



PROJECT MANUAL



JAMES B. DELAMATER ACTIVITY CENTER RENOVATIONS

LAS CRUCES, NEW MEXICO

JANUARY 31, 2024

100% Construction Documents



PROJECT MANUAL INCLUDING TECHNICAL SPECIFICATIONS
FOR GENERAL CONSTRUCTION

FOR



JAMES B. DELAMATER ACTIVITY CENTER
RENOVATIONS

NEW MEXICO STATE UNIVERSITY

LAS CRUCES, NEW MEXICO

JANUARY 31, 2024

100% Construction Documents

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CERTIFICATION PAGE

The technical material and data contained in this Project Manual were prepared under the supervision and direction of the undersigned, whose seal as a Professional Architect, licensed to practice in the State of New Mexico, is affixed below.



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Division One

GENERAL

SECTION 01 1000**SUMMARY****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes:
 - 1. Project Summary
 - 2. Contractor's Duties.
 - 3. Description of Alterations Work.
 - 4. Work Sequence.
 - 5. Work by Others.
 - 6. Owner Occupancy.
 - 7. Contractor use of site.
 - 8. Contractor's Personal Jobsite Restrictions.
 - 9. Definitions.
 - 10. Abbreviations.
- B. Related documents and sections:
 - 11. Document 00 700 - General Conditions of the Contract
 - a. Article 2: Basic responsibilities and rights of Owner.
 - b. Article 3: Basic responsibilities of Contractor.
 - 12. Section 01 2300 - Alternates: Alternates which increase scope of Project.

1.02 PROJECT

- A. Project Name: JAMES B DELAMATER ACTIVITY CENTER RENOVATIONS
- B. Owner's Name: NEW MEXICO STATE UNIVERSITY
- C. Architect's Name: VIGIL & ASSOCIATES ARCHITECTURAL GROUP
- D. Project Summary:

Renovation of two areas within the James B Delamater Activity Center at NMSU, with programmatic change in both areas. Replacement and renovation of existing weightroom with a new student lounge. The weightroom will be moved to replace an auxiliary basketball court, which is also to be renovated.

 - 1. The contractor shall review the contract documents for a full understanding of the scope of this project.
 - 2. There are Five (5) **Additive Alternates** for the project. Refer to Section 01 2300 - Alternates.

1.03 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in construction contract agreement.

1.04 CONTRACTOR'S DUTIES

- A. Except as noted, provide and pay for all labor, materials, and equipment.
 - 1. Pay required sales, gross receipts, and other taxes. Owner will pay Contractor applicable New Mexico gross receipts tax including local option tax and any increase in tax becoming effective after Contract date. Tax is to be excluded from bid prices but included as separate amount on Applications for Payment.
- B. Secure and pay for permits (including plan checking fees), fees, and licenses necessary for execution of Work as applicable at time of receipt of bids or as otherwise required in other sections of the Specifications.
- C. Give required notices.
- D. Comply with codes, ordinances, regulations, and other legal requirements of public authorities which bear on performance of Work.
- E. Request required inspections from public authorities, correct any noted deficiencies, and obtain certifications of satisfactory inspection. Deliver certificates to Owner in accordance with Section - 01 7800 – Closeout Submittals.

1.05 WORK SEQUENCE

- A. Construct Work in stages during the construction period as coordinated with Owner and Architect.
- B. Coordinate construction schedule and operations with Owner and Architect.
- C. Refer to Sequence of Work on Sheet G-002.

1.06 WORK BY OTHERS

- A. Owner will award separate construction contracts for purchase and installation of:
 - 1. Moveable Furniture and Equipment except where noted
 - 2. Other items indicated as “By Owner”
- B. Items noted “NOT IN CONTRACT” (NIC) will be supplied and installed by Owner:
 - 1. Furniture, Fixtures, and Equipment as shown on **drawings**.
- C. Owner will remove and retain possession of the following items prior to start of Work:
 - 1. Existing movable Furniture and Equipment.
- D. Future work not included in this contract:
- E. Products supplied by Owner for installation by Contractor:
- F. Owner’s responsibilities:
 - 1. Schedule and assist Contractor in coordination of work by Owner’s own forces and separate contractors.
 - 2. Schedule delivery of Owner supplied products.
 - 3. Obtain and provide to Contractor shop drawings, product data, and installation instructions for Owner supplied products.
 - 4. Arrange and pay for delivery of Owner supplied products to site.
 - 5. Submit claims for transportation damage and replace damaged, defective, or deficient items.
- G. Contractor’s responsibilities:
 - 1. Participate in coordination of work with other installers, including Owner’s own forces and separate contractors.
 - 2. Inform Owner of required delivery dates for Owner supplied products and installation dates for work by others.

3. Review shop drawings, product data, and installation instructions; coordinate installation with other work; and provide blocking and other preparation required for Owner supplied products.
4. Unload Owner supplied products required to be installed by Contractor at site and inspect for completeness and damage. Assemble, finish and install products as indicated by Contract Documents.
5. Repair or replace items damaged after receipt.

1.07 OWNER OCCUPANCY

- A. Owner intends to occupy the Project upon Substantial Completion.

1.08 CONTRACTOR USE OF SITE

- A. Construction Operations: Limited to areas noted on Drawings as coordinated with Owner and Architect.
- B. Contractor will have restricted use of site to allow Owner occupancy, Owner to conduct normal operations.
 1. Access to site by trucks, equipment, and automobiles. Limited to route and entrances designated in Section 01 5000 – Temporary Facilities and Controls. Schedule construction traffic and material deliveries to site during time periods coordinated in advance with Owner.
 2. On site construction vehicle and equipment traffic shall be limited to pathways, areas, and time periods approved in advance by Owner to ensure safe site conditions.
 3. Parking: Contractor and work force shall coordinate with the Owner for parking locations.
 4. Unless otherwise agreed to in advance by Owner, construction shall be performed only during these time periods:
 - a. Normal weekday work hours.
 5. Construction activities shall be limited to areas of actual construction. Unless otherwise agreed to in advance by Owner, restrict workmen from entering adjacent restricted areas.
- C. Contractor shall make arrangements with Owner to secure any keys necessary for access to site areas so that the work can be performed. The Contractor assumes sole responsibility for the security and use of facility keys obtained from the Owner and shall not reproduce them nor lend them out during the progress of work.
- D. Do not allow dust and debris to blow onto adjacent restricted areas.
- E. Provide 72 hours notice to Owner for any work that may interrupt or otherwise impact the facility's normal operation including noisy dust or odor producing activities.
- F. Utility outages and shutdowns:
 1. Maximum allowable duration: **2 hours** or as approved in advance by Owner.
 2. Coordinate all utility shutdowns which affect the operation of the facility and neighbors with the Architect, Owner, and any entity having jurisdiction over or ownership of impacted public or private utility infrastructure.
 3. Schedule outages during off hours to facilitate Owner's operations.
 4. Submit written requirements for outage to Owner and Architect **7 Days** before anticipated outage. **Outage must be approved in writing by Owner.**
- G. Owner reserves right to place and install equipment and furnishings in completed areas of building prior to Substantial Completion, provided such occupancy does not interfere with construction. Placing of equipment and furnishings does not constitute Substantial Completion of any portion of the Work. An inspection by Contractor, Owner and Architect shall be made prior to such limited

occupancy solely for the purpose of establishing the condition of finishes and other items that might be damaged or obscured by placement and installation of Owner's items.

- H. Existing natural vegetation at the site shall be retained to the extent possible. Limit movement and storage of equipment and materials to minimize damage to natural vegetation and terrain. Contractor shall make corrections to any damaged vegetation.

1.09 CONTRACTOR'S PERSONNEL JOBSITE RESTRICTIONS

- A. Contractor shall enforce the following requirements on his entire workforce throughout the progress of the Work:
1. All personnel on site, directly or indirectly in the employment of Contractor, are restricted from any interaction with any Owner, Owner's staff and Representatives, or other members of the public while on, or adjacent to Owner's property except through jobsite meetings conducted by the Design Professional and the Owner or as otherwise determined by the Owner.
 2. Contractor's personnel shall remain in their designated work areas. Communications with any non-project related persons on or near the site shall be through Project Superintendent.
 3. No firearms or other types of weapons, of any sort are allowed on site. If member of the Contractor's workforce is found to be in possession of a firearm, of any kind, they will be directed to leave immediately and will not be allowed to return. This includes firearms found in company or private vehicles, tool boxes, or brought on site in any other manner.
 4. Smoking shall be limited to designated areas, if allowed in advance by Owner.
 5. There shall be no use, possession, sale, and distribution of alcohol, drugs, or other controlled substances on its premises. The Contractor shall also prohibit the presence of an individual with such substances in their body from the workplace.
 6. Any employee who is found in violation of requirements of these restrictions, or of any others within the Contract Documents, or who refuses to permit inspection shall be barred from the Project site at the discretion of the Owner in accordance with Subparagraph 13.8.4.1 of the General Conditions.
 7. Comply with Owner's procedures for individual visual identification of Contractor's workforce on site and in occupied areas. If identification badges are required, make sure that they are worn at all times on site during the work.

1.10 DEFINITIONS

- A. Refer to Document 00 700 – General Conditions, Article 1.1 for definitions of terms used within Contract Documents.
- B. Additional terms used within Specifications but not defined by Document 00 700 – General Conditions shall have the following definitions:
1. Products: Materials, manufactured items, components, fixtures, machinery, equipment, or systems forming the Work but not including machinery, equipment, and other aids used for preparing, fabricating, conveying, and installing the work.
 1. Supply: Furnish, deliver, and unload at Project site. Same meaning as furnish.
 2. Furnish: Supply, deliver, and unload at Project site. Same meaning as supply.
 3. Install: Operations and Project site to incorporate products into the Work such as unpacking, assembling, anchoring, erecting, applying, placing, curing, finishing, and preparing for use.
 4. Provide: To supply or furnish a product and to also install it.
 5. Execution: Operations at Project site including preparatory actions, installing, and post-installation adjusting, testing, cleaning, and demonstrating.

1.11 ABBREVIATIONS

1. Abbreviations used within the Specifications are defined as follows. For abbreviations not listed, contact Architect for definitions.

ASTM – American Society for Testing and Materials.

ANSI – American National Standards Institute

CF – Cubic feet.

CFM – Cubic feet per minute.

F – Fahrenheit.

LF – Linear feet.

LB – Pound.

MPH – Miles per hour.

SF – Square feet.

SY – Square yards.

PSI – Pounds per square inch.

PSF – Pounds per square foot.

RPM – Revolutions per minute.

IBC – International Building Code as published by International Code Council.

UL – Underwriters Laboratory.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

01 1000

SECTION 01 2000**PRICE AND PAYMENT PROCEDURES****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

- A. General Conditions of the Contract: Additional requirements for progress payments, final payment, changes in the Work.

1.03 SCHEDULE OF VALUES

- A. Form to be used: AIA Form G703.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 15 (fifteen) days after effective date of Owner-Contractor Agreement.
- E. Format: Provide separate Schedule of Values for each Bid Lot accepted (if applicable). Utilize the Table of Contents of this Project Manual. Break down and identify each line item with number and title of the specification Section. Identify sufficient detail to allow computation of values for progress payments during construction as approved by Architect.
- F. To protect the Owner from the significant liability and arduous accounting efforts required by lingering documentation and close-out work, the Schedule of Values shall provide a separate line item titled "Documentation and Close-out" to provide value consistent with and appropriate to required documentation provision throughout the Contract (at a minimum, utilize 2 ½ percent of the total contract value). The Documentation and Close-out line item shall include, but are not limited to Punch list items, Record Drawings, O & M Manuals, and "Close-out" Documents. Refer to AIA Document A201-1997 General Conditions, Article 9.2.
- G. Include separate line items for:
 - 1. All work identified in the construction documents
 - a. **Organized by division.**
 - b. **Separated by mobilization, shop drawings, labor, and materials.**
 - 2. Each alternate selected by Owner.
 - 3. Each Contract modification.
 - 4. Bonds.
 - 5. Insurance.
 - 6. Taxes.

