Piers out of horizontal and vertical alignment, in excess of tolerances indicated.
 - 3. Piers of improper size and depth.
 - 4. Installation not complying with specifications.
- C. Pay for additional engineering work required for redesign due to rejected piers.

END OF SECTION



DIVISION 32

EXTERIOR IMPROVEMENTS



SECTION 32 13 13
CONCRETE PAVING AND CURBS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Concrete Paving and Curbs, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Construction minimum standards: State of Texas, Department of Transportation, "Standard Specifications for Road and Bridge Construction," latest edition, as amended to date.
- B. Should conflicts arise between standard specifications of government agencies mentioned herein and Contract Documents, Contract Documents shall govern.
- C. Where a particular type of material or method is specified, no other type of material or method will be permitted, except as described in Section 01 25 13 Substitution Procedures, but balance of State Specifications shall apply.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Concrete mix design.
- B. Mock Up
 - 1. Install 100 SF mock up on site.
 - a. Finish to be approved by Architect.
 - b. Mock up to include each concrete finish scheduled for project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Expansion joint filler:
 - 1. Base:
 - a. Sonneborn Building Products
 - 2. Optional:
 - a. Meadows, WR.
- B. Other manufacturers desiring approval comply with Section 01 25 13 Substitution Procedures.

2.2 MATERIALS

- A. Concrete:
 - 1. Air entrained.
 - 2. Vehicular paving and curb and gutter:
 - a. F'c = 4,000 PSI.
 - b. 5 IN maximum slump.
 - c. 4-6 percent air.
 - d. 3/4 IN maximum aggregate size.
 - e. 30 percent coarse aggregate; 70 percent fine aggregate.
 - f. Portland Cement: ASTM C150, Type I, 580 LBS/CY.
 - 1) Cement Color: Natural gray.

3. Walk paving:
 - a. $F'c = 3,500$ PSI.
 - b. 4 IN maximum slump.
 - c. 7 percent air.
 - d. 3/4 IN maximum aggregate size.
 - e. 30 percent coarse aggregate; 70 percent fine aggregate
 - f. Portland Cement: ASTM C150, Type I, 580 LBS/CY.
 - 1) Cement Color: Natural gray.
 - 2) Cement Color for Decorative Concrete: As specified by Section 32 13 15.
- B. Expansion joint filler:
 1. ASTM D545, flexible foam.
 - a. Base: Sonneborn Building Products, Sonoflex F.
 - b. Optional: Meadows, WR, Ceramar.
 2. Vehicular paving and curbs: 3/4 IN thick.
 3. Walks: 1/2 IN thick.
- C. Dowels, load transfer devices, tie bars, etc.: ASTM A615, Grade-60.
- D. Sealant:
 1. See Section 07 92 13.
 2. Use self-leveling type for horizontal joints.
 3. Use gun grade, non-sag type for vertical joints.
- E. Bond breaker: Liquid membrane, plastic film or asphalt saturated felt or paper.
- F. Liquid curing compound:
 1. Comply with ASTM C309 and State Specifications.

PART 3 - EXECUTION

3.1 CONSTRUCTION - GENERAL

- A. Construct to line and grade indicated.
- B. Construct in accordance with State specifications.

3.2 CONCRETE VEHICULAR PAVING WITH INTEGRAL CURB

- A. On properly compacted subgrade, install layer of concrete as indicated on plans.
 1. Scream to avoid material segregation using mechanical methods. Manual methods may be used in small areas.
 2. Hand finish as necessary, non-directional, swirled and uniform.
 3. Texture surface by a wet, double-burlap drag or broom-finish.
- B. Provide longitudinal and transverse control joints in locations indicated.
 1. 1/2 IN wide by 1/4 depth of slab with 1/4 IN radius edges at top, or:
 2. Saw cut, 1/8 IN by minimum 1/4 depth of slab.
 3. Fill with sealant.
- C. Provide expansion joints in locations indicated.
 1. 3/4 IN wide by full depth of pavement with 1/4 IN radius edges at top.
 2. Provide expansion joints where paving abuts other structures.
 3. Set joint filler to within 1 IN of surface.
 4. Seal with sealant.
- D. Provide construction joints at end of each day's work and whenever necessary to suspend work for a period of more than 30 minutes.
 1. Key joints with 2 x 1 IN key

2. Provide 1/2 IN diameter by 30 IN long deformed tie bars at 30 IN OC, centered in pavement; perpendicular to joint.
 3. Provide 1/2 IN wide by 1 IN deep joint with 1/4 IN radius edges at top.
 4. Seal with sealant.
- E. Integral curb:
1. 6 IN high by minimum 7 IN wide at gutter line, with 1 IN batter back from bottom to top.
 2. 1 IN radius at bottom and top face of curb.
- F. Provide thickened edge at drive entrances abutting slabs.
1. At end of concrete, make slab 1.5 times normal thickness and slope bottom to normal thickness in 3 FT.
- G. Correct surface deviations by removing and replacing the non-complying sections; or by grinding as approved by Engineer.
- H. Cure concrete per State Specifications.
- I. Dimensions on Drawings are to face of curb, where vertical face meets gutter line.
- J. Depress curbs for curb ramps.

3.3 CONCRETE WALK PAVING

- A. On properly compacted sub-grade, install 4 IN layer of concrete.
1. Place walk paving 1/4 IN above top of curb.
 2. Slope surface at 1:50 transversely toward curb.
- B. At single width walks 8 FT maximum, provide bond breaker between walk paving and back of curb.
1. At other locations, provide expansion joint material between walk paving and back of curb.
- C. Provide control joints:
1. Construct tooled joints.
 2. Keep joints straight and perpendicular to edge of walk unless otherwise indicated.
 3. Locate joints as indicated.
- D. Provide expansion joints as indicated and where walks meet other structures.
1. Expansion joints at maximum 30 FT OC.
 2. Set joint filler to within 1/2 IN of surface.
 3. Do not seal transverse joints of single width walks.
 4. Seal other joints.
- E. Construct curb ramps.
1. All curb ramps to have ADA approved tactile warning strips, per ADA specifications.
- F. Correct low areas to eliminate ponding conditions.
1. Correct surface deviations by removing and replacing the non-complying sections; or by grinding as approved by Engineer.
- G. Cure concrete per State Specifications.

3.4 CONCRETE CURB AND GUTTER

- A. Width: Curb and gutter. Per plans.
- B. Height: Curb and gutter. Per plans.
- C. 1 IN radius at bottom and top face of curb.
- D. Provide control joints at maximum 10 FT OC using metal templates or saw cutting.
1. Saw cut to be 0.25 of gutter depth.
 2. Cut gutter, top and face of curb.
- E. Provide 3/4 IN expansion joints, at maximum 100 FT O.C.

1. Do not seal joints.
- F. Reverse gutter slope when drainage is directed away from curb.
- G. Dimensions on Drawings are to face of curb, where vertical face meets gutter line.
- H. Depress curbs for curb ramps.
- I. Cure concrete per ASTM C309 and State Specifications.

END OF SECTION

SECTION 32 17 23
PAVING STRIPING AND MARKING

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Project information:
 - 1. Manufacturer of listed products

1.2 JOB CONDITIONS

- A. Do not paint when surface is wet, during wet or damp weather, or when temperature is below 40 degF.
- B. Do not paint or install markers when surface is wet, during wet or damp weather, or when temperature is below 40 degF.
- C. Painting Equipment:
 - 1. Self contained, self propelled striping machine
 - 2. Capable of painting line 4 IN wide with spray nozzle
 - 3. Paint kept in constant agitation and under pressure

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Paint:
 - a. Base:
 - 1) ICI Paints
 - b. Optional:
 - 1) Sherwin-Williams
 - 2. Other manufacturers desiring approval comply with Section 01 25 13 Substitution Procedures.

2.2 PAINT

- A. Non-Reflective Paint:
 - 1. Description: Non-reflective paint conforming to F.S.TT-P-1952B.
 - 2. Base Product: "Traffic Paint, Water Reducible Acrylic," Series 4800 by ICI Paints.
- B. Reflective Paint:
 - 1. Description: Reflective paint conforming to F.S.TT-P-1952B.
 - 2. Base Product: "Traffic Paint, Water Reducible Acrylic," Series 4800 by ICI Paints.
 - 3. Glass beads: 6 LBS/GAL.

Color Schedule - Paving Paint		
Item	Color	Reflective / Non-Reflective
Parking Striping	Yellow	Non-Reflective
Lane Divider lines	Yellow	Non-Reflective
Traffic Arrows	White	Non-Reflective
Pavement Lettering	Yellow	Non-Reflective
Accessible Symbols	Blue	Non-Reflective

Fire Lanes	Red	Non-Reflective
Paint-out of existing items	Black	Non-Reflective

PART 3 - EXECUTION

3.1 PREPARATION OF SURFACE

- A. Do not paint until a minimum of 5 days has elapsed from time surface is completed or cured.
 - 1. A longer period of time may be required if directed by Architect.
- B. Thoroughly clean surfaces to receive striping or marking.
- C. Assure surface is dry.

3.2 PAINTING

- A. Mark and stripe in accordance with applicable drawings with approved striping machine.
- B. Width of painted lines: 4 IN.
- C. Provide painted accessible symbols in handicapped parking stalls.
- D. Use a guide to form markings true to line and width.
- E. Keep paints thoroughly stirred and of uniform consistency during application.
- F. Do not thin in excess of manufacturer's recommendations.
- G. Use rates of application sufficient to produce complete coverage without voids or thin spots.
 - 1. Minimum Dry Film Thickness: 7mil.
- H. Overpaint unsatisfactory markings as directed by Architect.
- I. Protect marking from traffic until paint has dried to prevent tracking.

3.3 CLEANING UP

- A. Consolidate water-based paints not used and recycle or dispose per local regulations.
- B. Do not mix unused solvent based paints and recycle or dispose per local regulations.
- C. Rags and waste from solvent based paint applications which might constitute a fire hazard shall be treated or disposed per local regulations.
- D. Remove containers from site.
- E. Remove paint spots or stains on adjacent surfaces.
- F. Leave job clean and acceptable to Architect.

END OF SECTION

SECTION 32 31 14
SECURITY CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Security Chain Link Fence and Gates, as indicated, in accordance with provisions of Contract Documents.
- B. Although such work is not specifically indicated, provide all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Material Standards:
 - 1. Chain Link Fence Manufacturers Institute (CLFMI).
 - a. Metallic-coated Steel Chain Link Fence Fabric.
 - b. Industrial Steel Specifications for Fence Posts, Gates and Accessories.
 - 2. Like items of materials to be the end products of one manufacturer.
- B. Tests for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles: ASTM A90.
- C. Pipe, Steel, Black and Hot Dipped Zinc Coated, Welded and Seamless: ASTM A53.
- D. Zinc-Coated (Galvanized) Steel Barb Wire: ASTM A121.
- E. Hot Galvanized Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Bars and Strip: ASTM A123.
- F. Specification for Zinc-Coating (Hot Dip) on Iron and Steel Hardware: ASTM A153.
- G. Zinc-Coated Steel Chain Link Fence Fabric: ASTM A392.
- H. Specification for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process, Structural (Physical) Quality: ASTM A653.
- I. Specification for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process, General Requirements: ASTM-A653.
- J. Specification for Sheet and Strip, Hot Rolled Structural Quality: ASTM A1011.
- K. Standard Specification for Fence Fittings: ASTM F626.
- L. Standard Specification for Aluminum - Coated Steel Chain Link Fence Fabric: ASTM A491.
- M. Standard Specification for Aluminum - Coated Steel Barbed Wire: ASTM A121.
- N. Standard Test Method for Weight of Coating on Aluminum - Coated Iron or Steel Articles: ASTM A428.
- O. Standard Specification for Metallic-Coated Steel Wire for Chain Link Fence Fabric: ASTM A817.
- P. Standard Specification for Metallic-Coated Marcellled Tension Wire for Use with Chain Link Fence: ASTM A824.
- Q. Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures: ASTM F1083.
- R. Standard Specification for Strength Requirements of metal Posts and Rails for Industrial Chain Link Fence: ASTM F1043.