7. Documentation and Close-out.
 8. Additional items required by the Owner and Architect.
- H. Include within each line item, a direct proportional amount of Contractor's overhead and profit.
- I. Revise schedule to list approved Change Orders, with each Application for Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Form to be used: AIA Form G702.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
1. Item Number.
 2. Description of work (organized by division).
 3. Scheduled Values.
 4. Work Completed for This Period and from Previous Applications.
 5. Work in Place and Stored On-Site Materials under this Application.
 6. Change Order Summary and Authorized Change Orders.
 7. Total Completed and Stored to Date of Application.
 8. Percentage of Completion.
 9. Balance to Finish.
 10. Allowances (If applicable).
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. Include with Application for Payment, appropriate invoices and insurance coverage for material stored off-site or as requested by Architect.
- I. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.
- J. Submit three (3) hard copies of each Application for Payment or one (1) electronic copy as approved by Owner.
- K. Include the following with the application:
1. Transmittal letter as specified for Submittals in Section 01 3000.
 2. Construction progress schedule, revised and current as specified in Section 01 3000.
 3. Current construction photographs specified in Section 01 3000.
- L. When Architect requires substantiating information, submit data justifying dollar amounts in question. Indicate the application number and date, and line item in question by number and description. Provide one copy of data with cover letter for each copy of submittal.
- M. Prior to acceptance of application for payment, Architect will review On-Site project Record Drawings and Shop Drawings to ensure that recorded data is current.

1.05 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to the Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor. Contractor shall promptly enter changes into the Project Record Documents.
- C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications. Contractor shall prepare and submit a fixed price quotation within seven (7) days.
- E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6000. Product Requirements.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
- G. Substantiation of Costs: Provide full information required for evaluation.
 - 1. On request, provide following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 - 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 - 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 - 1. All closeout procedures specified in Section 01 7000 - Execution and Closeout Requirements.
 - 2. All requirements as per paragraph 9.10, Final Completion and Final Payment, General Conditions of the Contract for Construction.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

01 2000

SECTION 01 2300**ALTERNATES****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Description of alternates.
- B. Procedures for pricing alternates.
- C. Documentation of changes to Contract Sum and Contract Time.

1.02 RELATED REQUIREMENTS

- A. Division 0 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.
- B. Division 0 - Alternates Form: List of Alternates in Bid Form.
- C. Division 0 - Agreement Form: Incorporating monetary value of accepted Alternates.

1.03 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each alternate.
- C. Work not specifically identified in the following Additive Alternates descriptions shall be included in the Base Bid.

1.04 SCHEDULE OF ALTERNATES

- A. **Additive Alternate No. 1:** NORTH GYM WINDOWS & STUCCO
 - 1. Consists of ...
- B. **Additive Alternate No. 2:** RESURFACE TRACK
 - 1. Consists of ...
- C. **Additive Alternate No. 3:** SANDBLAST INTERIOR PAINT
 - 1. Consists of ...
- D. **Additive Alternate No. 4:** GYM FANS
 - 1. Consists of ...
- E. **Additive Alternate No. 5:** SUPPLEMENTARY AV SYSTEM
 - 1. Consists of ...

1.05 PROCEDURES

- A. Consider all work that must be accomplished for complete incorporation of alternates including modifications to Base Bid items.
- B. Include in lump sum prices for alternates all costs of labor, materials, equipment, permits, fees,

insurance, bonds, overhead, and profit.

- C. Where work is shown in Additive Alternates that represent an "upgrade" to the base Bid, include additional costs only (separate from costs already included in Base Bid) for the "upgrade" in the designated Additive Alternate.
- D. Immediately after award of the Contract, advise all necessary personnel and suppliers as to which Alternates have been selected by Owner. Use all means necessary to alert those personnel and suppliers involved as to all changes in the work caused by Owner's selection or rejection of alternates.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

01 2300

SECTION 01 3100**PROJECT MANAGEMENT & COORDINATION****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Project coordination.
- B. Field engineering.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Construction progress schedule.
- G. Submittal procedures.
- H. Requests For Interpretation (RFI).
- I. Progress photographs.
- J. Aerial photos & videos.
- K. Coordination drawings/ BIM coordination modeling.

1.02 RELATED REQUIREMENTS

- A. Document 00 700 - General Conditions of the Contract.
- B. Document 00 300 - Supplementary Conditions.
- C. Section 01 1000 - Summary
- D. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.
- E. Section 01 3300 - Submittal Procedures: Shop drawing and product submittal requirements.
- F. Section 01 7000 - Execution Requirements: Additional coordination requirements.
- G. Section 01 7700 - Closeout Procedures: Additional coordination requirements.
- H. Section 01 7800 - Closeout Submittals: Project record documents.

1.03 PROJECT COORDINATION

- A. Cooperate with the Owner in allocation of mobilization areas of site; for field offices and sheds, for general access, traffic, and parking facilities.
- B. During construction, coordinate use of site and facilities with Owner and Occupants.
- C. Comply with Architect's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- D. Scheduling: Coordinate scheduling, submittals, and work of various specification sections to ensure efficient and orderly sequence of installation of interdependent construction elements. Ensure that work of one specification section is not installed in such a manner as to limit, preclude, or restrict work of another section.

- E. Coordinate completion and cleanup of work of separate specification sections in preparation for final inspection specified in Section 01 7000 - Execution and Closeout Procedures.
- F. After acceptance of Work, coordinate access to facility for required maintenance, monitoring, adjusting, and correcting deficiencies to manner to minimize disruption of Owner's activities.
- G. Make the following types of submittals to Architect:
 - 1. Requests for interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples. See Section 01 3300.
 - 4. Test and inspection reports.
 - 5. Manufacturer's instructions and field reports.
 - 6. Applications for payment and change order requests.
 - 7. Progress schedules.
 - 8. Coordination drawings.
 - 9. Closeout submittals.

1.04 FIELD ENGINEERING (When required)

- A. Existing control datum for field engineering as indicated on Drawings.
- B. Locate or establish survey control and reference points prior to starting site construction. Protect points during construction and record locations with horizontal and vertical data on Project Record Documents in accordance with Section 01 7800 - Closeout Submittals.
- C. Prior to start of construction, verify location of control points and layout information on Drawings relative to property, setback, and easement lines.
- D. Provide competent field engineering services. Establish elevations, lines, and levels utilizing recognized engineering survey practices. Periodically verify layouts.
- E. Promptly replace dislocated control and reference points based on original survey control.

PART 2 - PRODUCTS

2.01 EQUIPMENT

- A. Verify utility requirements and characteristics of equipment are compatible with facility utilities. Coordinate work of various specification sections having interdependent requirements for installing, connecting to, and placing in service such equipment.

PART 3 - EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Architect will schedule a meeting after Notice of Award.
- B. Contractor will administer Pre-Construction Meeting to be held on site.
- C. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Consultants.
 - 5. Officials.

6. Major Subcontractors.
 7. Suppliers.
- D. Agenda:
1. Notice to Proceed.
 2. Submission of list of Subcontractors, list of Products, schedule of values, and Construction schedule.
 3. Designation of personnel representing the parties to Contractor, Owner, and Architect.
 4. Channels of communication.
 5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 6. Construction Schedule.
 7. Presentation and discussion of site mobilization plan specified in Section 01 5000 - Temporary Facilities and Controls.
 8. Construction facilities, storage, controls, and temporary utilities.
 9. Employment practices and wage rates.
 10. Security, safety, first aid, and housekeeping procedures.
 11. Permits.
 12. Procedures for maintaining project record documents.
 13. Testing procedures / requirements.
 14. Public relations.
 15. Other pertinent items.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

- A. Contractor will schedule a meeting at the Project site prior to mobilization.
- B. Attendance Required:
1. Contractor.
 2. Owner.
 3. Architect.
 4. Contractor's Superintendent.
 5. Major Subcontractors.
 6. Officials.
- C. Agenda:
1. Use of premises by Owner (if applicable) and Contractor.
 2. Owner's requirements.
 3. Construction facilities and controls.
 4. Temporary utilities.
 5. Survey and building layout.
 6. Construction signage and safety.
 7. Parking and deliveries.
 8. Materials storage.
 9. Security, fencing and housekeeping procedures.

- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

- A. Contractor will schedule and administer meetings throughout progress of the Work at maximum monthly intervals.
- B. Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, and distribute notice of meeting five (5) days in advance of meeting.
- C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Review of aerial photos & videos.
 - 4. Field observations, problems, and decisions.
 - 5. Identification of problems that impede, or will impede, planned progress.
 - 6. Review of submittals schedule and status of submittals.
 - 7. Review of off-site fabrication and delivery schedules.
 - 8. Maintenance of progress schedule.
 - 9. Corrective measures to regain projected schedules.
 - 10. Planned progress during succeeding work period.
 - 11. Coordination of projected progress.
 - 12. Maintenance of quality and work standards.
 - 13. Effect of proposed changes on progress schedule and coordination.
 - 14. Review proposed change orders and effect on schedule.
 - 15. Review project record documents.
 - 16. Review of RFI's and status of RFI's.
 - 17. Other business relating to Work.
- E. Contractor will record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
- F. Pre-Installation Conferences:
 - 1. When required by an individual specification section, Contractor will convene a pre-installation conference at site.
 - 2. Require attendance of entities directly concerned with item of work.
 - 3. Notify Architect five (5) days in advance of meeting.
 - 4. Prepare agenda and preside at conference. Record minutes and distribute copies within three (3) days to participants and Architect.
 - 5. At meeting, review conditions of installation, preparation and installation procedures, and coordination with related work.

3.04 SUBMITTAL PROCEDURES - See Section 01 3300 for complete instructions.

- A. Schedule submittals to expedite work. Unless otherwise noted, submittals shall be submitted within forty-five (45) days of the effective date of the Owner – Contractor Agreement.
- B. Schedule submittals to expedite the Project, and coordinate submission of related items.

- C. Submittals shall be submitted to the architect for review allowing fifteen (15) calendar days excluding delivery time to and from the Contractor.

3.05 REQUESTS FOR INTERPRETATION - See General Conditions of the Contract for Construction

- A. Any question concerning a variation or deviation from the Contract Documents, including a minor change in the Work found necessary due to actual field conditions, shall be submitted to the Design Professional as a Request for Interpretation (RFI) for review and resolution before proceeding with the Work. When submitting an RFI, the Contractor must provide all information necessary for the Design Professional to promptly process, including detailed:
1. reference(s) to Specification number, Drawing page and detail, and the like;
 2. description of issue;
 3. drawings, photos or sketches of conditions, if necessary; and,
 4. submittals or other information as necessary to facilitate resolution.
- B. Request for Interpretation may be initiated only by the Contractor and shall be answered by Design Professional within seven (7) calendar days. All Subcontractor RFI's must be initiated through the Contractor. All answers to RFI's by the Design Professional's consultants or Owner must be initiated through the Design Professional.

3.01 CONSTRUCTION PROGRESS SCHEDULE - See Section 01 3216

3.02 PROGRESS PHOTOGRAPHS and AERIAL PHOTOS/VIDEOS

- A. Contractor will submit photographs and aerial photos/videos with each application for payment.
- B. Photography Type: Digital; electronic files.
- C. Aerial photos/videos: Electronic file showing work. Format must be viewable on any standard PC or Mac based. These videos shall remain accessible during the full duration of the project and will be archived at the end of the project with the other O&M documents (converted to a file format that is downloadable).
- D. Provide photographs and aerial footage of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Architect.
- E. In addition to periodic, recurring views, take photographs and aerial photos/videos of each of the following events:
1. Completion of site clearing.
 2. Excavations in progress.
 3. Foundations in progress and upon completion.
 4. Structural framing in progress and upon completion.
 5. Enclosure of building, upon completion.
 6. Final completion, minimum of ten (10) photos.
- F. Take photographs and aerial photos/videos as evidence of existing interior and exterior project conditions.
- G. Views:
1. Provide aerial and non-aerial photographs from four cardinal views at each specified time, until Date of Substantial Completion.
 2. Consult with Architect for instructions on views required.
 3. Provide factual presentation.
 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

5. Point of View Sketch: Provide sketch identifying point of view of each photograph.
- H. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
 1. Delivery Medium: Via email.
 2. File Naming: Include project identification, date and time of view, and view identification.
 3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
 4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.03 COORDINATION DRAWINGS

- A. Provide information required by Architect for preparation of coordination drawings.
- B. The software used by the A/E design team is REVIT (contact Architect for correct REVIT version to be used on this project- NO UPDATES WILL BE ALLOWED). The contractor will be required to provide 3D BIM modeling and to reconstruct their own coordination model separate from the A/E team as a means to coordinate all trades of work on the project.
- C. The contractor shall be responsible for hosting periodic trade coordination meetings with the A/E team to review pending model element "clashes" or conflicts within the building components. The Contractor and appointed GC "BIM Coordinator" shall host the meetings.
- D. A running list of clashes shall be maintained (including Structural, Mechanical, Electrical and Plumbing) and contribute a model to the review model. Each party shall resolve their clashes.
- E. BIM coordination must be made prior to commencement with the work. At a minimum, the Contractor will assume all risk if an area of the project is started without this coordination effort, so work could commence (i.e. site work etc.) before acceptance, but this is a tool used to minimize waste and RFI's before implementation in the field.
- F. Provide a printout of drawings for approval and for as built purposes for Closeout documentation.

END OF SECTION

01 3100

SECTION 01 3216**CONSTRUCTION PROGRESS SCHEDULE****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 REFERENCES

- C. AGC (CPSM) - Construction Planning and Scheduling Manual; Associated General Contractors of America; 2004.

1.03 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Submit updated schedule with each Application for Payment.
- E. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.
- F. Submit under transmittal letter form specified in Section 01 3000.

1.04 QUALITY ASSURANCE

- A. Coordinate Construction Progress Schedule with testing services required in the contract.

1.05 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 22 x 17 inches or width required.
- C. Sheet Size: Multiples of 8-1/2 x 11 inches.
- D. Scale and Spacing: To allow for notations and revisions.

PART 2 - PRODUCTS - NOT USED**PART 3 - EXECUTION****3.01 PRELIMINARY SCHEDULE**

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- D. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, Products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- E. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

END OF SECTION

01 3216

SECTION 01 3300**SUBMITTAL PROCEDURES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes submittal procedures for:
 - 1. Shop drawings.
 - 2. Product data.
 - 3. Samples.
 - 4. Manufacturer's instructions.
 - 5. Design data and calculations.
 - 6. Manufacturer's certificates.
 - 7. Reports for testing, inspecting, and demonstrating.
 - 8. HVAC & Controls construction checklists
- B. Related documents and sections:
 - 1. Document 00 700 - General Conditions Paragraph 3.12: Contractor's responsibilities regarding submittals.
 - 2. Section 01 3000 - Administrative Requirements: Submittal of Progress Schedule and coordination drawings.
 - 3. Section 01 3301 - Submittal Transmittal Form.
 - 4. Section 01 4000 - Quality Requirements: Manufacturers' field services and reports.
 - 5. Section 01 6000 - Product Requirements: Submittal of substitution requests.
 - 6. Section 01 7800 - Closeout Submittals: Submittal of project record drawings, operation and maintenance manuals, warranties, certifications of inspection, extra materials, and other closeout submittals.
 - 7. Refer to individual specification sections for unique submittal requirements related to a specific product, system, or procedure.

1.02 HVAC & CONTROLS CONSTRUCTION CHECKLISTS

- A. Submission:
 - 1. Submit the checklists prior to TAB work as required by Division 23.
 - 2. Submit reports as required by Division 23.
- B. Form:
 - 1. Use forms provided in Section 23 0593 – Testing, Adjusting and Balancing.
 - 2. Bind with titled cover in folder, plastic binder, or three ring binder as appropriate for quantity of material.
- C. Reports shall include:
 - 1. Completion of all required checklist items.
 - 2. Names of persons performing activity.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION**3.01 SUBMITTALS FOR REVIEW**

- A. When the following are specified in individual sections, submit them for review:

1. Product data.
2. Shop drawings.
3. Samples for selection.
4. Samples for verification.

NOTE: Submittals may be "Rejected" or returned as "Revise & Resubmit" if required samples are not included in the submittal package to be reviewed by the Architect.

- B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - CLOSEOUT SUBMITTALS.

3.02 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:

1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.03 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual sections, submit them at project closeout:

1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

- B. Submit for Owner's benefit during and after project completion.

3.04 NUMBER OF COPIES OF SUBMITTALS AND FORMATTING

- A. All documents shall be submitted electronically through FTP site plus one (1) hard copy, unless directed otherwise by Architect.

- B. Documents for Review:

1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit electronic copies in PDF format, plus one (1) hard copy that will be retained by Architect.
2. Larger Sheets, Not Larger Than 30 x 42 inches: Submit electronic copies in PDF format, plus one (1) hard copy that will be retained by Architect.

3. Review will be returned electronically.
- C. Documents for Information: Submit electronically plus three (3) hard copies; one that will be retained by Architect, one by Owner's Representative and one may be retained by the engineering consultant.
- A. Documents for Project Closeout: Submit one hard copy for Architect's review. Submit three (3) copies of final, revised and approved Project Closeout submittals.
- D. Samples: Submit the number specified in individual specification sections; two (2) of which will be retained by Architect.
 1. After review, produce duplicates.
 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.05 SAMPLES

- A. Submit the number specified in individual specification sections; two (2) of which will be retained by Architect.
 1. For color samples, after review, produce duplicates.
 2. Label each sample with identification related to Submittal Transmittal Form.
 3. Product samples will not be returned to Contractor unless specifically so stated.
 4. Submit samples at least thirty (30) days prior to the date the contractor needs approval for ordering or incorporation into the Work.
 5. Colors and Patterns: Unless a color and pattern is specified for the product, submit two sets of accurate color and pattern charts, and samples illustrating the manufacturer's full range for selection by the Architect. All color samples must be submitted before a color schedule can be generated allowing any color to be assigned to any product for ordering.
 6. Type: Submit samples to illustrate functional and aesthetic characteristics of the products, with all integral parts and attachment devices. Include full range of manufacturer's standard finishes, indicating color, textures and patterns for the Architect's selection.
 7. Reviewed product samples may be used in the work with approval by the Architect.
 8. **Submittals may be "Rejected" or returned as "Revise & Resubmit" if required samples are not included in the submittal package to be reviewed by the Architect.**

3.06 SUBSTITUTION PROCEDURES

- A. The Instructions to Bidders in the front end of project manual specifies time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. Architect will consider requests for substitutions prior to bidding per the Instructions to Bidders and within 30 days after the date established in Notice to proceed.
 1. Only requests submitted on "01 6310 – Substitution Request Form" will be considered.
- C. Substitutions may be considered after bidding (unless noted otherwise) when:
 1. A product becomes unavailable through no fault of the Contractor.
 2. There will be a delay in schedule without a substitution through no fault of the Contractor.
 3. At sole discretion of the Architect/Owner.
 4. Only requests submitted on "01 6310 – Substitution Request Form" will be considered.
- D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- E. A request for substitution constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 2. Will provide the same warranty for the substitution as for the specified product.
 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 4. Waives claims for additional costs or time extension that may subsequently become apparent.
 5. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- G. Substitution Submittal Procedure:
1. Submit two copies of request for substitution for consideration. Limit each request to one proposed substitution.
 2. Submit separate request for each substitution with Form 01 6310, Substitution Request Form. Only requests submitted on this form will be accepted.
 3. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer. Include in the request:
 - a. Complete data substantiating compliance of proposed substitution with Contract Documents.
 - b. For products:
 - 1) Product identification, including manufacturer's name and address.
 - 2) Manufacturer's literature containing product description, performance and test data, and reference standards with the sections pertaining to the product to be substituted highlighted or marked.
 - 3) Samples as required. **Note: Product substitutions may be rejected based on aesthetic or finish including color, pattern, or texture of the material if it does not meet the intent of the design.**
 - c. For construction methods: Detailed description of proposed method, and drawings illustrating methods, if a change is needed from the original methods listed in the Construction Documents.
 - d. Itemized comparison of proposed substitution with product specified.
 - e. Data relating to changes in construction schedule.
 - f. Give cost data comparing proposed substitution with specified product.

3.07 SUBMITTAL PROCEDURES

- A. Schedule submittals to expedite work. Unless otherwise noted, submittals shall be submitted within 45 days of the effective date of the Owner – Contractor Agreement.
- B. Transmit each submittal with a separate Submittal Transmittal Form. The form follows this section in Section 01 3301 - Submittal Transmittal Form.
- C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- D. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information

is in accordance with the requirements of the Work and Contract Documents. Return non-conforming submittals to preparer for revision rather than submitting to Architect.

- F. Sign Submittal Transmittal Form and deliver submittals electronically to Architect plus one hard copy to business address
- G. Schedule submittals to expedite the Project, and coordinate submission of related items.
- H. Submittals shall be submitted to the architect for review allowing 15 calendar days excluding delivery time to and from the Contractor.
- I. Provide separate submittals for each specification section requiring submittals. Include all material requested for that section. Provide folders or binders for material.
- J. **Provide samples as required in individual sections - Submittals may be "Rejected" or returned as "Revise & Resubmit" if required samples are not included in the submittal package to be reviewed by the Architect.**
- K. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- L. Do not fabricate products or begin work which requires submittals until return of submittal with the Architect's acceptance.
- M. Coordinate submission of related items. Group submittals of related products or a system in a single transmission.
- N. Mark or show dimensions and values in the same units as specified.
- O. Provide space for Contractor and Architect review stamps.
- P. When revised for resubmission, identify all changes made since previous submission.
- Q. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- R. Submittals not requested or not approved in advance by the Contractor will not be recognized or processed.

3.08 PRODUCT DATA

- A. Submission: Submit the number of copies which Contractor requires plus two (2) originals to be retained by Architect.
- B. Form:
 - 1. Provide all critical information such as references standards, performance characteristics, capacities, power requirements, wiring and piping diagrams, controls, component parts, finishes, dimensions, and required clearances.
 - 2. Submit only data which are pertinent. **Highlight and mark each copy of manufacturer's standard printed data to identify products, models, option, and other data pertinent to project.**

3.09 MANUFACTURER'S INSTRUCTIONS

- A. Submission: Submit the number of copies which Contractor requires plus two (2) to be retained by Architect.
- B. Form:
 - 1. Manufacturers' printed instructions for activities such as delivery, storage, assembly, installation, wiring, start-up, adjusting, finishing, and maintaining.
 - 2. Indicate pertinent portions and identify conflicts between manufacturers' instructions and Contract Documents.