- S. Standard Specification for Industrial and Commercial Swing Gates: ASTM F900.
- T. Standard Specification for Industrial and Commercial Horizontal Slide Gates: ASTM F1184.
- U. Standard Practice for Installation of Chain Link Fence: ASTM F567.
- V. Installer qualifications: Skilled and experienced.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit schedule of components and hardware schedule indicating type of materials to be used prior to installation.
- B. Product Data:
 - 1. Provide manufacturer’s technical data and specifications for products to be installed prior to installation.
 - 2. Submit manufacturer’s certificate of compliance that specific products proposed for use meet or exceed specified requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Framework:
 - 1. General:
 - a. Pipe sizes indicated are commercial pipe sizes.
 - b. Open seam material not allowed.
 - c. All posts over 3 IN OD to be zinc-coated.
 - 2. Framework may be Type I or II pipe, unless specified otherwise: ASTM-F1043.
 - a. Type I: Schedule-40 steel pipe plain ends; Zinc-Coated: ASTM-F1083, 1.9 OZ/SF minimum.
 - b. Type II: Grade-D, cold formed, electric welded; Minimum yield strength of 50,000 PSI; Zinc-coated, ASTM-A1011 or ASTM-A653, external surface triple coated, 1 OZ/SF plus/minus 0.10 OZ, with 0.3 MIL clear overcoat.
 - 3. Performance criteria:
 - a. All pipe shall meet performance criteria in accordance with ASTM-B117.
 - b. Exterior: 1000 HRS with a maximum 5 PCT red rust.
 - c. Interior: 650 HRS with a maximum of 5 PCT red rust.
 - 4. Dimensions and weights:

Framework Size Outside Dia (OD)	Type I Steel Weight LBS/FT	Type II Steel Weight LBS/FT
1-5/8 IN	2.27	1.84
2 IN	2.72	2.28
2-1/2 IN	3.65	3.12
3 IN	5.79	4.64
3-1/2 IN	7.58	5.71
4 IN	9.11	6.56
6-5/8 IN	18.97	Not Permitted

- 5. Terminal posts (end, corner and angle):
 - a. Type I: 3 1/2 IN OD steel pipe.
 - b. Type II: 4 IN OD steel pipe.
 - c. Of sufficient length to permit minimum 48 IN to be set in concrete footing.
- 6. Line posts:
 - a. Type I: 2 1/2 IN OD steel pipe.
 - b. Type II: 2 7/8 IN OD steel pipe.
 - c. Of sufficient length to permit minimum 48 IN to be set in concrete footing.
- 7. Rails and braces:

- a. Minimum 1-5/8 IN OD.
- b. Provide expansion couplings of outside sleeve type which provide rigid attachment and allow for anticipated movement.
- c. Interrupt rails only at posts.
- 8. Gate posts:
 - a. Type I pipe.
 - b. For gates 60 IN or less: 4 IN steel pipe.
 - c. For gates greater than 60 IN: 6 IN steel pipe.
 - d. Of sufficient length to permit minimum 48 IN to be set in concrete footing.
 - e. Gate post strength to support gate without sagging in open or closed position.
- B. Fabric:
 - 1. 12 FT, nominal.
 - 2. Zinc-coated, ASTM-A392, Class 2, minimum 2 OZ/SF.
 - 3. Aluminum-coated, ASTM-A491, minimum 0.40 OZ/SF.
 - 4. Woven steel wire; 2 IN diamond mesh; 6 GA.
 - 5. Minimum tensile strength after coating: 70,000 PSI.
 - 6. Twisted and barbed at top selvages.
 - 7. Galvanize after fabrication.
 - 8. One piece wide fabric.
- C. Barbed wire:
 - 1. Zinc-coated, ASTM-A121, Class 3, 0.80 OZ/SF minimum.
 - 2. Aluminum-coated, ASTM-A121, 0.30 OZ/SF minimum.
 - 3. 12.5 GA, Two strand steel wire.
 - 4. 14 GA, 4-point barbs at 3 IN spacing.
 - 5. Provide sharp barbs tightly wrapped around uniformly twisted 12-1/2 GA wires.
- D. Barbed tape (razor tape):
 - 1. Fabricate from 430 series stainless steel.
 - 2. 0.025 IN thick x 1-1/4 IN wide.
 - 3. Assembly: Single helical coil.
 - 4. Diameter: 18 IN.
 - 5. Attachments per loop: 3.
 - 6. Pitch: 3 IN.
 - 7. Provide clusters of four 1 IN long razor barbs cut 4 IN on center.
 - 8. Form around 0.098 IN diameter stainless core wire.
- E. Concrete and reinforcing: See Division 03.

2.2 ACCESSORIES

- A. Fittings:
 - 1. Malleable steel, cast iron, pressed steel, or aluminum.
 - 2. Zinc-coating for hardware and accessories: ASTM-A153, minimum 1.8 OZ/SF; on miscellaneous items: ASTM-A53, minimum 1.8 OZ/SF.
 - 3. Aluminum-coating for hardware and accessories: ASTM-F626, aluminum or aluminum-coated steel.
 - 4. Fittings include extension arms for barbed wire, tension bars and bands, clips, truss rod assemblies, boulevard clamps, brace bands, hardware, fabric fasteners and accessories.
- B. Tension (stretcher) bar:
 - 1. Minimum 3/16 x 3/4 IN, steel.
 - 2. One -piece lengths equal to full height of fabric.
- C. Tension (stretcher) bar bands:
 - 1. Minimum 1/8 x 3/4 IN, steel.
 - 2. To secure tension bars to post; not spaced greater than 15 IN OC.

- D. Post tops: Steel, wrought iron, or malleable iron, designed as weathertight closure cap, one cap per post.
 - 1. Provide mechanical attachment to prevent unauthorized removal.
- E. Bracing:
 - 1. Compression and tension members.
 - 2. Compression: 1-1/4 IN steel pipe.
 - 3. Tension: 3/8 IN diameter steel truss rod with turnbuckles; capable of withstanding 2000 LBS tension.
- F. U-bolts:
 - 1. 3/8 IN U-bolts, galvanized or zinc-coated.
 - 2. Extend 6 IN into concrete grade beam.
 - 3. Set at third points between posts.
- G. Boulevard clamps:
 - 1. Two piece clamp with carriage bolt.
- H. Brace Bands:
 - 1. Bands, 5/8 x 1/8 IN with carriage bolt.
- I. Ties and stakes:
 - 1. For tying fabric to posts and rails: ASTM-F626.
 - 2. Provide 5 IN long, 18 GA stainless steel, double loop bar wire ties, or C-ring ties.
 - a. Provide ties for fastening razor tape as indicated to:
 - 1) Wire on fence top.
- J. Tension Wire (ASTM-A824):
 - 1. Marcellled, 7 GA steel wire.
 - 2. Minimum zinc-coating of 0.80 OZ/SF.
 - 3. Minimum aluminum-coating of 0.40 OZ/SF.

2.3 GATES

- A. Minimum 1-1/2 IN steel pipe, 2.72 LB/LF, weld corners.
- B. Fasten fabric with adjustable hook bolts on every side.
- C. Provide tension rods.
- D. Fabricate to accept detention locks provided by Section 11 19 00.
- E. Fabricate with padlock hasp for Owner furnished padlock for sliding gates.
- F. Provide 3 strands of barbed wire fastened to extended vertical of gate frame.

2.4 GATE HARDWARE

- A. Hinges:
 - 1. Pressed of forged steel or malleable iron.
 - 2. Rated heavy duty and sized for the supported gate, with large bearing surfaces for clamping in position.
 - 3. Hinges shall not twist or turn under the action of the gate.
 - 4. Non-removable type.
 - 5. Offset to permit 180 degree gate opening.
- B. Latches and stops:
 - 1. Latches for single leaf gates: Forked gravity drop bar with positive locking features.
 - 2. Latches shall be arranged for locking with specified locking hardware.
 - 3. Gates and posts shall be modified as required to receive hardware, including locking and operating mechanisms as herein specified.
 - 4. Furnish suitable casting set in concrete to hold gate leaf in place when drop rod is engaged.

- C. Hold-open-stop:
 1. Mechanical device which automatically engages the free end of the gate leaf when in the full open position and holds it in the open position until manually released.
 2. Provide hold open stops for manually operated swinging gates.
- D. Sliding gates:
 1. Provide steel heavy-duty track, ball bearing hanger sleeves, overhead framing and supports, guides, stays, bracing, end stops, catches, operating system, and accessories as required for complete operable assembly.
 2. The lock shall not be used as the “stop” when closing manual sliding gates.
 3. Provide an approved brake such that a continuous 10 to 20 LB force would be required to close the gates, preventing the gate from freely coasting along, or provide a rubber cushioned stop in the bottom guide track to absorb the energy required to stop the sliding gate when slammed closed.
 4. Support Posts: Type I pipe; minimum 4 IN OD.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of areas to accept installation.
 1. Ground surface should allow fence construction with gap of no more than 1 IN between bottom of rail and finished grade.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. General:
 1. Do not start installation until final finish grade elevations are established.
 2. Contractor to verify location of all underground utilities.
 3. Install fence in a true and correct alignment between angle points.
- B. Posts and rails:
 1. Provide holes in firm, undisturbed or compacted soil, with minimum diameter equal to 4 times OD of post.
 - a. Minimum diameter 12 IN.
 - b. Gate post: 5 times post ID.
 2. Depth:
 - a. 24 IN plus 3 IN/FT for each foot of fence height over 4 FT.
 - b. Minimum 4 IN deeper than bottom of pipe.
 - c. Provide greater depth if indicated.
 - d. Gate posts: minimum 48 IN.
 3. Set posts in minimum 3000 PSI concrete.
 - a. Work concrete into post holes leaving no voids.
 4. Set a reinforcing cage in concrete, of 4 No.4 vertical and horizontal No.4 rod bands at 12 IN OC at gate, corner and terminal posts.
 5. Plumb posts to 1/4 IN in 10 FT.
 6. Slope or dome concrete top to shed water.
 7. Space line posts equally not over 10 FT OC.
 8. Install terminal posts at ends and corners of runs and wire pull stations.
 9. Provide bracing assemblies between terminal posts and line posts adjacent to terminal posts.
 - a. Locate compression members at mid-height of fabric.
 - b. Extend diagonal tension members from compression members to bases of posts.
 10. Provide rails with expansion couplings at not more than 50 FT OC.
 11. Provide top, middle and bottom rail on fences, unless otherwise noted.
 12. Install reinforced concrete beam at fence bottom, secure bottom fence rail to beam with U-bolts embedded in concrete.