3.10 DESIGN DATA AND CALCULATIONS

- A. Submission: Submit the number of copies which Contractor requires plus two (2) to be retained by Architect.
- B. Form:
 - 1. Provide basic calculations, analyses, and data to support design decisions and demonstrate compliance with specified requirements. State assumptions and define parameters. Give general formulas and references. Provide sketches as required to illustrate design method and application.
 - 2. Arrange calculations and data in a logical manner with suitable text to explain procedure.
 - 3. Indicate name, title, and telephone number of individual performing design and include professional seal of designer where applicable or required.

3.11 MANUFACTURERS' CERTIFICATES

- A. Submission: Submit the number of copies which Contractor requires plus two (2) to be retained by Architect.
- B. Form:
 - 1. Certificates shall indicate that products conform to or exceed specified requirements. Submit supporting reference data, affidavits, and certifications as required.
 - 2. Certificates may be based on recent or previous test results if acceptable to Architect.

3.12 REPORTS

- A. Submission:
 - 1. Submit the number of copies which Contractor requires plus two (2) to be retained by Architect.
 - 2. Submit reports within fifteen (15) days after completion of activity.
- B. Form:
 - 1. Present complete information in a clear concise manner.
 - 2. Typed or computer printed on 8-1/2 by 11 inch white paper.
 - 3. Bind with titled cover in folder, plastic binder, or three ring binder as appropriate for quantity of material.

3.13 Reports shall include:

- 1. Time, location, conditions, and duration of activity.
 - a. Names of persons performing and witnessing activity.
 - b. Equipment used.
 - c. Description of activity, data recorded, and results.
 - d. Location (mapping) - **submit a site plan and/or floor plan indicating the exact locations of the activity, data recorded, inspection, sample(s), or test(s) performed** (a description of the location alone will not be accepted).
 - e. Deficiencies found, corrective measures, and results of retesting.
 - f. Other pertinent data.

END OF SECTION

01 3300

SECTION 01 3010
SUBMITTAL TRANSMITTAL FORM



Date: _____

Project: JAMES B DELAMATER ACTIVITY CENTER RENOVATIONS

Project No. _____

Owner: NEW MEXICO STATE UNIVERSITY

Contractor: _____

Submittal Number: _____

Number of Copies Submitted: _____

(Include transmittal number - referenced specification section -
submission number; i.e. "24-01 3300-01" Or "24-01 3300-02" if re-submittal)

Resubmittal: ☐ Yes ☐ No

Submittal Title/Item: _____

Referenced Specification Section: _____

Name of Subcontractor / Supplier: _____

Comments:

Samples Included: ☐ Yes ☐ NoColor Selection Required: ☐ Yes ☐ No

The undersigned, as Contractor for the above project, submits the following and certifies that submittal has been reviewed and conforms to requirements of the Contract Documents.

Reviewed and Submitted By: _____

Signature: _____

Note: Submittal review corrections and comments by Architect do not relieve Contractor from compliance with Contract Documents. Review is only for general conformance with design concept and general compliance with information given in Contract Documents. Contractor is responsible for verifying dimensions, selecting fabrication processes and techniques of construction, coordination with other trades, and performing work in safe and satisfactory manner.

FOR ARCHITECT USE:

Date Received by Architect: _____

Distributed To:

☐ Owner ☐ Civil ☐ Landscape ☐ Structural ☐ Mechanical ☐ Electrical

Other: _____

SECTION 01 4000**QUALITY REQUIREMENTS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. References and standards.
- B. Mock-ups.
- C. Control of installation.
- D. Tolerances.
- E. Testing and inspection services.
- F. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

- A. AIA 201A 1997 General Conditions: Contractor's supervision and construction procedures, Requirements for tests and inspections, Inspections and approvals required by public authorities, Contractor's responsibility for uncovering and correction of work.
- B. Section 01 3300 - Submittal procedures.
- C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

- A. When specifications require conformance to a reference standard, applicable standard shall be the edition current at date of receiving bids.
- B. Should specified reference standard conflict with Contract Documents, request clarification from Architect.
- C. Contractual relationship, duties, and responsibilities of the parties to the Contract nor those of Architect shall not be altered from that stated in the Contract Documents by mention or inference to the contrary in a specified reference standard.
- D. ASTM C 1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008.
- E. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2008.
- F. ASTM C 1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2008.
- G. ASTM E 329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2008.
- H. ASTM E 543 - Standard Specification for Agencies Performing Nondestructive Testing; 2008a.

1.04 SUBMITTALS

- A. Testing Agency Qualifications:
 - 1. Prior to start of Work, submit agency name, address, and telephone number, and names of full-time registered Engineer and responsible officer.

- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.
- C. Test Reports: After each test/inspection, promptly and directly submit two copies of report to Architect, one copy to Owner, one copy to Contractor, one copy to Engineer (if applicable), and other copies as requested by Architect.
 - 1. Test reports to include the following:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project (mapping) - **submit a site plan and/or floor plan indicating the exact locations of the inspection, sample(s), or test(s) performed** (a description of the location alone will not be accepted).
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Conformance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
 - 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.05 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.06 TESTING AND INSPECTION AGENCIES

- A. Standard Quality Testing & Inspections: **Contractor** shall coordinate the required inspections by the Authority Having Jurisdiction (Local and State AHJ's) to assure compliance with requirements of construction documents and as required by Section 110.3 of the 2015 IBC. **Contractor will pay for cost of these services.**
- B. Special Inspections: When indicated in individual specification sections and in drawings, **Owner shall pay for services of an independent testing agency to perform Special Inspections** in accordance with Chap. 17 of the 2015 IBC. Contractor shall coordinate, and schedule all required special inspections with Owner's Testing Agency.
- C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- D. Submit within fourteen (14) days of the effective date of Agreements Between Owner and Contractor, testing laboratory qualifications for acceptance by the Architect.
- E. Contractor Employed Testing Agency:
 - 1. Testing agency: Comply with requirements of ASTM E 329, ASTM E 548, ASTM E 543, ASTM C 1021, ASTM C 1077, and ASTM C 1093; and individual specification sections.
 - 2. Laboratory: Authorized to operate in State in which Project is located.
 - 3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 - 4. Testing Agency shall be approved by Owner and Architect.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step, in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. All installers/subcontractors who fall within the listing threshold noted in Section 00430, Supplements to Bid Forms, List of Subcontractors, page 21 of the Bidding Documents, must be licensed in the State of New Mexico.
- G. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- H. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be a comparison standard for the remaining Work.
- D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. Contractor shall coordinate and make arrangements to perform inspections and compliance testing for:
 - 1. Soils for engineered fill at building structures (including backfill for site utilities).
 - 2. Earthwork Compaction (including earthwork compaction for site utilities).
 - 3. Asphalt and/or Concrete Paving.
 - 4. Concrete.
 - 5. Masonry.
 - 6. HVAC systems.
 - 7. Special Inspections. (Paid for by Owner)
 - 8. Other inspections and testing as needed or as per individual specification sections.
- B. See individual specification sections for testing required.
- C. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. **Provide locations of all tests/inspections performed in the Project (mapping) - submit a site plan and/or floor plan indicating the exact locations of the inspection, sample(s), or test(s) performed** (a description of the location alone will not be accepted).
 - 7. Test samples of mixes submitted by Contractor.
 - 8. Submit reports of all tests/inspections specified. Submit reports of all tests/inspections specified: Testing firm shall submit to the Architect three (3) copies of reports indicating observations and results of inspections and tests with indication of compliance or non-compliance with contract Documents. Additional copies may be required to be distributed to Owner and/or other Engineering consultants at the direction of the Architect.
- D. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.

3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.
- E. Contractor Responsibilities:
 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- F. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
- G. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and other criteria as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of manufacturers' observer to Architect fifteen (15) days in advance of required observations.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

01 4000

SECTION 01 5000**TEMPORARY FACILITIES, UTILITIES, AND CONTROLS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes:
 - 1. Temporary services: Electrical, lighting, heating, ventilating, water, communications.
 - 2. Security, barriers, enclosures, and protection.
 - 3. Construction facilities: Access and parking.
 - 4. Protection of Work and existing facilities.
 - 5. Bulletin board.
 - 6. Waste Removal Facilities and Services.
- B. Related documents and sections:
 - 1. Section 01 3100: Project Management and Coordination
 - 2. Section 01 7000 - Execution Requirements: Progress cleaning.

1.02 REFERENCES

- A. NFPA 10 - Standard for Portable Fire Extinguishers.
- B. NFPA 241 - Safeguarding Building Construction, Alterations, and Demolition Operations.

1.03 TEMPORARY ELECTRICITY

- A. Provide for temporary electricity used during construction. Provide service disconnect and overcurrent protection. Provide temporary feeder as required. Owner will pay cost of electricity used. Exercise measures to conserve power.
- B. Do not disrupt Owner's need for continuous service in occupied facilities.
- C. Provide power outlets for construction operations with branch wiring, distribution boxes, and flexible power cords as required.
- D. Permanent convenience receptacles may be utilized during construction.

1.04 TEMPORARY LIGHTING

- A. Provide lighting for construction operations in accordance with Paragraph 3.13 in the General Conditions. Lighting levels shall be appropriate for type and difficulty of work. Use these minimums as guidelines:
- B. After dark, provide security lighting for interior and exterior work and storage areas.
- C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

- D. Maintain lighting and provide routine repairs.
- E. Permanent building lighting may be utilized during construction. Document existing lighting system conditions at start of Work and submit report to Design Professional for approval before Work begins. Re-lamp, replace, or repair existing fixtures at end of job to return lighting to conditions documented prior to commencement of Work.

1.05 TEMPORARY HEATING AND VENTILATING

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, and gases.
- B. Provide temporary fan units to maintain clean air for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F in interior areas where construction is in progress.
- D. Use of Owner's existing HVAC system to maintain specified conditions: Owner will pay cost of energy used. Exercise measures to conserve energy.
- E. Change all HVAC filters in existing system serving area of Work at end of Project.

1.06 TEMPORARY WATER SERVICE

- A. Provide, maintain, and pay for suitable quality water service required for construction operations.
- B. Assume responsibility for temporary connections and water lines. Upon completion, remove temporary facilities.
- C. Contractor to use care when disposing of wastewater. No dumping or rinsing of equipment or tools allowed in mop sinks or drains on premises. The contractor shall utilize exterior hoses when cleaning.

1.07 TEMPORARY COMMUNICATIONS

- A. Provide, maintain, and pay for telephone, internet, and/or Wi-Fi service to field office. Owner's telephones will not be available to Contractor's workforce unless for an emergency.
- B. Provide, maintain, and pay for facsimile service to field office.

1.08 SECURITY, BARRIERS, ENCLOSURES, AND PROTECTION

- A. Security: Provide to protect Work and existing facilities from unauthorized entry, vandalism, and theft. Coordinate with Owner's security program and personnel.
- B. Barriers: Provide to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from construction operations.
- C. Barricades and covered walkways: As required by Design Professional, Owner and governing authorities for safe public access to existing buildings.
- D. Enclosures - Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces.

- E. Temporary partitions: Provide to separate work areas from existing building at point of connection and completed Work. Prevent penetration of dust and moisture into existing and completed portions of building.
- G. Emergency exits shall be maintained during construction. Provide separate barriers as appropriate.
- H. Protect existing detection devices such as smoke detectors and sensors from construction dust.

1.09 PROTECTION OF EXISTING AND INSTALLED WORK

- A. Protect installed Work. Control activity in immediate work area.
- B. Provide temporary and removable protection for installed products.
- C. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, and movement of heavy objects with durable sheet materials.
- D. Prohibit traffic and storage on roof surfaces and landscaped areas.

1.10 TEMPORARY FIRE PROTECTION

- A. Install and maintain temporary fire protection components. Establish and follow procedures to protect against fire losses. Comply with NFPA 241.
- B. Fire extinguishers: Provide hand carried, portable, UL rated fire extinguishers of type and size recommended by NFPA 10 for building exposure conditions. Place in accessible, convenient locations in clear view with a minimum of one extinguisher per floor.
- C. Access: Maintain unobstructed access to fire hydrants, water supply, fire extinguishers, stairways, and access routes for fighting fires.
- D. Heating devices: Exercise care and monitor use of temporary heaters to minimize fire risk.
- E. Store combustible materials in fire-safe containers.
- F. Volatile products: Do not store paints, varnishes, paint removers, solvents, adhesives, cleaning rags, and other volatile products in building. Take precautionary measures to prevent fire hazards and spontaneous combustion.
- G. Cutting and welding: Approve in advance use of open flame cutting, welding, and soldering equipment. Ensure that safe conditions exist before granting approval.

1.11 ACCESS

- A. Refer to Drawings for location of acceptable access routes and site entrances. Protect existing curbs and walks traversed by construction vehicles from damage.
- B. Identify access to Contractor's work and office area with appropriate signs so that delivery personnel and others may contact Contractor. Owner's facilities/offices shall not be used as destination for Contractor's deliveries.
- C. Prevent unauthorized personnel from accessing construction areas or site through Contractor's work area.

1.12 BULLETIN BOARD

- A. Furnish and maintain bulletin board adjacent to field office. Display the following throughout construction period:
 - 1. State wage rates.
 - 2. Safety requirements.
 - 3. Official notices and announcements.

1.13 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore new permanent facilities used during construction to specified condition.

PART 2 – PRODUCTS

Not used

PART 3 - EXECUTION

Not used.

END OF SECTION

01 5000

SECTION 01 5813**TEMPORARY PROJECT SIGNAGE****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Project identification sign.
- B. Project informational signs.
- C. Template

1.02 RELATED REQUIREMENTS

- A. Document 00 700 - General Conditions of the Contract; **Additional Conditions, Section 9.1** Owner requirements.

1.03 QUALITY ASSURANCE

- A. Design sign and structure to withstand up to 50 miles/hr wind velocity.
- B. Sign Painter: Experienced as a professional sign painter for minimum three years.
- C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

PART 2 - PRODUCTS**2.01 SIGN MATERIALS**

- A. Structure and Framing: New, wood, structurally adequate.
- B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch thick, standard large sizes to minimize joints.
- C. Rough Hardware: Galvanized.
- D. Paint and Primers: Exterior quality, two coats; sign background of color as selected.
- E. Lettering: Exterior quality paint, contrasting colors.

2.02 PROJECT IDENTIFICATION SIGN

- A. One printed sign of construction, design, and content, location as directed by Owner and Architect.

2.03 PROJECT INFORMATIONAL SIGNS

- A. Provide municipal traffic agency directional traffic signs to and within site.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Install project identification sign within 30 days after date fixed by Notice to Proceed.
- B. Erect at designated location.
- C. Erect supports and framing on secure foundation, rigidly braced, and framed to resist wind

loadings.

- D. Install sign surface plumb and level, with butt joints. Anchor securely.

3.02 REMOVAL

- A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.
- B. Turn over Project Sign to Owner.

END OF SECTION

01 5813

(Project Sign Template follows)

SECTION 01 6000**PRODUCT REQUIREMENTS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Procedures for Owner-supplied products.
- E. Substitution limitations and procedures.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Document 00 100 - Instructions to Bidders: Product options and substitution procedures prior to bid date.
- B. Section 01 3300 - Submittal Procedures
- C. Section 01 4000 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. **Submit within 30 days after date of Notice to Proceed.**
 - 2. For products specified only by reference standards, list applicable reference standards.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 - PRODUCTS**2.01 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Where all other criteria are met, Contractor shall give preference to products that:
 - 1. Are extracted, harvested, and/or manufactured closer to the location of the project.
 - 2. Have longer documented life span under normal use.

3. Result in less construction waste.

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 - EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. Architect will consider requests for substitutions **prior to** bidding per Section 3.3 of "Instructions to Bidders" and within 30 days after date established in Notice to Proceed.
 1. **Only requests submitted on "01 6310 – Substitution Request Form" will be considered (Form follows this section).**
- C. Substitutions may be considered **after** bidding when:
 1. A product becomes unavailable through no fault of the Contractor.
 2. There will be a delay in schedule without a substitution through no fault of the Contractor.
 3. At sole discretion of the Architect/Owner.
 4. **Only requests submitted on "01 6310 – Substitution Request Form" will be considered (Form follows this section).**
- D. Substitutions are subject to compliance with **Basis of Design products for physical and performance characteristics as well as aesthetics; color, pattern, and textures. Provide products as indicated on the drawings (refer to Finish and Material Schedule) or as approved by the Architect.**
- E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request including justification as per paragraph C. above, or when acceptance will require revision to the Contract Documents.
- F. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- G. A request for substitution constitutes a representation that the submitter:
 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 2. Will provide the same warranty for the substitution as for the specified product.
 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 4. Waives claims for additional costs or time extension that may subsequently become

apparent.

5. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

H. Substitution Submittal Procedure:

1. Submit two copies of request for substitution for consideration. Limit each request to one proposed substitution. Any catalogs or brochures shall be highlighted to indicate the item desired for substitution.
 - a. Prior Approval Requests made during bidding and are less than 20 pages may be emailed or faxed. Larger documents must be delivered as hard copies.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer. Include in the request:
 - a. Complete data substantiating compliance of proposed substitution with Contract Documents.
 - b. For products:
 - (1.) Product identification, including manufacturer's name and address.
 - (2.) Manufacturer's literature containing product description, performance and test data, and reference standards with the sections pertaining to the product to be substituted highlighted or marked.
 - (3.) Samples as required.
 - c. For construction methods: Detailed description of proposed method, and drawings illustrating methods, if a change is needed from the original methods listed in the Construction Documents.
 - d. Itemized comparison of proposed substitution with product specified.
 - e. Data relating to changes in construction schedule.
 - f. Give cost data comparing proposed substitution with specified product.
3. **Submit separate request for each substitution with Form 01 6310 - Substitution Request Form. Only requests submitted on this form will be accepted.** (Copy of form follows this Section.)
4. The Architect will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:

1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.02 TRANSPORTATION AND HANDLING

- A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- B. Transport and handle products in accordance with manufacturer's instructions.
- C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- H. Prevent contact with material that may cause corrosion, discoloration, or staining.
- I. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

01 6000

SECTION 01 6300**PRODUCT SUBSTITUTION PROCEDURES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes requirements for product options and substitution procedures.
- B. Related documents and sections:
 - 1. Section 00 7200 General Conditions: Paragraph 3.4 – Labor and Materials

1.02 SUBSTITUTIONS

- B. During bidding, Design Professional will consider written requests from qualified offerors, subcontractors, and manufacturers for substitutions.
 - 1. Submit separate request for each substitution with Form 01 6301 - Prior Approval Substitution Request Form. Copy of form follows this Section.
 - 2. Submit substitution request in accordance with procedures and time limitations stated in Document 00 2113 - Instructions to Bidders.
 - 3. Substitutions approved during bidding will be listed in Addenda.
- C. After Contract award:
 - 1. After signing of Agreement Between Owner and Contractor, Design Professional will consider written requests for substitutions in accordance with Subparagraph 3.4.2 of the General Conditions.
 - 2. Submit separate request for each substitution with Form 01 6302 - Contractor Substitution Request Form. Copy of form follows this Section. Provide data documenting need for substitution and substantiating compliance of proposed product with Contract Documents. Include proposed changes to contract amount and time if substitution is accepted.
- C. Substitutions may be considered after Contract award when:
 - 1. A product becomes unavailable through no fault of the Contractor.
 - 2. There will be a delay in schedule without a substitution through no fault of the Contractor.
 - 3. At sole discretion of the Architect/Owner.
- D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request including justification as per paragraph C. above, or when acceptance will require revision to the Contract Documents.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- F. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality

level of the specified product.

2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension that may subsequently become apparent.

G. Substitution Submittal Procedure:

1. Submit two copies of request for substitution for consideration. Limit each request to one proposed substitution. Any catalogs or brochures shall be highlighted to indicate the item desired for substitution.
 - a. Prior Approval Requests made during bidding and are less than 20 pages may be emailed. Larger documents must be delivered as hard copies.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. The Architect will notify Contractor in writing of decision to accept or reject request.

PART 2 – PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

FORMS FOLLOW

PRIOR APPROVAL SUBSTITUTION REQUEST FORM

The undersigned, qualified bidder, subcontractor, manufacturer, or supplier requests that the following product be accepted for use in the Project

PRODUCT: _____

MODEL NO.: _____

MANUFACTURER: _____

ADDRESS: _____

The above product would be used in lieu of

PRODUCT: _____

specified in

SECTION: _____

PARAGRAPH: _____

Attached are the following circled items:

1. Product description including specifications, performance and test data, and applicable reference standards.
2. Drawings.
3. Photographs.
4. Samples.
5. Tabulated comparison with specified product.
6. For items requiring color selections, full range of manufacturer's color samples.
7. Documentation for reason of request.
7. Other: _____

The undersigned certifies that the following statements are correct. Explanations for all items which are **not** true are attached.

1. Proposed substitution has been thoroughly investigated and function, appearance, and quality meet or exceed that of

specified product.	TRUE FALSE
2. Same warranty will be provided for substitution as for specified product.	TRUE FALSE
3. No aspect of Project will require re-design.	TRUE FALSE
4. Use of substitution will not adversely affect:	
a. Dimensions shown on Drawings.	TRUE FALSE
b. Construction schedule and date of completion.	TRUE FALSE
c. Work of other trades.	TRUE FALSE
5. Maintenance service and replacement parts for proposed substitution will be readily available in Las Cruces area.	TRUE FALSE
6. Proposed substitution does not contain asbestos in any form.	TRUE FALSE
7. NOTE: Any additional costs for modifying project design, which subsequently becomes apparent caused by use of proposed substitution, will be paid for by Contractor.	

Submitted By:

COMPANY: _____

ADDRESS: _____

TELEPHONE NUMBER: _____

NAME OF PERSON SUBMITTING REQUEST: _____

TITLE: _____

DATE: _____

SECTION 01 6302

CONTRACTOR SUBSTITUTION REQUEST FORM

The undersigned, as Contractor for the above Project, requests that the following product be accepted for use in the Project

PRODUCT: _____

MODEL NO.: _____

MANUFACTURER: _____

ADDRESS: _____

The above product would be used in lieu of

PRODUCT: _____

specified in

SECTION: _____

PARAGRAPH: _____

Reason for substitution request: _____

Attached are the following circled items:

1. Product description including specifications, performance and test data, and applicable reference standards.
2. Drawings.
3. Photographs.
4. Samples.
5. Tabulated comparison with specified product.
6. For items requiring color selections, full range of manufacturer's color samples.
7. Documentation of reason for request.
8. Cost data for comparing proposed substitution with specified product.
9. Other: _____

The undersigned certifies that the following statements are correct. Explanations for all items which are **not** true are attached.