13. Anchor top rails to terminal post with appropriate wrought iron or malleable fittings.
 14. Provide center and bottom rails.
 - a. Install in one piece between posts and flush with posts of fabric side.
 - b. Use special offset fittings as required for a continuous straight line appearance.
 - c. Place bottom rail minimum 1 IN above finished grade.
 - d. Correct minor grade irregularities to maintain maximum 1 IN clearance from bottom rail.
 15. Install bracing assemblies at all end and gate posts and at both sides of corner and pull posts.
 - a. Locate compression members at mid-height of fabric.
 - b. Extend diagonal tension members from compression members to bases of posts.
 - c. Install so that posts are plumb when under correct tension.
 16. Horizontal fabric joints are not allowed.
 17. Pull post spacing, maximum 300 FT from terminal or corner post or between pull post.
- C. Sliding gate:
1. Coordinate operating and locking requirements with detention equipment supplier, Section 11 19 00.
 2. Adjust for rigid installation and smooth operation.
 3. Coat all welds with Zinc rich coating.
- D. Swinging gate:
1. Coordinate locking requirements with detention equipment supplier.
 2. Provide minimum 8 x 8 x 12 IN block of concrete at open and closed position for cane bolt keeper on double gates.
 3. Adjust for rigid, non-warping installation, no free swing in open position.
 4. Coat all welds with Zinc rich coating.
- E. Fabric:
1. Pull fabric taut and secure to posts, rails and supports.
 2. Install fabric on security side of fence.
 3. Secure so that fabric remains in tension after pulling force is released.
 4. Stretch fabric tight between terminal posts, thread tension bars through fabric and secure to posts with metal bands spaced not over 15 IN on center.
 5. Use fabric in one continuous piece between terminal posts.
 6. Tie fabric to posts and rails with tie wire.
- F. Tension bars:
1. Install nuts for tension bar and hardware bolts on side of fence opposite fabric side.
 2. Fully tighten nuts and bolts and galv-weld.
- G. Barbed or tension wire:
1. Attach to each post it intersects and arms with 12 GA galvanized tie wire.
 2. Fasten sufficiently to prevent slippage.
- H. Barbed tape:
1. Attach each coil pitch to fence and 7 GA galvanized support wire for fence mounted tape.
 2. Attach every third pitch of adjoining tape coils at their intersections for ground mounted coils.
 3. Drive stakes so notch is level with ground surface at coil to ground intersection and attach adjacent tape pitch to stake with 12 GA galvanized tie wire.
- I. Supports:
1. Attach supports with appropriate fasteners in prefabricated holes.
 2. Fully tighten fasteners and galv-weld.

END OF SECTION

SECTION 32 31 15
GATE OPERATOR - SLIDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Gate Operator - Sliding, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Company specializing in manufacture of hydraulic gate operators of type specified, with minimum of ten (10) years experience.
- B. Installer Qualifications:
 - 1. Minimum of three (3) years experience installing similar equipment.
- C. Labeling:
 - 1. Each operator to bear a label indicating that operator mechanism has been tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components and electrical test of all overload devices.
- D. Codes and Regulatory Requirements:
 - 1. Operators to be built to UL-325 standards and listed by testing laboratory.
 - a. Complete electrical work according to local codes and National Electrical code.
 - 2. Use of multiple external sensors capable of reversing gate in either direction upon sensing an obstruction.
 - 3. Gate operators to be designed and labeled for specific usage classes.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Drawings including dimensioned plan location, gate elevation and relationship to operating mechanism and unit details.
 - 2. Show connections to adjacent construction, range of travel, and electrical and mechanical connections to operator.
 - 3. Show size, reinforcement and location of concrete mounting pad.
 - 4. Indicate below grade electrical runs.
- B. Project Information.
 - 1. Manufacturer certification of gate mechanism completing 200,000 cycles without failure.
 - 2. Installation instructions:
- C. Contract Closeout Information:
 - 1. Warranty.
 - 2. Operation and Maintenance Data.
 - a. See Section 01 78 23.

1.4 WARRANTY

- A. Provide a five (5) year warranty against defects in materials and/or workmanship.
 - 1. Replace defective materials with comparable materials furnished by manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Gate Operators:
 - 1. Base:
 - a. Hy-Security Gate Operators.
 - 2. Optional:
 - a. DoorKing Inc
 - b. Linear LLC.
 - 3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Base Product: SlideDriver 50VF2, Model 222 X2 by Hy-Security Gate Operators.
- B. UL Class II and III gate operator for horizontally sliding gates.
- C. Maximum Gate Weight: 5000 LBS.
- D. Drawbar Pull: 300 LB.
- E. Rate of Travel: 26 IN per second.
- F. Chassis: 1/4 IN steel baseplate with 12 GA steel sides.
- G. Chassis cover: 16 GA sheet metal with all joints welded, filled and ground smooth.
- H. Channel support arms: Cast aluminum with 3/4 IN diameter stainless steel arm pivot pins.
- I. Drive wheels: Metal hubs with polyurethane tread.
- J. Drive rail: 1/8 IN thick extruded 6061 T6 aluminum.
- K. Factory primed with field painted finish.
- L. Start and Stop: Ultra soft start and stop.
- M. Motor:
 - 1. 2 HP.
 - 2. Variable frequency drive.
 - 3. Duty cycle: Continuous.
 - 4. Voltage: 460 VAC, 3-phase.
 - 5. Overload protection.
- N. Controls:
 - 1. Smart Touch Controller Board with 128K memory.
 - 2. For use with all UL class I - IV applications.
 - 3. Conform to UL 991 and UL 325 standards.
 - 4. Type A - Inherent entrapment sensing system.
 - 5. Warn before operate system.
 - 6. Surge protection.
 - 7. 1-wire input terminal connections and common wire bus.
 - 8. Configurable for installer options or end user options.
 - 9. 26 programmable output relay options.
 - 10. EEPROM event logging capability for troubleshooting diagnostics.
- O. Safety Sensors:
 - 1. Device which caused closing gate to reverse its motion when the presence of a foreign object is sensed.
 - a. Photo Eye, gate edge or combination as required for safe protection.
- P. Activation Device:
 - 1. Furnished and Installed by Division 28 subcontractor.
 - 2. Card Reader:

- a. Activate automatic opening of gate when valid ID card is read.
 - b. Card Reader, Support pedestal, and concrete footing,
- 3. Manual remote operation, open and close, in and out.
 - a. Locate controls in Phase I Jail Tower, Central Control Room .
- Q. Cold Weather Accessories:
 - 1. Heater with thermostat control
 - 2. Weather-strip drive rail slot in chassis.
 - 3. Snow wiper blades for drive rail.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify gate is operating smoothly under manual conditions before installation of operator.
- B. Install detector loops per manufacturer’s requirements.
- C. Install gate operator in accordance with manufacturer’s printed instructions.
 - 1. Coordinate locations of operators with contract drawings, other trades and Shop Drawings.
- D. Test gate operator through ten full cycles and adjust for operation without binding, scraping or uneven motion.
 - 1. Test limit switches for proper gate position.
- E. Fully assemble and test, at factory, each gate operator to assure smooth operation, sequencing and electrical connection integrity.
- F. Check mechanical connections for tightness and alignment.
 - 1. Verify welds for completeness and continuity.
 - 2. Verify corners and edges to assure square and aligned.
- G. Inspect painted finish.
 - 1. Touch up imperfections.
- H. Check hydraulic hoses and electrical wires to assure chafing cannot occur during operation.
- I. Fully conceal anchor bolts in finished installation.

3.2 GENERAL MAINTENANCE

- A. Train Owner’s personnel in general operation and maintenance of gate operator and accessories.

END OF SECTION

4-18-2017		
05-03-2016		
08 Oct 14		

SECTION 32 84 23
IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Irrigation system design:
1. Successful irrigation provider to design system in accordance with specifications.
 2. Submit irrigation design as shop drawing for Architect's approval.
 3. Install system per approved shop drawings.
 4. Provider responsible for proper operation of system and, therefore, adjustments can be made to insure a more suitable system.
 5. Comply with all Local codes and regulations.
 6. Contractor will be solely responsible for the irrigation system maintenance and all irrigation programming as appropriate for plant watering requirements during the one-year (1) warranty period.
 7. Irrigation/Landscape Vendor will supply owners with the following information for each of their employees who will access the on-line irrigation control system for the one (1) year warranty period; full name, email address and phone number.
 8. The proposed irrigation system must be operational before grassing operations may begin.
 9. After planting, any breakdowns or malfunctions of the irrigation system must be immediately repaired by the Contractor. Otherwise, the cost of replacing lost turf caused by the Contractor's failure to promptly repair the irrigation system will be borne by the Contractor.

1.2 QUALITY ASSURANCE

- A. Design criteria:
1. Design sprinklers to provide head to head coverage of areas indicated.
 2. Provide minimum of 1.5 IN of precipitation per week to lawn and shrubbed areas.
 3. Provide minimum of 30 PSI at base of moving spray sprinklers and 20 PSI for fixed spray sprinkler heads.
 4. Design for prevailing wind of 5 MPH and local soil types.
 5. Adjust sprinkling time to soil type to reduce water runoff.
 6. Allowable watering time: Between 10 PM and 6 AM.
 7. Locate sprinklers as required.
 8. Avoid overspray onto adjacent walks, drives, parking areas, and buildings.
- B. Installer qualifications: Personnel experienced in this work and engaged in this type of work for at least 2 years.
- C. Coordinate system with existing plants and new plants indicated on drawings.
- D. Provide head to head coverage of areas.
- E. Ball valves should be installed in front of every zone valve.
- F. Flow meter (Rain Bird) must be equipped to detect and verify flow (excessive flow and no flow)

1.3 SUBMITTALS

- A. Shop Drawings:

1. Indicate complete layout of piping, type, size, station flow rates, operating pressure, amount of water system is designed to apply per week, and length of time each station is designed to apply required water.
 - a. Differentiate between type of ground coverage (groundcovers, lawns, shrubs, trees, etc.).
 - b. Location of components.
 - c. Identify irrigation components used.
- B. Product Data:
 1. Manufacturer's specifications for materials.
- C. Project Information:
 1. Hydrostatic trunk line test report.
- D. Contract Closeout Information:
 1. Operating, programming, and maintenance data.
 2. As-built drawings of installed irrigation system with time and flow rates of each station.
 3. Warranty of all materials.

1.4 JOB CONDITIONS

- A. Provide irrigation tap, meter, all connections, and backflow preventer.
 1. Contractor to verify if existing tap, meter, and backflow preventer are able to be re-used.
- B. Verify location of existing and new underground utilities and structures.
- C. Protect existing utilities and structures and replace if damaged.

1.5 WARRANTY

- A. Written warranty for one year on installation and materials.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 1. Rain Bird is the acceptable manufacture for Flow Meter, Sprinkler heads, nozzles, controllers and valves
 2. Sprinkler heads and nozzles, controllers, and valves:
 - a. Base:
 - 1) Rain Bird Sprinkler Manufacturing.
 - a) Controller: Rain Bird LXD two (2) wire system with Rain Bird decoders
 3. Valve boxes:
 - a. Base:
 - 1) Pentek Access Boxes.
 4. Backflow preventer:
 - a. Base:
 - 1) Febco.
 - b. Optional:
 - 1) Watts Regulator.
 5. Major components manufactured or assembled by one manufacturer.
 6. Other manufacturers desiring approval comply with Section 01 25 13 Substitution Procedures.

2.2 PIPING AND WIRING

- A. PVC plastic pipe (for main trunk lines):
 1. PVC pipe:
 - a. Solvent weld, ASTM-D2241, Class 200, SDR 21.

- b. Pipe marked with manufacturers name and trademark, size, schedule, type of pipe and working pressure.
 - 2. Pipe connections:
 - a. Solvent welded socket type: ASTM-D2466, Schedule-40.
 - b. PVC threaded fittings: ASTM-D2464.
 - 3. Sprinkler head connections:
 - a. PVC fittings per sprinkler manufacturer's recommendations.
 - b. PVC threaded fittings: ASTM-D2464, Schedule-80.
 - c. Threaded nipples: ASTM-D1785, Schedule-80.
 - d. PVC swing joint assemblies: ASTM-D1785, Schedule-80.
 - e. PVC saddle tees.

- B. Polyethylene pipe (for lateral lines):
 - 1. Polyethylene pipe:
 - a. Size 1-1/2 IN and smaller; ASTM-D2239.
 - b. Pressure rating 80 PSI at 73 degF.
 - c. Mark pipe continuously and permanently with manufacturers name or trademark, size, schedule type of pipe, and working pressure.
 - 2. Pipe connections:
 - a. PVC plastic insert type with stainless steel pinch ear or screw type clamp.
 - 3. Sprinkler head fittings:
 - a. Polyethylene flexible swing joint assembly with barbed elbows.
 - b. PVC plastic ells, tees, and couplers with stainless steel pinch ear or screw type clamp.
 - c. Polyethylene adjustable length, cut-off risers and fittings.

- C. Riser assembly:
 - 1. Rotating pop up sprinkler or quick coupling valves to have an adjustable riser assembly (triple swing joint riser) assembled by use of 3 standard 90 degree ells as recommended by sprinkler manufacturer.
 - 2. Swing joint riser to be same size as inlet to sprinkler head.
 - 3. Stationary spray pop up sprinkler heads to have flexible PVC pipe or polyethylene adjustable length cut off risers.
 - 4. Sprinkler riser to be same size as inlet to sprinkler head.

- D. Sleeves for control wiring and piping:
 - 1. ASTM-D1785, Schedule-40 PVC.
 - 2. Install under walks and paving as indicated prior to installation of walks and paving.

- E. Valve boxes:
 - 1. Molded polyfiber, with green colored, non-hinged, bolted cover.
 - 2. Ametek models 10-182-001, 10-170-001, or 10-190-001.
 - 3. Carson Industries models 910, 1419 or 1419E.

- F. Jointing materials:
 - 1. Solvent cement: ASTM-D2564.
 - 2. Rubber gaskets: AWWA-C111.

- G. Electrical wiring:
 - 1. Type "UF," 600 volt, stranded or solid copper, single conductor wire with PVC insulation, UL labeled for direct underground burial.
 - 2. Conductors not smaller than No.14 AWG.
 - 3. Insulation: 1/16 IN thick minimum covering of ICC-100 compound for positive waterproofing protection.
 - 4. Sizes 14, 12, 10 and 8: Single conductor solid copper wire; sizes 6 and 4: Stranded copper wire.
 - 5. Control or "hot" wires orange, red or black; common or ground wires white.
 - 6. Wire types and installation conform to local codes.

7. Provide expansion coils as required.
8. Size conductors to provide sufficient voltage at valve solenoids for proper operation.
9. Provide wiring from control valves to controllers.

2.3 VALVES

- A. Manual circuit valves:
 1. 2 IN and smaller: Ball valve, Schedule-80 PVC, ASTM-D1785.
 - a. Pressure rated at 200 PSI at 73 degF.
 - b. Teflon ball seals.
 - c. One-piece PVC body.
 2. 2-1/2 IN and larger: Brass ball valve:
 - a. Pressure rated at 200 PSI.
 - b. Teflon ball seals.
 - c. Forged body.
 3. Locate in valve boxes.
- B. Manual drain valves:
 1. Ball valve, Schedule-80 PVC, ASTM-D1785.
 - a. Pressure rated at 200 PSI at 73 degF.
 - b. Teflon ball seals.
 - c. One-piece PVC body.
 2. Locate in valve boxes.
 3. Provide 1 CF gravel sump in bottom of valve box.
- C. Quick coupling valves:
 1. Bronze or brass, 2 piece, cast body.
 2. Valve seat and throat with replaceable seals.
 3. Bronze cover.
 4. Size: 3/4 IN single or double lug, with 3/4 IN valve key and hose swivel for 3/4 IN hoses.
- D. Automatic drain valves:
 1. Brass or PVC.
 2. Positive sealing at 3 to 5 PSI and opening to drain below this pressure.
 3. 1/2 IN male pipe thread connection.
 4. Install 30 - 45 degrees below horizontal position with 6 IN length of PVC pipe placed over outlet to prevent dirt particles from being washed back into valve.
 5. Provide 1 CF gravel sump at outlet pipe.
- E. Remote control valves:
 1. Body, bonnet, etc., molded from high strength engineering plastic.
 2. Normally closed, electrically operated.
 3. 24 VAC solenoid.
 4. Flow control.
 5. Manual bleed.
- F. Backflow preventer.
 1. Approved by local governing agency.

2.4 SPRINKLER CONTROLLER

- A. Sprinkler controller:
 1. Three valve programming per station.
 2. 24 HR watering cycle programmable for variable day cycle with capability to skip a day in watering period.
 3. 0 to 90 minutes and 0 to 9.9 hour timing per station.
 4. Rainy weather ON/OFF switch.
 5. Master valve/pump start circuit.
 6. Locking cabinet with keys.

7. Manual or automatic operation without disturbing preset automatic operation.
 8. 115-120 VAC, with internal hard wired transformer.
 9. Battery back-up to maintain programs for two weeks.
 10. Maximum 12 hour drip irrigation station timing.
- B. Evapotranspiration (ET) Features:
1. Freeze and rain sensor capability.

2.5 SPRINKLER HEAD AND NOZZLES

- A. Rain Bird:
1. Sprinkler nozzles with shrub adapter: MPR plastic and brass nozzle with brass shrub adapter.
 2. Fixed spray sprinklers: Series 1800 pop-up spray sprinklers and related nozzles.
 3. Rotary sprinklers: Series 15111B, 41-51AP, MAXI-PAW 2045A, R-50, R-70, Falcon, T-Bird and T-Bird II.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Stake out location of each run of pipe and sprinkler heads and valve locations prior to ditching.
1. Design location of heads is approximate.
 2. Modify location in field to obtain best coverage possible.
- B. Excavate trenches to required depth and width to permit proper handling and installation of pipe and fittings.
1. Compact backfill thoroughly, in 8 IN lifts, evened off with adjacent soil level.
 2. Hand rake smooth.
- C. If possible, pipe may be installed with a vibratory plow to minimize surface disturbance.

3.2 INSTALLATION

- A. Lay piping at sloped grade so that entire system of piping will completely drain to low point.
1. Install manual drain valves at low points along main trunk line.
 2. Install automatic drain valves at low points along lateral lines.
 3. Install manual circuit valves as indicated.
- B. Carefully place pipe, fittings and valves.
1. Keep interior of pipes free of dirt and debris.
 2. Close or cap open ends of pipe when laying is not in progress.
- C. Install sprinkler heads and valves to finish grade indicated. Readjust setting not at proper level.
- D. Main trunk lines: 18 IN minimum of cover over top of pipe.
- E. Lateral lines depth: 12 IN minimum of cover over top of pipe.
- F. Install pipe under existing concrete or asphalt pavement by jacking, boring or hydraulic driving.
1. Where cutting or breaking of sidewalks, concrete work and/or asphalt is necessary, remove and replace to original pavement section.
 2. Replace full panels of concrete sidewalk.
- G. Install new sleeves for pipe and wires prior to paving.
1. Depth: 18 IN minimum of cover over top of sleeve.
- H. Set heads perpendicular to finished grades.

- I. Snake plastic pipe in trench to provide for expansion and contraction as recommended by manufacturer.
- J. Cut plastic pipe with hacksaw and square or sawing vise to ensure square cut.
 - 1. Remove burrs at cut ends prior to installation.
 - 2. Solvent weld plastic to plastic joints.
 - 3. Use only solvent recommended by manufacturer.
 - 4. For plastic to metal joints, use plastic male adapters.
 - 5. Allow joints to set at least 24 hours before pressure is applied to pipe system.
- K. Install electric wiring in pipe trenches where possible.
 - 1. Install wiring along side of pipe if possible.
 - 2. Snake wire in trench as much as possible to allow for expansion and contraction.
 - 3. If wire is run in separate trench, provide 12 IN of cover.
 - 4. Provide sufficient wire at remote control valves so that, in case of repair, valve bonnet or splice may be brought to surface without disconnecting wire.
- L. Install controllers as indicated.
 - 1. Connect common wires of remote control valves of one controller to that controller's common ground wire system.
- M. Install drip system per manufacturer's guidelines.
- N. Restore existing improvements and sod damaged as a result of this work.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of main trunk line, hydrostatically test to pressure not less than 50 percent more than maximum operating pressure, but in no case less than 100 PSI.
 - 1. Maintain this pressure for 30 minutes.
 - 2. Repair or replace leaks or defective pipe and repeat tests until test requirements are met.
- B. After sprinkler piping, risers and heads are in place and connected, open control valves and flush out system with full head of water.
 - 1. Remove and clean internal parts of vertical valves.
 - 2. Repeat as many times as necessary to insure a completely flushed system.

3.4 ADJUST AND CLEAN

- A. Adjust pins of adjustable sprinklers into stream for proper and adequate distribution of water over coverage pattern.
- B. Tighten nozzles on stationary sprinklers.
- C. Adjust sprinklers having an adjusting screw, adjusting stem or adjusting friction collar for proper arc of coverage, radius, diameter and/or gallonage discharge.
- D. Adjust automatic control valves to correct operating pressure for specific sprinkler heads downstream of valve.
- E. Thoroughly clean parts, equipment, fixtures, pipe, valves and fittings of grease, plastic cuttings and sludge.
- F. Prior to final acceptance, inspect and test operation of each piece of equipment and system to satisfaction of Owner and Architect.
- G. Adjust system to provide uniform coverage, insofar as practical.
- H. Remove debris produced as a result of work.
- I. Adjust height of heads and valve boxes as required.
- J. Provide Owner operating and winterizing instructions.

3.5 OPERATION

- A. Submit three (3) written operating instructions, including winterization procedures and start-up with cut sheets of products, and coordinate controller/watering operation instruction with Owner personnel.
- B. Controller charts: Do not prepare charts until recorded as constructed. Drawings will be reviewed by Engineer.
- C. Provide one (1) controller chart for each automatic controller installed. Chart may be a reproduction of recorded drawing and attached on the wall above the controller.
- D. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility including the numbers for each zone.
- E. Chart shall be a copy of actual "as constructed" system showing area covered by that controller.
- F. Identify area of coverage of each remote control valve, using a distinctly different pastel color over entire area of coverage.
- G. Following review of charts by Consultant, they shall be hermetically sealed between two (2) layers of 20 mm thick plastic sheet.
- H. Charts shall be completed and reviewed prior to final review of irrigation system.

3.6 MAINTENANCE

- A. Irrigation/Landscape contractor will be solely responsible for the irrigation system monitoring and all irrigation programming as appropriate for plant watering requirements during the one year warranty period.
- B. Irrigation/Landscape Vendor will supply owners with the following information for each of their employees who will access the on-line irrigation control system for the one (1) year warranty period; full name, email address and phone number.

END OF SECTION

SECTION 32 92 23
SODDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Sodding, as indicated, in accordance with provisions of Contract Documents.
- B. Location of work:
 - 1. Establish sodding on areas indicated which are not occupied by other planting or construction.
 - 2. Sod disturbed areas outside limits of construction.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Minimum standards: In accordance with American Sod Producers Association, (ASPA) "Guideline Specifications for Sodding" (ASPA-01), current edition.