1. Proposed substitution has been thoroughly investigated and function, appearance, and quality meet or exceed that of specified product. TRUE FALSE
2. Same warranty will be provided for substitution as for specified product. TRUE FALSE
3. **No** aspect of Project will require re-design. TRUE FALSE
4. Use of substitution will **not** adversely affect:
 - a. Dimensions shown on Drawings. TRUE FALSE
 - b. Construction schedule and date of completion. TRUE FALSE
 - c. Work of other trades. TRUE FALSE
5. Maintenance service and replacement parts for proposed substitution will be readily available in Las Cruces area. TRUE FALSE
6. Proposed substitution does **not** contain asbestos in any form. TRUE FALSE
7. All changes to Contract Sum related to use of proposed substitution are included in price listed below. Contractor waives claims for additional costs related to acceptance of substitution which may subsequently become apparent. TRUE FALSE
8. Costs of modifying project design caused by use of proposed substitution which subsequently become apparent will be paid for by Contractor. TRUE FALSE

If substitution request is accepted:

Contract Sum will be [decreased] [increased] by \$ _____

Contract Time will be [decreased] [increased] by _____
calendar days.

Submitted By:

CONTRACTOR: _____

ADDRESS: _____

TELEPHONE NUMBER: _____

NAME OF PERSON SUBMITTING REQUEST: _____

TITLE: _____

DATE: _____

SECTION 01 7000**EXECUTION REQUIREMENTS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes:
 - 1. Basic requirements for examination, preparation and installation.
 - 2. Requirements and limitations for cutting and patching incidental to work, including excavation and backfilling, and as required making several parts fit together.
 - 3. Progress cleaning.
- B. Related documents and sections:
 - 1. General Conditions:
 - a. Paragraph 3.13: Contractor's responsibilities regarding use of the site.
 - b. Paragraph 3.14: Contractor's responsibilities regarding cutting and patching operations.
 - c. Article 12: Uncovering and correction of work.
 - 2. Section 01 5000 - Temporary Facilities and Controls: Temporary barriers and enclosures.
 - 3. Section 01 7700 - Closeout Procedures: Final cleaning.
 - 4. Section 02 4100 - Demolition: Demolition required to accommodate new construction and renovation.

1.02 SUBMITTALS

- A. See Section 01 3300 - for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:

- a. Identification of Project.
- b. Location and description of affected work.
- c. Necessity for cutting or alteration.
- d. Description of proposed work and products to be used.
- e. Effect on work of Owner or separate Contractor.
- f. Written permission of affected separate Contractor.
- g. Date and time work will be executed.

- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

- A. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

1.05 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- C. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
- E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.
- I. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

1.06 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible

with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.03 PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set of the following record documents; record actual revisions to work:
 - 1. Contract Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed submittals.
- B. Store Record Documents separate from documents used for construction. Label "Project Record Documents".
- C. Record information concurrent with construction progress. Use erasable colored pencil. Date all entries. Call attention to entry by circling area affected.
- D. Specifications: Legibly mark and record in each section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- E. Contract Drawings and shop drawings: Legibly mark each item to record actual construction including:
 - 1. Actual items of equipment and system components installed.
 - 2. Actual locations of components and routing of piping and raceways.
 - 3. Measured horizontal and vertical locations of underground water, sewer, irrigation, electrical, and other utilities and appurtenances, referenced to permanent surface improvements.
 - 4. Measured locations of piping, raceways, and other items concealed in construction, referenced to visible and accessible features.
 - 5. Field changes of dimension and detail.

- 6. Details not on original Contract Drawings.
 - 7. Accurately record actual locations of capped and active utilities.
- F. Documents will be reviewed by Architect at each submittal of Application for Payment to ensure that entries are current.
- G. Submit documents to Architect prior to or in conjunction with submission of Notice of Substantial Completion.

1.02 LOCATION OF UNDERGROUND UTILITIES

- A. The Contractor shall arrange for all spotting of lines by utility companies in advance of any excavation work.
- B. The Contractor shall arrange for spotting of lines by Owner's forces in advance of any excavation work on the site. Procedures for arranging for line spots and obtaining clearance prior to excavation shall be strictly adhered to.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Patching and replacement materials: Those used for original installation.
- B. Product substitutions: For any proposed change in patching materials, submit request for substitution in accordance with Section 01 6300 - Product Substitution Procedures.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to

applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, and ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement. . Where manufacturers' instructions conflict with specifications, notify Architect. Do not proceed until clarification is received.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.
- F. Remove excess materials such as adhesive, grout, mortar, and sealants, from finished surfaces in a manner which does not stain, corrode, disfigure, or otherwise damage finished surface.
- G. Replace deformed, scratched, cracked, broken, or otherwise damaged products as result of installation.
- H. Follow Indoor Air Quality Management Plan as required by Division 1 Section "Sustainable Design Requirements."

3.06 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.

4. Match work that has been cut to adjacent work.
 5. Repair areas adjacent to cuts to required condition.
 6. Repair new work damaged by subsequent work.
 7. Remove samples of installed work for testing when requested.
 8. Remove and replace defective and non-conforming work.
 9. Uncover in order to install improperly sequenced work.
 10. Execute patching to complement adjacent work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.
- D. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Size openings to exactly fit penetrating item plus allowance for sealant. Form edges of hole even and smooth.
- H. Drill penetrations through concrete for conduit and piping.
- I. Drill round hole and saw cut rectangular openings in concrete masonry units. Where block is broken or chipped in process, remove complete face of exposed block and replace with partial block.
- J. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- K. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400 - Firestopping, to full thickness of the penetrated element.
- L. Patching:
1. Restore work with new products meeting requirements of Contract Documents.
 2. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 3. Match color, texture, and appearance.
 4. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 ASPHALT PAVEMENT [IF APPLICABLE]

- A. Where existing or new pavement is damaged from construction operations, cut to install new underground utilities and where existing items are removed from paved areas:
1. Cut pavement with saw or other means to provide neat, straight joints.
 2. Where existing pavement is damaged by removals, remove additional pavement to allow clean cuts.
 3. Backfill and sufficiently compact removal area prior to placement of pavement.
 4. Place pavement to match existing materials and thicknesses.
- B. Immediately after placement, protect new pavement from mechanical damage.

3.01 ROOF PENETRATIONS

- A. New roofing:
1. Coordinate, locate and schedule roof penetrations prior to installation of new roof system.
 2. Coordinate roof penetrations such that installation does not void roof warranty.

- B. Existing roofing: Prior to penetrating, cutting, and patching existing roofing, verify with Owner if roof is under warranty. If warranted, employ roof contractor certified by manufacturer of roof system, make required inspections and notifications, and perform cutting and patching as required to ensure warranty is not violated. Protect building interior during operations and return roof to weathertight condition after the work is performed.

3.09 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.10 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

END OF SECTION

01 7000

SECTION 01 7500**STARTING AND ADJUSTING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes: General procedures for starting, monitoring, and adjusting items of equipment and complete systems.
- B. Related sections:
 - 1. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.
 - 2. Section 23 0593 - Testing, Adjusting, and Balancing: Balancing of HVAC system.
 - 3. Division 26

PART 2- PRODUCTS

Not used.

PART 3 - EXECUTION**3.01 SYSTEM STARTUP**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit written report in accordance with Section 01 3300 - Submittal Procedures that equipment and systems have been properly installed and are functioning correctly.

3.02 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 7900 - Demonstration and Training.

3.03 ADJUSTING

- A. Testing, adjusting, and balancing HVAC systems: See Section 23 0593.

END OF SECTION**01 7500**

SECTION 01 7700**CLOSEOUT PROCEDURES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes:
 - 1. Substantial Completion Procedures.
 - 2. Final Completion Procedures
 - 3. Systems Start-Up
 - 4. Demonstration and Instruction.
 - 5. Adjusting.
 - 6. Final cleaning.
 - 7. Closeout procedures.
 - 8. Maintenance.
 - 9. Inspection held immediately prior to end of one year correction period.
- B. Related documents and sections:
 - 1. Document 00 700 - General Conditions of the Contract,
 - a. Paragraph 9.8: Substantial Completion.
 - b. Paragraph 9.9: Partial occupancy.
 - c. Paragraph 9.10: Closeout Requirements
 - d. Paragraph 9.11: Final completion and final payment.
 - e. Subparagraph 12.2.2.1: One year correction period for Contractor to correct defective work.
 - f. Paragraph 3.13: Use of site.
 - 2. Section 01 7000 - Execution Requirements: Progress cleaning.
 - 3. Section 01 7500 - Starting and Adjusting: Starting and adjusting items of equipment and complete systems.
 - 4. Section 01 7800 - Closeout Submittals: Submittal of project record documents, operation and maintenance manuals, warranties, certificates of inspection, extra materials, and keys.
 - 5. Section 01 7900 - Demonstration and Training: Demonstrations and training for Owner's personnel.

1.02 SUBSTANTIAL COMPLETION PROCEDURES

- A. Prior to or in conjunction with submission of Contractor's request for Substantial Completion, submit the items specified in Section 01 7800 - Closeout Submittals:
- B. Comply with Document 00 700 - General Conditions of the Contract, Paragraph 9.8 for issuance of Certificate of Substantial Completion.

1.03 FINAL COMPLETION PROCEDURES

- A. Follow procedures as outlined in Article 9 of the General Conditions.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION**3.01 SYSTEMS STARTUP**

- A. Coordinate with requirements of Section 01 7500 - Starting & Adjusting.
- B. Coordinate schedule for start-up of various equipment and systems.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. Submit written report in accordance with Section 01 3300 - Submittal Procedures that equipment and systems have been properly installed and are functioning correctly.

3.02 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.
- D. See Section 01 7900 - Demonstration and Training.

3.03 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.04 FINAL CLEANING

- A. Execute final cleaning prior to final inspection by methods and with materials and equipment suitable for commercial/institutional building maintenance. See Paragraph 3.13 – General Conditions.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.05 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Substantial Completion.
- D. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.
- E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.
- F. Notify Architect when work is considered finally complete.
- G. Complete items of work determined by Architect's final inspection.

3.06 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Furnish service and maintenance of components indicated in specification sections during the warranty period.
- D. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- E. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- F. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

01 7700

SECTION 01 7800**CLOSEOUT SUBMITTALS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties
- D. Performance and Payment Bonds.

1.02 RELATED REQUIREMENTS

- A. General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 3100 – Project Management & Coordination: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01 7700 - Closeout Procedures: Contract closeout procedures.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION**3.01 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. Provide for each Product, Applied Material, and Finish.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- C. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- D. Provide servicing and lubrication schedule, and list of lubricants required.
- E. Include manufacturer's printed operation and maintenance instructions.
- F. Include sequence of operation by controls manufacturer.
- G. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- H. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- B. Prepare data in the form of an instructional manual.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D-ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE MANUALS; identify title of Project; identify subject matter of contents.
- E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
- F. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- G. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- H. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning

methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Certificates.
 - c. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D-ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

01 7800

SECTION 01 7900**DEMONSTRATION AND TRAINING****PART 1 - GENERAL****1.01 SUMMARY**

A. Section includes: Training of Owner's designated personnel in operation and maintenance of equipment and systems.

B. Related sections:

1. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

1.02 SUBMITTALS

A. Provide in accordance with Section 01 3300 - Submittal Procedures:

1. List of names, resumes, and qualifications of personnel conducting training sessions.
2. Preliminary schedule listing times, dates, and outline showing organization and proposed contents of training sessions for approval by Design Professional and Owner.
3. Copies of training manuals and other materials to be used in training sessions for approval by Design Professional and Owner.
4. Provide Owner additional copy of audio visual material on the same media used in training sessions.
5. Three (3) copies of training manuals for future use in training by Owner and three (3) digital copies of training manuals.
6. Submit report within 1 week after completion of training that sessions have been satisfactorily completed. Give times, dates, list of persons trained, and summary of instructions.

1.03 QUALITY ASSURANCE

A. Personnel conducting demonstration and training sessions shall be knowledgeable of installation, operation, sequence of operations, and maintenance of specific project equipment and systems. Where appropriate manufacturer's representatives shall conduct training.