1.3 SUBMITTALS

- A. Project Information:
 - 1. Certificates for sod stating botanical and common names and percentages of each species percentage of purity.
 - 2. Sod labeled in accordance with ASPA-01 and equaling or exceeding specification requirements.
 - 3. Fertilizer indicating chemical analysis.
 - 4. Copies of invoices for fertilizer used on project, indicating grade furnished, to determine total quantity applied.
- B. Contract Closeout Information:
 - 1. Maintenance data.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect sod from drying out.
- B. Deliver fertilizer to site in original unopened containers, labeled with manufacturers chemical analysis.

1.5 JOB CONDITIONS

- A. Perform sodding during conditions conducive to successful results.
 - 1. Provide proper and adequate protection.
 - 2. Do not lay on dried-out soil.
 - 3. Do not place dried-out sod.
 - 4. Do not lay when temperature is below 32 degF.
 - 5. Lay within 24 hours of stripping.
- B. Actual dates for sodding will vary depending on construction schedule and pending weather conditions. Notify Architect of anticipated dates for doing work at least 30 days in advance.

1.6 WARRANTY

- A. Remove and replace dead or dying sod during one year from Substantial Completion.

- B. Replacement materials and methods identical to original.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Establish a smooth, healthy, uniform close stand of sod.
- B. Materials:
 - 1. Sod Variety: Common Bermuda.
 - 2. Thickness of Cut: Turfgrass sod shall be machine cut at uniform soil thickness of 0.60 inch (15 mm), plus or minus 0.25 inch (6 mm), at the time of cutting. Measurement for thickness shall exclude top growth and thatch.
 - 3. Pad Size: Individual pieces of Turfgrass sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 0.5 inch (15 mm) on width and plus or minus five percent on length. Broken pads and torn or uneven ends will not be acceptable.
 - 4. Strength of Turf Sod Sections: Standard size sections of Turfgrass sod shall be strong enough that it can be picked up and handled without damage.
 - 5. Moisture Content: Turfgrass sod shall not be harvested or transplanted when its moisture content (excessively dry or wet) may adversely affect its survival.
 - 6. Mowing Height: Before harvesting, the Turfgrass shall be mowed uniformly at a height of 1 to 2.5 inches (25 to 60 mm).
 - 7. Time Limitations: Turfgrass sod shall be harvested, delivered and installed/transplanted within a period of 24 hours, unless a suitable preservation method is approved prior to delivery. Turfgrass sod not transplanted within this period shall be inspected and approved by the inspecting officer or his representative prior to its installation.
 - 8. Thatch: Turfgrass sod shall be relatively free of thatch, up to 0.5 inch (15 mm) allowable (uncompressed).
 - 9. Diseases, Nematodes and Insects: Turfgrass sod shall be reasonably free of diseases, nematodes and soil-borne insects. Specific nursery and/or plant materials laws may require that all sod entering inter-state commerce be inspected and approved for sale. The inspections and approval must be made by the appropriate government representative of the agriculture department or office of entomologist.
- C. Fertilizer:
 - 1. Commercial fertilizer of 18-46-0 analysis, meeting applicable requirements of State and Federal Law.
 - 2. Do not use cyanamic compounds or hydrated lime.
- D. Water for planting purposes:
 - 1. Supplied by Owner.
 - 2. Provide equipment necessary to transport water from source to required locations.
 - 3. Do not waste water.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

- A. Limit preparation to areas which will be sodded soon after preparation.
- B. Loosen surface to minimum depth of 4 IN.

- C. Remove stones and debris over 1 IN in any dimension.
- D. Recess grade at walks and curbs 1 IN.
- E. Correct surface irregularities in order to prevent pocket or low areas which will allow water to stand.
- F. Grade areas to be sodded to smooth, even surface with loose, uniformly fine texture.
 - 1. Roll and rake, remove ridges and fill depressions as required to meet finished grades.
 - 2. Fine grade just prior to sodding.
- G. Distribute fertilizer uniformly over areas to be sodded at rate of 8.3 LB/1000 SF.
 - 1. Use suitable distributor.
 - 2. Incorporate fertilizer into soil to depth of at least 2 IN.
- H. Clean surface of substances which will interfere with turf development or subsequent mowing operations.
- I. Restore areas to specified condition if eroded or otherwise disturbed between finished grading and sodding.
- J. If fertilizer application rate is found, by invoices submitted, to be less than that specified, provide and apply additional fertilizer.

3.2 SODDING

- A. Lay to form solid mass with tightly fitted joints.
 - 1. Butt ends and edges; do not overlap.
 - 2. Stagger joints.
 - 3. Lay across slope, at right angles to slope.
 - 4. Lay beginning at base of slope, working up slope.
 - 5. Blend sod into existing lawn.
- B. Tamp or roll lightly to ensure full contact with subgrade.
- C. Work sifted soil into minor cracks, avoid smothering adjacent grass.
- D. Peg sod on slopes to prevent slippage.
 - 1. Use sharpened 1 x 1 x 6 IN wooden pegs.
 - 2. Drive pegs flush with surface of sod.
 - 3. Space pegs 24 IN on center maximum.

3.3 MAINTENANCE

- A. Maintain sod for 30 days after laying.
 - 1. Water, fertilize, weed, mow, trim, roll, regrade, resod as required.
 - 2. Establish a smooth, healthy, uniform, close stand, free of eroded or bare areas, weeds and surface irregularities.
- B. Provide and maintain temporary piping, hoses and watering equipment as required to keep sodded areas uniformly moist for proper growth.
 - 1. Lay out temporary watering system and arrange watering schedule to avoid walking over muddy and newly sodded areas.
 - 2. Prevent puddling and water erosion and displacement of sod.
- C. Mow sod as soon as there is enough top growth to cut with mower set at recommended height for principal species and before height exceeds 3 IN.
 - 1. Repeat mowing as required to maintain height.
 - 2. Do not delay mowing until grass blades bend over and become matted.
 - 3. Do not mow when grass is wet.

4. Time initial and subsequent mowings as required to maintain height of 1-1/2 to 2 IN.
 5. Do not mow lower than 1-1/2 IN.
 6. Remove no more than one-half grass leaf surface at any time.
- D. Resod bare, dead or dying areas using same materials specified.

END OF SECTION



DIVISION 33

UTILITIES



SECTION 33 10 00
WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes water-distribution piping and related appurtenances from tapping of main to:
 - 1. Within 5 feet of outside the building limits for domestic and irrigation water service; and,
 - 2. 1 foot above finished floor elevation for fire service mains.
 - 3. Supply and discharge piping, including connections, to fire protection water tank if shown on plans.
- B. All work shall conform to the requirements of the local water authority, fire marshal, any other regulatory authorities having jurisdiction, or this specification, whichever is more stringent.

1.2 REFERENCED SECTIONS

- A. Section 31 23 33 – Trenching, Backfilling and Compacting for utilities

1.3 REFERENCE STANDARDS

- A. Factory Mutual (FM)
 - 1. Approval Guide
- B. Underwriters Laboratories (UL)
 - 1. Fire Protection Equipment Directory
 - 2. UL 1285 - Pipe and Couplings, Polyvinyl Chloride (PVC), for Underground Fire Service
 - 3. UL 262 - Gate Valves for Fire-Protection Service
 - 4. UL 246 - Hydrants for Fire-Protection Service
- C. National Sanitation Foundation (NSF)
 - 1. NSF 14 - Plastics Piping System Components and Related Materials
 - 2. NSF 61 - Drinking Water System Components - Health Effects
- D. National Fire Protection Association (NFPA)
 - 1. NFPA 70 - National Electrical Code
- E. NFPA 24 - Standard for the Installation of Private Fire Service Mains and their Appurtenances
 - 1. NFPA 1963 - Screw Threads and Gaskets for Fire Hose Connections
(revision of ANSI/NFPA 1963-1993)
 - 2. NFPA 13 – Installation of Sprinkler Systems (latest edition)
- F. American Water Works Association (AWWA)
 - 1. C151 Ductile-Iron Pipe, Centrifugally Cast, for Water (revision of ANSI/AWWA C151/A21.51-91)
 - 2. C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
 - 3. C150 - Thickness Design of Ductile-Iron Pipe
 - 4. C110 - Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (75 mm through 1200 mm), for Water and Other Liquids
 - 5. C153 - Ductile-Iron Compact Fittings, 3 in. through 24 in. (76 mm Through 610 mm) and 54 in. through 64 in. (1,400 mm Through 1,600 mm), for Water Service
 - 6. C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inch through 12 Inch for Water Distribution
 - 7. C500 - Gate Valves for Water and Sewage Systems
 - 8. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 - 9. C550 - Protective Epoxy Interior Coatings for Valves and Hydrants
 - 10. C509 - Resilient-Seated Gate Valves for Water Supply Service

11. M44 – Distribution Valves: Selection, Installation, Field Testing, and Maintenance
 12. C800 - Underground Service Line Valves and Fittings
 13. C702 - Cold Water Meters - Compound Type
 14. C502 - Hydrants, Dry Barrel Fire
 15. M41 – Ductile Iron Pipe and Fittings
 16. C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances
 17. C605 - Water Treatment - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water
 18. M23 - PVC Pipe: Design and Installation
 19. M17 - Fire Hydrants: Installation, Field Testing, and Maintenance
 20. C651 - Disinfecting Water Mains
- G. American Society for Testing and Materials (ASTM)
1. B88 - Standard Specification for Seamless Copper Water Tube
 2. B813 - Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
 3. B32 - Standard Specification for Solder Metal
 4. D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
 5. D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
 6. F645 - Standard Guide for Selection, Design, and Installation of Thermoplastic Water Pressure Piping Systems
- H. American Society of Mechanical Engineers (ASME)
1. B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings R(1994)
 2. B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- I. Manufacturer’s Standardization Society (MSS)
1. SP-60 - Connecting Flange Joint Between Tapping Sleeves and Tapping Valves
- J. Copper Development Association (CDA)
1. Copper Tube Handbook

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements of the regulatory authorities having jurisdiction; including tapping of water mains, backflow prevention, installation, testing, and disinfection. Comply with standards of the regulatory authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: UL listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the regulatory authorities having jurisdiction, and marked for intended use.
- D. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 13 and NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- F. NSF Compliance: Comply with NSF 14 for plastic potable-water-service piping. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.
- G. Comply with requirements of Section 31 23 23 – Trench Excavation and Backfill.

1.5 SUBMITTALS

- A. The General Contractor and the Subcontractor shall execute the Conformance Submittal(s) at the end of this section.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify the Owner not less than 2 days in advance of proposed utility interruptions; and,
 - 2. Do not proceed with utility interruptions without written permission from the Owner.
- B. Removal/Relocation of Existing Utilities: The contractor shall be responsible for removal and/or relocation of existing utilities, whether shown or not shown on the drawings, at locations where conflicts occur with proposed water line improvements at no additional cost to the owner.

1.7 COORDINATION AND FEES

- A. The Contractor shall be responsible for obtaining and payment of all tap and construction permit fees associated with this section.
- B. The Contractor shall provide and install domestic and irrigation water lines, meters, and appurtenances as shown on the drawings to within 5 feet of building limits, including, but not limited to, any taps, meters, vault, and backflow prevention. If Contractor's work terminates at a connection point where work by others is complete, Contractor shall make the connection. If future connections will be required by others, Contractor shall install plugging and marking apparatus as necessary to protect his work.
- C. The Contractor shall provide and install fire service water lines, meters, and appurtenances as shown on drawings to 1 foot above finished floor elevation, including, but not limited to any taps, meters, backflow prevention, hydrants, and free standing fire department connections. If Contractor's work terminates at a connection point where work by others is complete, Contractor shall make the connection. If future connections will be required by others, Contractor shall install plugging and marking apparatus as necessary to protect his work.

PART 2 - MATERIALS AND APPLICATION

2.1 PIPE AND FITTINGS, APPLICATION

- A. Ductile-Iron Pipe, NPS 3 inches or larger:
 - 1. Ductile iron pipe shall conform to the requirements of AWWA C151, class 350, and shall have a cement-mortar lining of standard thickness in accordance with AWWA C104; pipe thickness shall be in accordance with AWWA C150; pipe shall have push-on joints in accordance with AWWA C110. Additional fittings shall be mechanical-joint ductile-iron compact fittings in accordance with AWWA C153 or standard size in accordance with AWWA C110.
- B. Soft Copper Tubing, NPS 3 inches or smaller:
 - 1. Tubing shall be manufactured in accordance with ASTM B88, Type K, annealed temper. Fittings shall be in accordance with ASME B16.18, for cast-copper-alloy, solder joint pressure fitting, or ASME B16.22 for wrought-copper, and copper-alloy, solder joint pressure fitting type. Soldering flux shall be in accordance with ASTM B813, water-flushable type. Solder filler metal shall be in accordance with ASTM B 32, lead-free type with 0.20 percent maximum lead content.
- C. Polyvinyl Chloride (PVC) Pipe, NPS 4 inches to NPS 12 inches:
 - 1. PVC pipe shall conform to the requirements of AWWA C900, Class 150, DR 18. Pipe joints shall be elastomeric joints only. Sleeve couplings are not permitted except as necessary for repairs during testing, or connections to existing mains. Comply with UL 1285 for fire-service mains. Fittings shall be mechanical-joint ductile-iron compact fittings in accordance with AWWA C153 or standard size in accordance with AWWA C110.
- D. Polyvinyl Chloride (PVC) Pipe NPS 2 inch to NPS 3 inch:

1. Pipe shall conform to the requirements of ASTM D2241, SDR 21, with elastomeric joints conforming to ASTM D3139. Pipe jointing shall be by elastomeric joints only. Sleeve couplings are not permitted except as necessary for repairs during testing, or connections to existing mains. Fittings shall be PVC fabricated fittings with elastomeric gaskets, or ductile iron compact fittings conforming to AWWA C153 with elastomeric gaskets.

2.2 VALVES

A. Cast-Iron, Gate Valves:

1. Nonrising-Stem, Metal-Seated Gate Valves: AWWA C500, UL 262, FM-approved, gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
 - a. Minimum Working Pressure: 200 psig (1380 kPa).
 - b. End Connections: Mechanical joint, per (AWWA C 111).
 - c. Interior Coating: Complying with AWWA C550.
 - d. Nut: 2 inches square, complying with AWWA C500.
2. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509, UL 262, FM-approved, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - a. Minimum Working Pressure: 200 psig (1380 kPa).
 - b. End Connections: Mechanical joint, per ANSI A21.11 (AWWA C111).
 - c. Interior Coating: Complying with AWWA C550.
 - d. Nut: 2 inch square, complying with AWWA C500.

B. Tapping-Sleeve Assemblies: Conform to the requirements of MSS SP-60. Tapping sleeves may be cast-iron, ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection.

C. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, lid with lettering "WATER," bottom section with base of size to fit over valve, and approximately 5 inch diameter barrel. Provide a 2' x 2' x 6" concrete apron around all valve boxes in asphalt pavement areas.

D. Operating Wrenches: Steel tee-handle, stem of length to operate deepest buried valve, and 2 inch square socket matching valve operating nut, placed in sprinkler room.

2.3 CORPORATION VALVES AND CURB STOPS

A. Service-Saddle Assemblies: Comply with AWWA C800.

B. Corporation Valve: Comply with AWWA C800, bronze body, threaded inlet and outlet matching service piping material.

C. Curb Stops: Comply with AWWA C800, bronze body, with inlet and outlet matching service piping material.

2.4 POST INDICATOR VALVES

A. Post indicator valves shall be UL listed and FM approved.

2.5 WATER METERS

A. As required by City of Denton.

2.6 BACKFLOW-PREVENTION DEVICES

A. Comply with regulatory authorities having jurisdiction requirements. Maximum pressure loss for a double detector check valve shall be 5 psi @ 2250 gpm and maximum pressure loss for a RPZ shall be 12 psi @ 2250 gpm.

2.7 FREESTANDING FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants: AWWA C502, UL 246, FM-approved, 1 NPS 4.5 inch and 2 NPS 2.5 inch outlets, 5.25 inch main valve, drain valve, and NPS 6 inches mechanical-joint inlet.

Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig minimum working-pressure design. Provide a 2' x 2' x 6" concrete apron around all hydrant valves in asphalt pavement areas.

1. Outlet Threads: NFPA 1963, with external hose thread used by regulatory authorities having jurisdiction, including fire department. Include cast-iron caps with steel chains;
2. Operating and Cap Nuts: Pentagon, standard;
3. Direction of Opening: standard, a clearly visible arrow and the word "open" shall be cast in relief on the top of the hydrant so as to designate the direction of opening; and,
4. Exterior Finish: Red alkyd-gloss enamel paint, two coats.

2.8 RESTRAINED JOINT SYSTEMS FOR FIRE LINE LEAD-IN

- A. The following section shall only apply to the portion of fire protection main extending from the 90 degree elbow below the sprinkler riser room floor to the flanged end of the pipe extending 1'-0" above the sprinkler riser room finished floor and the horizontal portion of pipe extending from the 90 degree elbow towards the building foundation.
- B. The fire protection main entering the sprinkler riser room through the floor shall be restrained from movement by the following:
 1. Pipe Clamps
 - a. Clamp dimensions shall be 5/8" x 2 1/2" for 10" pipe, 5/8" x 3" for 12" and larger pipe;
 - b. Clamp bolt dimensions shall be 3/4" for 10" pipe, 7/8" for 12" and larger pipe;
 - c. The diameter of the bolt hole shall be 1/16" larger than that of the corresponding bolt.
 2. Tie Rods: Threaded sections of rods shall not be formed or bent. Rods shall not be less than 5/8" in diameter and the minimum number of rods for each clamp shall be:
 - a. 10" Pipe: (4)-5/8" or (3)-3/4" or (2)-7/8" rods;
 - b. 12" Pipe: (6)-5/8" or (4)-3/4" or (3)-7/8" rods; and
 - c. 14" Pipe: (8)-5/8" or (5)-3/4" or (4)-7/8" rods
 - d. 16" Pipe: (10)-5/8" or (7)-3/4" or (5)-7/8" rods
 3. Washers
 - a. Cast-iron washer dimensions shall be 5/8" x 3" for 10" pipe, 1/2" x 3 1/2" for 12" pipe and larger;
 - b. Steel washer dimensions shall be 1/2" x 3" for 10" pipe, 1/2" x 3 1/2" for 12" pipe and larger; and
 - c. The diameter of the hole in the washer shall be 1/8" larger than the rod.
 4. Polyethylene Encasement: To prevent corrosion, a polyethylene tube/sheet shall be applied to the exterior piping, fittings, clamp and rods. The polyethylene casing shall be applied per the manufacturer's listing and shall extend 6" above finished floor elevation in the sprinkler room.

PART 3 - EXECUTION

3.1 TRENCHING

- A. Comply with requirements of Section 02305, Trench Excavation and Backfill.

3.2 VALVES

- A. General Application: Use mechanical joint valves for NPS 2 inch and larger underground installation. Use threaded or flanged-end valves for installation in vaults.
- B. Provide 2' x 2' x 6" concrete apron around all valve boxes in asphalt pavement areas.

3.3 PIPE AND FITTING INSTALLATION

- A. Water-Main Connection: Verify with regulatory authorities having jurisdiction that size of tap and location shown on drawings is acceptable. Make tap conforming to requirements of regulatory authorities having jurisdiction and Manufacturers Standardization Society (MSS) standards.

- B. Comply with NFPA 24 for fire-service-main piping materials and installation.
- C. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- D. Install copper tube and fittings in accordance with Copper Development Association (CDA) "Copper Tube Handbook."
- E. Install PVC pipe in accordance with AWWA C605 M23 and ASTM F 645.
- F. All piping shall be installed with a minimum of 42 inches of cover, or 12 inches below level of max frost penetration, or as required by regulatory authorities having jurisdiction, whichever is deeper. If pipe is installed in a cut section prior to completion of grading operations, pipe shall be installed so that minimum required cover will exist upon completion of grading operations.
- G. Terminate water piping as required per above Article 1.06.
- H. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports. See thrust block details on drawings.
- I. Pipe Bedding: Pipe bedding material shall be as specified on trenching and bedding details as shown on drawings. No pipe shall be laid resting on a rock, blocking or unyielding objects.
- J. Location with Sewers: Separate trenches shall be provided for water lines and sewer lines, with lines separated by a minimum of 10 feet horizontally. Water mains that cross sewers shall have a minimum vertical separation of 18 inches.
- K. All piping shall be installed and verified to be level. This shall apply to piping in the horizontal and vertical positions.

3.4 ANCHORAGE INSTALLATION

- A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600;
 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23;
 3. Fire-Service-Main Piping: According to NFPA 24; and,
 4. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 BACKFLOW-PREVENTER INSTALLATION

- A. Comply with regulatory authorities having jurisdiction, including water authority requirements.
- B. Do not install bypass piping around backflow preventers.

3.6 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. Comply with AWWA M17 and NFPA 24.

3.7 QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests:
 1. The Contractor shall test all pipe lines and appurtenances with water at test pressure of 200 psi or 50 psi in excess of the system working pressure, whichever is greater. Test pressure must be maintained for at least 2 hours. All leakage apparent after testing must be repaired immediately. The work will not be finally accepted until leakage shall be as follows:

- a. The amount of leakage at the joints shall not exceed 2 quarts per hour per 100 gaskets or joints, irrespective of pipe diameter.
 - b. The amount of leakage specified above shall be permitted to be increased by 1 fluid ounce per inch valve diameter per hour for each metal seated valve isolating the test section.
 - c. If dry barrel hydrants are tested with the main valve open so the hydrants are under pressure, an additional 5 fluid ounces per minute shall be permitted for each hydrant.
 - d. The amount of leakage in buried piping shall be measured at the specified test pressure by pumping from a calibrated container.
2. Fire Water System tests shall be in full conformity with the requirements of all applicable codes, NFPA standards, and other authorities having jurisdiction.
- a. All new underground mains and lead-ins shall be flushed thoroughly before connection is made to internal system piping. The site utility subcontractor shall be responsible for disposal of the test water drained from the test outlets.
 - b. The trench shall be backfilled between joints before testing to prevent movement of pipe.
 - c. Test shall be made by the site utility subcontractor in the presence of the regulatory authority having jurisdiction and/or the Owner's representative.
 - d. After the fire service underground main and lead-in have been installed by the site utility subcontractor and are ready for use, the site utility subcontractor shall furnish 2 completed copies of the "Contractor's Material and Test Certificate for Private Fire Service Mains" form to the General Contractor. Prior to attachment of any pipe or equipment to the lead-in located in the sprinkler room, the sprinkler subcontractor shall obtain a copy of the completed form from the General Contractor.
 - e. The site utility subcontractor shall prepare reports of testing activities and submit 2 copies to the General Contractor.