PART 2 - PRODUCTS**2.01 TRAINING MATERIALS**

A. Training manuals: Loose leaf notebook format with agenda and objectives of each lesson.

1. Manuals shall describe function, operation, sequence of operations, and maintenance of various items of equipment and be suitable for personnel with high school education.
2. Manuals shall be suitable for future training of Owner personnel by Owner staff.

3. Manuals shall be useful reference for staff maintaining facility.
- B. Visual aids: Provide charts, handouts, overhead projector slides, electronic presentations, and other visual aids required to make effective presentation and facilitate training.
1. Equipment needed for showing visual training aids shall be provided by Contractor.
 2. Visual aids shall be suitable for use by Owner's staff to train additional personnel in the future.

PART 3 - EXECUTION

3.01 SCHEDULING

- A. Schedule demonstration and training sessions after equipment and systems have been completely installed, startup completed, and adjustments made. Single demonstration and training session shall be conducted of all items prior to substantial completion. Schedule with Design Professional to accommodate Owner's representatives.

3.02 DEMONSTRATION AND TRAINING

- A. Provide demonstration and training session to emphasize operation, sequence of operations, use, and maintenance of installed items and systems:
1. Mechanical systems specified in Divisions 21, 22 and 23.
 2. Electrical systems specified in Division 26.
 3. Other items and systems as designated by Design Professional or requested by Owner.
- B. Conduct at project site using actual installed equipment and systems.
- C. Owner shall be responsible for designating and notifying personnel to attend and ensuring attendance at scheduled sessions.
- D. Have copies of operation and maintenance manuals specified in Section 01 7800 - Closeout Submittals available. Use as training aids. Include training on each of written sequence of operations contained in the Operations & Maintenance Manual.
- E. Owner shall have right to record or video tape demonstration and training sessions.

END OF SECTION

01 7900

Division Five

METALS

**SECTION 05 1200 –
STRUCTURAL STEEL FRAMING**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes structural steel and grout.
- B. Contractor shall be required to follow requirements contained in Division 1 of the specifications.

1.02 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
- C. Qualification Data: For qualified Installer and testing agency.
- D. Welding certificates.
- E. Mill test reports for structural steel, including chemical and physical properties.
- F. Source quality-control reports.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that uses the procedures in the AISC Quality Certification Program.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Preinstallation Conference: Conduct conference at **Project site**.

PART 2 - PRODUCTS**2.01 STRUCTURAL-STEEL MATERIALS**

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. W-Shapes: ASTM A 992, Grade 50.
- C. Channels, Angles S-Shapes: ASTM A 36.
- D. Plate and Bar: ASTM A 36.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
- G. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 , Type 1, heavy-hex steel structural bolts; hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 , Type 1, heavy-hex steel structural bolts, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.
- C. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: Straight.
 - 2. Finish: Plain.
- D. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
 - 1. Finish: Plain.
- E. Threaded Rods: ASTM A 36.
 - 1. Finish: Plain.

2.03 PRIMER

- A. Primer: Comply with Division 09 painting Sections.
- B. Primer: SSPC-Paint 25, Type I, zinc oxide, alkyd, linseed oil primer.

- C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.04 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.05 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
- B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

2.06 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened or Slip critical as indicated.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.07 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of **2 inches**.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of **1.5 mils**. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.08 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.03 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened or Slip critical as indicated.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION

**SECTION 05 5000 –
METAL FABRICATIONS**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Miscellaneous steel framing and supports.
 - 2. Shelf angles.
 - 3. Metal ladders.
 - 4. Ladder safety cages.
 - 5. Structural-steel door frames.
 - 6. Miscellaneous steel trim.
 - 7. Metal bollards.
 - 8. Loose bearing and leveling plates.
- B. Products furnished, but not installed, under this Section:
 - 1. Loose steel lintels.
 - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 3. Steel weld plates and angles for casting into concrete.
- C. Contractor shall be required to follow requirements contained in Division 1 of the specifications.

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Aluminum Ladders: Aluminum ladders shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

1.03 SUBMITTALS

- A. Product Data: For the following:
 - 1. Metal nosings and treads.
 - 2. Paint products.
 - 3. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS**2.01 METALS, GENERAL**

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

2.02 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- C. Rolled-Steel Floor Plate: ASTM A 786, rolled from plate complying with ASTM A 36 or ASTM A 283, Grade C or D.
- D. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. IKG Industries, a division of Harsco Corporation; Mebac.
 - b. SlipNOT Metal Safety Flooring, a W. S. Molnar company; SlipNOT.
- E. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53, standard weight (Schedule 40) unless otherwise indicated.
- G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: As indicated.
 - 2. Material: structural steel, **Grade 33**, with **G90** coating; **0.108-inch** nominal thickness.
 - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, **Grade 33 0.0677-inch** minimum thickness; unfinished.
- H. Cast Iron: Either gray iron, ASTM A 48, or malleable iron, ASTM A 47.

2.03 NONFERROUS METALS

- A. Aluminum Extrusions: **ASTM B 221** Alloy 6063-T6.
- B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632, Alloy 6061-T6.
- C. Aluminum Castings: ASTM B 26, Alloy 443.0-F.
- D. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
- E. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- F. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.04 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or **ASTM F 1941**, Class Fe/Zn 5, at exterior walls.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Post-Installed Anchors: chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or **ASTM F 1941**, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy **Group 1 (A1)** stainless-steel bolts, **ASTM F 593** and nuts, **ASTM F 594**.

2.05 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
 - 1. Repairs performed inside the weatherproofing membrane of the building must be done with products meeting the VOC requirements listed in Division 1 under the Sustainable Design Requirements section.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of **3000 psi**.

2.06 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches o.c.

2.07 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2.08 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with zinc-rich primer.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.09 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3 unless otherwise indicated.
 - 2. For elevator pit ladders, comply with ASME A17.1.

B. Steel Ladders:

1. Space siderails **16 inches** apart unless otherwise indicated.
2. Rungs: **3/4-inch**-diameter steel bars.
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Provide nonslip abrasive surfaces on top of each rung.
5. Galvanize exterior ladders, including brackets and fasteners.
6. Prime exterior ladders, including brackets and fasteners, with zinc-rich primer.

C. Aluminum Ladders:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ACL Industries, Inc.
 - b. Alco-Lite Industrial Products.
 - c. Halliday Products.
 - d. O'Keeffe's Inc.
 - e. Precision Ladders, LLC.
 - f. Royalite Manufacturing, Inc.
 - g. Thompson Fabricating, LLC.
2. Space siderails **16 inches** apart unless otherwise indicated.
3. Siderails: Continuous extruded-aluminum channels or tubes, not less than **2-1/2 inches** deep, **3/4 inch** wide, and **1/8 inch** thick.
4. Rungs: Extruded-aluminum tubes, not less than **3/4 inch** deep and not less than **1/8 inch** thick, with ribbed tread surfaces.

2.10 LADDER SAFETY CAGES

- A. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
- B. Provide primary hoops at tops and bottoms of cages and spaced not more than **20 feet** o.c. Provide secondary intermediate hoops spaced not more than **48 inches** o.c. between primary hoops.
- C. Galvanize steel ladder safety cages, including brackets and fasteners.
- D. Prime steel ladder safety cages, including brackets and fasteners, with **zinc-rich primer**.

2.11 STRUCTURAL-STEEL DOOR FRAMES

- A. Fabricate structural-steel door frames from steel shapes fully welded together, with **5/8-by-1-1/2-inch** steel channel stops. Plug-weld built-up members and continuously weld exposed joints. Reinforce frames and drill and tap as necessary to accept finish hardware.
 1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.
- B. Galvanize steel frames.
- C. Prime steel frames with **zinc-rich primer**.

2.12 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
- C. Galvanize miscellaneous steel trim.
- D. Prime miscellaneous steel trim with **zinc-rich primer**.

2.13 METAL BOLLARDS

- A. Fabricate metal bollards from **Schedule 40 steel pipe**.
 - 1. Cap bollards with **1/4-inch-** thick steel plate.
- B. Fabricate bollards with **3/8-inch-** thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for **3/4-inch** anchor bolts.
- C. Fabricate sleeves for bollard anchorage from steel **pipe** with **1/4-inch-** thick steel plate welded to bottom of sleeve.
- D. Prime bollards with **zinc-rich primer**.

2.14 ABRASIVE METAL NOSINGS TREADS AND THRESHOLDS

- A. Cast-Metal Units: Cast iron, with an integral-abrasive, as-cast finish.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Safety Tread Co., Inc.
 - b. Balco Inc.
 - c. Barry Pattern & Foundry Co., Inc.
 - d. Granite State Casting Co.
 - e. Safe-T-Metal Company, Inc.
 - f. Wooster Products Inc.
- B. Extruded Units: Aluminum, with abrasive filler in an epoxy-resin binder.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ACL Industries, Inc.
 - b. American Safety Tread Co., Inc.
 - c. Amstep Products.
 - d. Armstrong Products, Inc.
 - e. Balco Inc.
 - f. Granite State Casting Co.
 - g. Wooster Products Inc.

- 2. Provide ribbed units, with abrasive filler strips projecting **1/16 inch** above aluminum extrusion.
- C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- D. Apply bituminous paint to concealed surfaces of cast-metal units.
- E. Apply clear lacquer to concealed surfaces of extruded units.

2.15 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.16 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Galvanize loose steel lintels located in exterior walls.
- C. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.17 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.18 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.19 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.
- B. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Division 09 painting Sections unless zinc-rich primer is indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 3. Items Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.02 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards to existing construction with anchor bolts. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
- C. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout.
- D. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- E. Fill bollards solidly with concrete, mounding top surface to shed water.

3.03 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
- C. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

Division Six

**WOOD &
PLASTICS**

SECTION 06 1053**MISCELLANEOUS ROUGH CARPENTRY****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Roof-mounted curbs.
- B. Roofing nailers.
- C. Preservative treated wood materials.
- E. Miscellaneous framing and sheathing.
- F. Communications and electrical room mounting boards.
- G. Concealed wood blocking, nailers, and supports.
- H. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

1.03 REFERENCE STANDARDS

- A. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; Current edition.
- B. ASTM C 1396/C 1396M - Standard Specification for Gypsum Board; 2006a.
- C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.
- D. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood Protection Association; Current edition.
- E. AWPA C9 - Plywood -- Preservative Treatment by Pressure Processes; American Wood Protection Association; Current edition.
- F. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood-Protection Association; 2007.
- G. PS 1 - Structural Plywood; 2007.
- H. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); Current edition.
- I. WWPA G-5 - Western Lumber Grading Rules; Western Wood Products Association; Current edition.

1.04 SUBMITTALS

- A. See Section 01 3300 - for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent

deformation and to allow air circulation.

- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Douglas Fir-Larch, unless otherwise indicated.
 - 2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.02 DIMENSION LUMBER

- A. Grading Agency: Western Wood Products Association (WWPA).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Stud Framing (2 by 2 through 2 by 6):
 - 1. Species: Douglas Fir-Larch.
 - 2. Grade: No. 2.
- E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Exterior Wall Sheathing: Exterior Grade, Fire-treated Plywood, PS 1, Grade C-C Plugged or better.
- B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E 84.
- C. Other Applications:
 - 1. Plywood Concealed from View but Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 - 2. Plywood Exposed to View but Not Exposed to Weather: PS 1, A-D, or better.
 - 3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for preservative-treated wood locations, unfinished steel elsewhere.