3.8 IDENTIFICATION

- A. Install continuous underground detectable warning tape in accordance with Section 31 22 00 – Earthwork, or a 14-gauge solid copper tracer wire prior to backfilling of trench for underground PVC water-service piping. Locate below finished grade, directly over piping.

3.9 CLEANING AND FLUSHING

- A. Clean and disinfect water-distribution piping as follows:
 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use;
 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet;
 3. Use purging and disinfecting procedure prescribed by regulatory authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below; and,
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination
 4. The site utility subcontractor shall prepare reports of purging and disinfecting activities and submit 2 copies to the General Contractor.
 5. All fire protection underground mains shall be flushed per the flow rates listed below:

8" pipe	2,350 gpm	8" pipe	1,560 gpm
10" pipe	3,670 gpm	10" pipe	2,440 gpm
12" pipe	5,290 gpm	12" pipe	3,520 gpm
14" pipe	7,188 gpm		
16" pipe	9,388 gpm		

Underground and lead-in fire protection mains shall be flushed through fire hydrants at dead ends of the underground piping system or through aboveground flushing outlets which are accessible, will allow water to drain to a safe location and will provide the required flow listed above. Flush underground mains until water is clear. Continue to flush for five minutes after water is clear. Utilize approved waterflow measuring devices to verify that the required waterflow is achieved.

END OF SECTION

SECTION 33 31 00
SANITARY SEWER

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes sanitary sewer piping and related appurtenances from connection to main to within 5 feet of outside the building limits.
- B. All work shall conform to the requirements of the local sewer authority and any other regulatory authorities having jurisdiction, or this specification, whichever is more stringent.

1.2 REFERENCED SECTIONS

- A. Section 31 23 33 – Trenching, Backfilling and Compacting for utilities

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe
 - 2. D3034 - Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
 - 3. F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - 4. F679 - Standard Specification for Poly Vinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
 - 5. C476 - Standard Specification for Grout for Masonry
 - 6. C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
 - 7. C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
 - 8. D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
 - 9. C478 – Standard Specifications for Precast Reinforced Concrete Manhole Sections
 - 10. C969 – Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
- B. American Society of Sanitary Engineers (ASSE)
- C. American National Standards Institute (ANSI)
- D. American Concrete Institute (ACI)
 - 1. 318 - Building Code Requirements for Structural Plain Concrete
- E. National Sanitation Foundation (NSF)
- F. American Water Works Association (AWWA)
 - 1. C110 - Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (75 mm through 1200 mm), for Water and Other Liquids (revision of ANSI/AWWA C110/A21.10-93)
 - 2. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings C153 - Ductile-Iron Compact Fittings, 3 in. through 24 in. (76 mm Through 610 mm) and 54 in. through 64 in. (1,400 mm Through 1,600 mm), for Water Service (revision of ANSI/AWWA C153/A21.53-94)
 - 3. C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances (revision of ANSI/AWWA C600-93)
 - 4. C150 – ANSI Standard for Thickness Design of Ductile Iron Pipe
 - 5. C151 – ANSI Standard for Ductile Iron Pipe
 - 6. C153 – ANSI Standard for Ductile Iron Pipe Compact Fittings
- G. Federal Specifications

1. SS-S-00210 – Sealing Compound Preformed Plastic for Pipe Joints
- H. Uni-Bell PVC Pipe Association
 1. UNI-B-6 - Low-Pressure Air Testing of Installed Sewer Pipe

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.
- B. Force-Main Pressure Ratings: At least equal to system operating pressure, but not less than 150 psig.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements of the regulatory authorities having jurisdiction; including tapping of sewer mains, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with requirements of Section 31 23 33, Trenching, Backfilling and Compacting for utilities.

1.6 SUBMITTALS

- A. The General Contractor and the Subcontractor shall execute the Conformance Submittal(s) at the end of this section.

1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify the Owner not less than two days in advance of proposed utility interruptions; and,
 2. Do not proceed with utility interruptions without written permission from the Owner.
- B. Removal/Relocation of Existing Utilities: The contractor shall be responsible for removal and/or relocation of existing utilities, whether shown or not shown on the drawings, at locations where conflicts occur with proposed sanitary sewer improvements at no additional cost to the owner.

1.8 COORDINATION & FEES

- A. Contractor shall be responsible for obtaining and payment of all tap and construction permit fees associated with this section.
- B. Contractor shall install all sewer lines and appurtenances as shown on the drawings to within 5 feet of building limits. This shall include any taps, pumps, tanks, etc. If Contractor's work terminates at a connection point where work by others is complete, Contractor shall make the connection. If future connections will be required by others, Contractor shall install plugging and marking apparatus as necessary to protect, identify and locate his work.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. PVC Sewer Pipe and Fittings: 12 inches and smaller: ASTM D 3034, SDR 35, elastomeric gasket joints per ASTM F477 and ASTM D3212.
- B. PVC Sewer Pipe and Fittings: 15 inches and larger: ASTM F 679, SDR 35, Type T-1, elastomeric gasket joints per ASTM F477 and ASTM D3212.
- C. Ductile-Iron Sewer Pipe and Fittings: ASTM A 746, AWWA C110, AWWA C111, AWWA C150, AWWA C151, AWWA C153, for push on joints.

2.2 MANHOLES

- A. Instal per City of Denton details.

- B. Standard manhole frames and covers: shall conform to the standard detail of the regulatory authorities having jurisdiction for the project (if applicable). Otherwise, manhole frames and covers to be Neenah Foundry Co. No. R-1642 or Vulcan Foundry Inc. No. V-1357.
- C. All sanitary sewer manhole covers shall have the word "SANITARY SEWER" cast on the top in letters 2 inches high.

2.3 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, 4,000 psi

2.4 CLEANOUTS

- A. Cleanouts shall be provided on sewer service laterals at no more than 100' on centers. Exterior cleanout plug shall be US Foundry cover USF 7621 or equal. Each cleanout plug shall be level with adjacent grade and provided with a 2' x 2' x 6" thick concrete apron.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Excavating, trenching, and backfilling are specified.
- B. Identification: Materials and their installation are specified in Section 31 22 00 – Earthwork . Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.
 - 1. Use warning tape or detectable warning tape over ferrous piping; and,
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.
- C. Piping Applications: Include watertight joints.
- D. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- E. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- F. Install gravity-flow piping to within 5 feet of the building, at the building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.
- G. Install piping at slope shown on the drawings. If no slope is shown, minimum slope shall be 1% for 6 inch diameter pipes and 0.5% for 8 inch diameter pipes.
- H. Install piping with 36 inch minimum cover.
- I. Pipe Joint Construction and Installation: Join and install pipe and fittings according to installations indicated.
 - 1. PVC Sewer Pipe and Fittings: Install according to ASTM D 2321; and,
 - 2. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.
- J. Manhole Installation: Install complete with appurtenances and accessories indicated.
 - 1. Form continuous concrete channels and benches between inlets and outlet; and,
 - 2. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.
- K. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- L. Clear interior of piping and structures of dirt and superfluous material as work progresses.

1. Place plug in end of incomplete piping at end of day and when work stops; and,
2. Flush piping between manholes and other structures to remove collected debris.

3.2 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 1. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 95% of pipe diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from piping.
 2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 3. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 1. Do not enclose, cover, or put into service before inspection and approval;
 2. Test completed piping systems according to authorities having jurisdiction;
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice;
 4. Submit separate reports for each test to general contractor within 2 days of test;
 5. If authorities having jurisdiction do not have published procedures, perform tests as follows:
 - a. Sanitary Sewerage: Perform hydrostatic test.
 - 1) Allowable leakage is maximum of 50 gal. per inch of nominal pipe size per mile of pipe, during 24-hour period.
 - 2) Close openings in system and fill with water.
 - 3) Purge air and refill with water.
 - 4) Disconnect water supply.
 - 5) Test and inspect joints for leaks.
 - 6) Option: Test ductile-iron piping according to AWWA C600, Section "Hydrostatic Testing." Use test pressure of at least 10 psig.
 - b. Sanitary Sewerage: Perform air test according to UNI-B-6.
 - 1) Manholes: Perform hydraulic test according to ASTM C 969;
 - 2) Leaks and loss in test pressure constitute defects that must be repaired; and,
 - 3) Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION

SECTION 33 40 00
STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Work under this section shall consist of providing all labor, plant facilities, materials, tools, equipment, shop drawings and supervision necessary and required to install all of the storm drainage facilities, including piping, fittings, structures, bedding, and backfilling, as specified in accordance with the contract documents.

1.2 REFERENCED SECTIONS

- A. Section 31 23 33 – Trenching, Backfilling and Compacting for utilities

1.3 REFERENCE STANDARDS

- A. American Society For Testing and Materials (ASTM)
1. A185 – Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 2. A615 – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 3. A760 – Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains
 4. A798 – Installation of Corrugated-Steel Pipe for Sewers and Other Applications
 5. A929 – Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
 6. C76 – Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
 7. C443 – Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 8. C478 – Precast Reinforced Concrete Manhole Sections
 9. C913 – Precast Concrete Water and Wastewater Structures
 10. C1479 – Installation of Reinforced Concrete Pipe
 11. C990-01A – Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
 12. D1056 – Flexible Cellular Materials-Sponge or Expanded Rubber
 13. D2321 – Installation of Thermoplastic Pipe for Sewer/Gravity-Flow Applications
 14. D3034 – Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 15. D3212 – Joints for Drain and Sewer Plastic Pipes Using Elastomeric Seals
 16. F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 17. F794 – Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
 18. F949 – Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings
- B. American Association of State Highway and Transportation Officials (AASHTO)
1. M36 – Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains
 2. M198 – Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
 3. M252 – Corrugated Polyethylene Drainage Tubing
 4. M274 – Aluminum-Coated (Type 2), for Corrugated Steel Pipe
 5. M294 – Corrugated Polyethylene Pipe.
 6. M36 – Metallic Coated Corrugated Steel Culverts and Underdrains
 7. M190 – Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches
 8. M199 – Standard Specification for Precast Reinforced Concrete Manhole Sections
- C. American Water Works Association (AWWA)
1. C110 – Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (75 mm through 1200 mm), for Water and Other Liquids (revision of ANSI/AWWA C110/A21.10-93)
 2. C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 3. C151 – Ductile-Iron Pipe, Centrifugally Cast, for Water

- D. American Concrete Institute (ACI)
 1. 301 – Structural Concrete for Buildings, Specifications for
 2. 318 – Building Code Requirements for Structural Plain Concrete

1.4 PROJECT RECORD DOCUMENTS

- A. Accurately record as-built locations of pipe runs, connections, catch basins, cleanouts, top elevations and invert elevations.
- B. Identify and describe unexpected variations of subsurface conditions and location of any utilities encountered.

1.5 QUALITY ASSURANCE

- A. All costs related to reinspection due to failures shall be paid for by the Contractor at no additional expense to the Owner. Owner reserves the right to direct any inspection that is deemed necessary. Contractor shall provide free access to site for inspection activities.

1.6 PROJECT CONDITIONS

- A. Removal/Relocation of Existing Utilities: The contractor shall be responsible for removal and/or relocation of existing utilities, whether shown or not shown on the drawings, at locations where conflicts occur with proposed storm drainage improvements at no additional cost to the owner.

1.7 SUBMITTALS

- A. Material data sheets.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

- A. Reinforced Concrete Pipe (RCP)
 1. ASTM C76, Class III unless otherwise noted on drawings; and,
 2. Butyl mastic sealant shall meet the requirements of ASTM C990-01a for silt-tight designations or rubber gaskets meeting the material and joint configuration requirements of ASTM C443 for watertight designations.
- B. High Density Polyethylene Pipe (HDPE) Smooth Interior
 1. Pipe and fittings shall conform to AASHTO M252 and M294;
 2. Rubber gaskets shall meet the requirements of ASTM F477 with joints conforming to AASHTO M294, silt-tight or watertight designations;
 3. Maximum permitted diameter of 48 inches ; and,
 4. Approved pipe manufactures:

Advance Drainage Systems, Inc. 3300 Riverside Drive Columbus, Ohio 43221 (614) 457-3051	Hancor, Inc. 401 Olive Street Findlay, OH 45840 (888) 367-7473	Quality Culvert, Inc. 25726 County Road 561 Astatula, FL 34750 (800) 881-1100
--	---	--

- C. Polyvinyl Chloride Pipe (PVC)
 1. Pipe shall meet the requirements of ASTM D3034, SDR 35; and,
 2. Rubber gaskets shall meet the requirements of ASTM F477 with joints conforming to ASTM D3212.
- D. Corrugated Polyvinyl Chloride Pipe
 1. Pipe shall meet the requirements of ASTM F949 and F794;
 2. Rubber gaskets shall meet the requirements of ASTM F477 with joints conforming to ASTM D3212; and,

3. Approved Manufacture: Contech “A2000”, 1001 Grove Street, Middletown, OH 45044, (336) 854-2177.
- E. Ductile Iron Pipe (DIP)
1. Pipe shall meet the requirements of AWWA C151; and,
 2. Fittings shall meet the requirements of AWWA C110 with rubber gaskets conforming to AWWA C111.
- F. Subdrains
1. Shall be perforated PVC or HDPE; and,
 2. Installation shall be in accordance with the details and at the locations shown on the drawings.

2.2 DRAINAGE STRUCTURES, DROP INLETS, CATCH BASINS, MANHOLES AND JUNCTION BOXES

- A. Structures:
1. Precast Concrete Drainage Structures;
 - a. Heavy-duty traffic rated (H20) conforming to ASTM C478 or ASTM C913.
 2. Cast In-Place Concrete Drainage Structures; and,
 - a. Heavy-duty traffic rated in accordance with Department of Transportation Standards.
 3. Polyvinyl Chloride Pipe (PVC).
 - a. Surface drainage inlets and basins shall be manufactured by Nyloplast a division of Advanced Drainage Systems, Inc., or prior approved equal.
- B. Cast Iron Frames, Hoods, and Grates per details shown on drawings. If available provide hood with stencil or casting “Dump no waste – drains to waterways” or equal. Provide local casting if required. Provide 6 inch thick rectangular concrete apron, with 18 inch minimum width measured from the edge of structure frame to the end of concrete apron, around all structure frames in asphalt pavement areas. Provide saw cuts from each corner of the concrete apron to the frame of structure.
- C. Steps
1. Shall meet the requirements of AASHTO M199 for design, materials, and dimensions;
 2. Built into the walls of all structures over 3 feet 6 inches in height; and,
 3. Steps shall be 16 inches on center with lowest step being no more than 16 inches from the bottom.
- D. Reinforcement
1. Deformed reinforcing bars, grade 60, meeting the requirements of ASTM A615; and,
 2. Wire fabric meeting the requirements of ASTM A185.

2.3 CLEANOUTS & PLUGS

- A. Installation shall be in accordance with the details and at locations shown on the drawings.
- B. All Cleanouts shall have a 2’ x 2’ x 6” thick concrete apron.

2.4 MISCELLANEOUS

- A. Headwall: Construction shall be in accordance with details shown on drawings and concrete shall be in accordance with Article 2.06 of this section.
- B. Stone Rip-Rap: Meeting State DOT specifications, and unless noted otherwise on drawings, shall have a median stone size of 6 inches. All rip-rap shall be installed over a medium weight non-woven geotextile fabric.
- C. Concrete Lined Channels: Construction shall be in accordance with details shown on drawings and concrete shall be in accordance with Article 2.06 of this section.
- D. Flared-End Sections: Meeting State DOT specifications unless otherwise noted on drawings.

2.5 BEDDING AND BACKFILL MATERIAL

- A. Where the foundation material is found to be of poor supporting value or of rock, the Owner may make minor adjustments in the location of the pipe to provide a more suitable foundation. Where this is not practical, the foundation shall be conditioned by removing the existing foundation material by undercutting to the depth as conditioned by the geotechnical engineer and backfilling with either a suitable local material secured from unclassified excavation or borrow excavation at the nearest accessible location along the project, or foundation conditioning material consisting of crushed stone or gravel or a combination of sand and crushed stone or gravel approved by geotechnical engineer as being suitable for the purpose intended. The selection of the type of backfill material to be used for foundation conditioning will be made by the geotechnical engineer.

2.6 CONCRETE

- A. No concrete shall be placed when the temperature is below 40 degrees Fahrenheit, or when indications are for lower temperatures within 24 hours, unless protection of concrete is approved by the Owner. Damage to the structure because of freezing shall be corrected by the Contractor at his own expense, to the satisfaction of the Owner.
- B. Concrete shall conform to ACI 301 and applicable referenced specifications and shall have a 28 day compressive strength of 4,000 psi.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall install all drainage structures and pipe in the locations shown on the drawings and/or as approved by the Owner. Pipe shall be of the type and sizes specified on the drawings and shall be laid accurately to line and grade. Structures shall be accurately located and properly oriented.
- B. Excavation and Backfill – The provisions in Section 01 25 13, Trench Excavation and Backfill shall govern all work under this Section.
- C. Storage and Handling of Pipe – All pipe shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in the handling of the pipe. Storage of pipe on the job shall be in accordance with the pipe manufacturer's recommendations.
- D. Damage to Pipe
 - 1. Pipe which is defective from any cause, including damage caused by handling, and determined by the Owner as unrepairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner and as directed by the Owner; and,
 - 2. Pipe that is damaged or disturbed through any cause prior to acceptance of the work, shall be repaired realigned or replaced as directed by the Owner, at the Contractor's expense.
- E. Manholes, catch basins and drain inlets shall be constructed as soon as the pipe laying reaches the location of the structures. Should the Contractor continue his pipe laying without making provisions for completion of the structures, the Owner shall have the authority to stop the pipe laying operations until the structure is completed.
- F. Any structure, which is mislocated or oriented improperly, shall be removed and re-built in its proper location, alignment and orientation at the Contractor's expense.

3.2 BEDDING

- A. Bedding material shall be as specified by trenching and bedding details as shown on drawings.

3.3 PIPE INSTALLATION

- A. Comply with Section 31 23 33.

- B. Unloading and Handling: All pipes shall be unloaded and handled with reasonable care. Pipes shall not be rolled or dragged over gravel or rock during handling. The Contractor shall take necessary precautions to ensure the method used in lifting or placing the pipe does not induce stress fatigue in the pipe and the lifting device used uniformly distributes the weight of the pipe along its axis or circumference;
- C. Each length of pipe shall be inspected for defects and cracks before carefully lowered into the trench. Any damaged or any pipe that has had its grade disturbed after laying shall be removed and replaced. Bituminous coated pipe shall be handled with special care and repair of damaged coating shall conform with AASHTO M190;
- D. Lay pipe on prepared foundation starting at the downgrade end according to line and grade with the necessary drainage structures, fittings, bends and appurtenances as shown on the drawings. Pipes with bell/spigot connections shall be laid with the bell or groove ends upgrade with the spigot or tongue fully inserted. Lap joint pipes shall be laid with the inside circumferential laps pointing downstream and with the longitudinal laps at the side or quarter points. Reinforced concrete pipe shall be installed in accordance with ASTM C1479. Corrugated metal/steel pipe and arch pipe shall be installed in accordance with ASTM A798. HDPE pipes shall be installed in accordance with pipe manufacture's installation guidelines for heavy duty drainage applications and ASTM D2321; and,
- E. Pipe sections shall be firmly joined together with appropriate gaskets or bands.

3.4 DROP INLET, CATCH BASIN, MANHOLE, AND JUNCTION BOX INSTALLATION

- A. Precast Drainage Structures
 - 1. Structure units shall be assembled in accordance with the manufacturer's instructions to form a sound structural unit.
- B. Cast in Place Drainage Structures
 - 1. Structures shall be installed in accordance with the details or referenced specifications shown on the drawings; and
 - 2. Concrete shall comply with requirements of Article 2.06 of this section.
- C. Polyvinyl Chloride Pipe (PVC).
 - 1. Drainage inlets and basins shall be in accordance with the details or referenced specifications shown on the drawings.
- D. Fittings and Connections
 - 1. Pipe connections shall be made so that the pipe does not project 3 inches beyond the inside wall of the drainage structure, and shall be grouted as necessary to make smooth and uniform surfaces on the inside of the structure. Boxes to have bottoms filled with concrete to provide a bench between pipe inverts.
- E. Frames, Grates and Hoods
 - 1. Shall be set to grade in accordance with the drawings;
 - 2. Firmly embedded in mortar approximately 1 inch thick and aligned to fit the top section of the structure; and,
 - 3. Brick set in mortar used to adjust the frame to finished grade shall be limited to no more than four courses for precast structures and have a minimum wall thickness of 8 inches.
- F. Interface with Existing Facilities
 - 1. Compliance with Facility Owner Requirements: Connections made into existing drainage facilities shall be performed in accordance with the requirements of the Owner of the facility. The Contractor will be required to comply with all such requirements, including securing of all required permits, and paying the costs thereof. The cost of making the connections in accordance with the requirements of the Owner of the existing facility shall be included in the Contract Sum; and,
 - 2. Requirements: The Contractor shall make all required connections of the proposed drainage facilities into existing drainage facilities, where and as shown on the Drawings and/or as approved by the Owner.

3.5 CONSTRUCTION WITHIN THE PUBLIC R.O.W.

- A. Construction within the public right-of-way shall conform to all requirements of the regulatory authority having jurisdiction.

3.6 MODIFICATIONS OF EXISTING STRUCTURES

- A. General: The Contractor shall alter, reconstruct and/or convert existing structures where and as shown on the drawings, and/or as approved by the Owner. In general, alterations shall be performed with the same type of material used in the original construction unless otherwise indicated on the drawings or approved by the Owner.
- B. Damage to Existing Installations: The Contractor shall exercise extreme care during such alteration, reconstruction and/or conversions so as not to damage any portions of the structure and/or pipe shown to remain. Any such damage shall be repaired by the Contractor at his own expense and to the satisfaction of the Owner.

3.7 ROOF DRAINS AND LEADERS

- A. The Site Contractor shall install internal roof downspout leaders as provided on the drawings to within 5 feet of building limits and external roof downspout leaders connected directly to downspout as shown on the architectural drawings. If work by others is complete then the Contractor shall complete the connection. If future connections will be required by others, Contractor shall install plugging and material apparatus as necessary to protect and mark his work.
- B. All piping connections shall utilize watertight prefabricated fittings or drainage structure.

3.8 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.9 PROTECTION AND CLEANING

- A. The Contractor shall maintain all pipe installations and drainage structures in a condition such that they will function continuously and shall be kept clean of silt, debris and other foreign matter from the pipe and drainage structure is installed until the project is accepted.

3.10 FINAL INSPECTION

- A. Upon completion of the work and before final acceptance by the Owner, the entire drainage system shall be subject to a final inspection in the presence of the Owner and/or Site Engineer. The work shall not be considered as complete until all requirements for line, grade, cleanliness, and workmanship have been completed.

END OF SECTION