2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
3. Anchors: Toggle bolt type for anchorage to hollow masonry.
- B. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.
- C. Sill Flashing: As specified in Section 07 6200 - Sheet Metal Flashing & Trim.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWP A U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
- B. Fire Retardant Treatment:
 1. Exterior Type: AWP A U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E 84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D 2898.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat all exterior rough carpentry items.
 - c. Do not use treated wood in direct contact with the ground.
 2. Interior Type A: AWP A U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E 84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated.
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- B. Preservative Treatment:
 1. Preservative Pressure Treatment of Lumber Above Grade: AWP A U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber in contact with roofing, flashing, or waterproofing.
 - c. Treat lumber in contact with masonry or concrete.
 - d. Treat lumber less than 18 inches above grade.
 2. Preservative Pressure Treatment of Plywood Above Grade: AWP A U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention.
 - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
 3. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWP A standards.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.
- B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- D. Specifically, provide the following non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Smart boards, white boards, marker boards and bulletin boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.

3.04 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.

2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

3.06 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

3.07 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION

06 1053

SECTION 06 4100**ARCHITECTURAL WOOD CASEWORK****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Fabricated Cabinet Units.
- B. Solid Surface Countertops.
- C. Cabinet hardware.
- D. Factory finishing.
- E. Miscellaneous finish carpentry items.
- F. Preparation for installing utilities.
- G. Miscellaneous hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 4000 - Quality Requirements,
- B. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- C. Section 09 2116 - Gypsum Board Assemblies

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; current edition.
- B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; current edition.
- C. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; current edition
- D. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; (ANSI/BHMA A156.9) current edition
- E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; Hardwood Plywood & Veneer Association; 2004 (ANSI/HPVA HP-1).
- F. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.
- G. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.
- H. Underwriters Laboratories, Inc. (UL) 94 - Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing.
- I. NSF International/American National Standards Institute (NSF/ANSI) 51 - Food Equipment Materials.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Convene a pre-installation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3300 - for submittal procedures.
- B. Shop Drawings: Indicate materials, layout, dimensions, component profiles and elevations, assembly methods, cutouts, joint details, fastening methods, accessory listings, and hardware location, to a minimum scale of 1-1/2 inch to 1 foot (1:8). Include a schedule of finishes.
- C. Product Data: Provide data for materials and hardware accessories.
- D. Samples: Submit actual samples of architectural cabinet construction, illustrating proposed cabinet and shelf unit substrate and finish. Samples are not to be part of constructed work.
 - 1. Plastic laminate: as selected by Architect, minimum 12 inches square
 - 2. Hardware: Actual sample items of proposed pulls, shelf standards, locksets, and hinges demonstrating hardware design, quality, and finish
 - 3. Countertop: Submit actual samples of proposed items, demonstrating, quality, color, texture, pattern, and finish. Sample in 3 inches square for with seam filler color samples.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- C. All wood parts and hardware shall be structurally sound and free from defects in material and workmanship under normal use and service for a period of three (3) years. All lock parts are warranted for a period of one (1) year.

1.07 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 - PRODUCTS**2.01 LUMBER MATERIALS**

- A. Softwood Lumber: NIST PS 20; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade II/Custom; average moisture content of 5-10 percent; species as recommended by manufacturer.
- B. Hardwood Lumber: NHLA; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade II/Custom; average moisture content of 5-10 percent; species as recommended by manufacturer.
- C. Provide materials having fire and smoke properties as required by applicable code.

2.02 PANEL MATERIALS

- A. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, composed of wood chips bonded with interior grade adhesive under heat and pressure; sanded faces; thickness as required; use for components indicated on drawings.
- B. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as required.
- C. Plywood for Non-Decorative Purposes: NIST PS 1, Interior rated adhesives, core of wood plies

from listed species unless otherwise indicated, thickness as indicated or as required by application.

- D. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S).

2.03 LAMINATE MATERIALS

- A. Manufacturers:
1. Formica; www.formica.com
 2. Nevamar Decorative Surfaces: www.nevamar.com.
 3. Wilsonart International, Inc: www.wilsonart.com.
 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Laminate Cladding for Exposed Surfaces (including open shelving and interior side of all casework doors) for wood-finish laminates: High-pressure decorative laminate complying with the following requirements:
1. Horizontal Surfaces Other Than Tops: Grade HGS.
 2. Postformed Surfaces: Grade HGP.
 3. Vertical Surfaces: Grade HGS.
 4. Edges: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 5. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.
 6. Color: As selected by Architect from manufacturer's full range.
- D. Materials for semi-exposed surfaces:
1. 8-9 mil white Melamine.
 - a. Edges of Melamine shelves in wood-finish casework: 8-9 melamine.
 - b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
- E. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: White Melamine.

2.04 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness, matching laminate in color, pattern, and finish.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel, or chrome-plated finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Standard plastic or painted metal grommets for cut-outs, in color to match adjacent surface.
1. Provide grommet cut-outs for all desktop areas and where there is a receptacle below or inside casework.

2.05 COUNTERTOPS/WINDOWSILL

- A. General:
1. Back and End Splashes: size as indicated on drawings in same material, same thickness

as countertop; for field attachment.

2. Drill holes in countertops for plumbing fittings in shop.

B. Solid Surface Countertops/Windowsill: Solid surfacing sheet or plastic resin casting over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch, minimum.
2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISSFA-2 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E 84.
 - b. NSF approved for food contact.
 - c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - d. Color and Pattern: Refer to Drawings, Color & Material Schedule.
 - e. Approved Manufacturers:
 - 1) Avonite Surfaces: www.avonitesurfaces.com/
 - 2) Dupont: www.corian.com/
 - 3) Formica Corporation: www.formica.com/
 - 4) Living Stone Surfaces: www.livingstonesurfaces.com/
 - 5) Wilsonart International, Inc: www.wilsonart.com
 - 6) Substitutions: See Section 01 6000 – Product Requirements.
3. Other Components Thickness: 1/2 inch, minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; 3/8" roundover edge.

2.06 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- C. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self-rests, polished chrome finish, for nominal 1 inch spacing adjustments.
- D. Drawer and Door Pulls: "U" shaped wire pull, aluminum with satin finish, 4 inch centers ("U" shaped wire pull, aluminum with satin finish, 100 mm centers).
 1. Product: 4484 manufactured by Stanley.
 2. Product (with bases): 4487 manufactured by Stanley.
 3. Substitutions: See Section 01 6000 - Product Requirements.
- E. Pulls for casework adjacent to video display.
 1. Door and drawer pulls for casework adjacent to video display shall be semi-flush injection molded ABS plastic with round safety corners and surfaces eliminating the possibility of garments and equipment from getting caught.
 2. Bainbridge Manufacturing: Product number 1710. Color as selected by Architect.
www.bainbridgemfg.com
 3. Substitutions for the above products shall be submitted for approval prior to bidding in accordance with the requirements of Section 00101, Instruction to Bidders.
- F. Sliding Door Pulls: Circular shape for recessed installation, steel with satin finish.

- G. Catches: Magnetic.
- H. Drawer Slides:
 - 1. Type: Extension types as required; full extension for file drawers; partial extension of drawer depth minus 5 inches for other applications.
 - 2. Static Load Capacity: As required by drawer size to fit specific application.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
- I. Hinges: European style concealed self-closing type, 175 degree opening suitable for overlap cabinet doors BHMA No. A 156.9, B01602, steel with satin finish.
 - 1. Manufacturers:
 - a. Hardware Resources: www.hardwareresources.com.
 - b. Julius Blum, Inc: www.blum.com.
 - c. Stanley Hardware: www.stanelyhardware.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- J. Locks and Keying:
 - 1. Locks: Provide locks at all cabinet doors and drawers; keyed cylinder, steel with chrome finish.
 - a. Door Locks: BHMA A156.11, E07121 (includes sliding doors)
 - b. Drawer Locks: BHMA A156.11, E07041
 - 2. Keying:
 - a. Coordinate final keying with Owner prior to fabrication.
 - b. Keys: Provide a minimum of (2) two keys for each lock, clearly label each key as to function and location of lock.
 - c. Master Keys: Provide (5) five copies; master key to fit all locks, clearly label each key as to function and location of lock.

2.07 SHOP TREATMENT OF WOOD MATERIALS

- A. Provide UL approved identification on fire retardant treated material.
- B. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.08 FABRICATION

- A. Interior Woodwork Grade: Unless otherwise indicated, provide custom-grade interior woodwork complying with referenced quality standard.
 - 1. All casework is custom grade except casework with wood grain laminate or wood veneer faces.
- B. Fabricate all casework, lockers and accessories square, rigid and without warp. All exposed and semi-exposed joints shall be aligned and true. Fabricate corners, endpanels, and fillers as required by installation.
- C. Cabinet Style: Flush overlay.
- D. Cabinet Doors and Drawer Fronts: Flush style.
- E. Drawer Construction Technique: Dovetail joints.
- F. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- G. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length. Adjustable shelving shall be finished on all four edges.
- H. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

- I. Minimum thickness:
 - 1. Door and drawer fronts, cabinet sides, shelves: 3/4 inch.
 - 2. Drawer sides and backs: 1/2 inch.
 - 3. Cabinet backs and drawer bottoms: 1/4 inch.
- J. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
- K. Provide dust panels of 1/4 inch plywood or tempered hardboard above compartments and drawers, unless directly under tops.
- L. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.
- M. Provide welded steel angle brackets for wall support of toilet vanities and for work surfaces fabricated in accordance with Section 05 5000 - Metal Fabrications.
- N. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.09 FACTORY FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.
- C. Finish work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1500.
- E. All other custom fabricated architectural woodwork: Plastic laminate factory applied to all exposed surfaces of cabinets when doors and drawers are closed including countertops. Interiors of cabinets and drawers are to be prefinished with white melamine.

2.10 BUILT-IN ADJUSTABLE SHELVING (ON HEAVY DUTY STANDARDS) for STORAGE ROOMS

- A. Where indicated on drawings, contractor shall provide and install built-in adjustable heavy-duty standards.
 - 1. Basis of Design: Knap & Vogt, Grand Rapids, MI; [www. www.knapandvogt.com](http://www.knapandvogt.com) or approved equal.
 - 2. The heavy-duty steel wall standard features a double slot design with 1.25" vertical slot adjustability, strength-enhancing ribs and a durable titanium powder coat finish.
 - 3. Vertical Adjustability: 1.25"
 - 4. Wall Standard Width: 1.06"
 - 5. Wall Standard Depth: .69"
 - 6. Typical Shelving Depth: 16 inches, Unless Otherwise Noted.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.
- C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinets and counter bases to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

- A. Adjust installed work. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

Division Seven

**THERMAL &
MOISTURE**

SECTION 07 2100**THERMAL INSULATION****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Board insulation at perimeter foundation walls and underside of floor slabs.
- B. Board Insulation at Above Grade Exterior Walls (where shown).
- C. Batt insulation in exterior wall and ceiling construction.
- D. Batt insulation for filling perimeter wall crevices.
- E. Sound batt for interior walls.
- F. Foamed-In-Place Insulation in exterior wall and ceiling construction, hollow metal frames, filling perimeter window and door shim spaces.
- G. Foamed-In-Place Masonry Insulation: Refer to Section 07 2140

1.02 RELATED REQUIREMENTS

- A. Section 06 1053 – Miscellaneous Rough Carpentry: Supporting construction for batt insulation.
- B. Section 07 2726 - Fluid-Applied Water & Air Membrane
- C. Section 07 5419 – Induction Welded PVC System
- D. Section 07 8400 - Firestopping.
- E. Section 09 2116 - Gypsum Board Assemblies, **for acoustic and sound attenuation batts.**
- F. Section 09 2400 - Portland Cement Stucco

1.03 REFERENCE STANDARDS

- A. ASTM C 552 - Standard Specification for Cellular Glass Thermal Insulation; Current edition.
- B. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; Current edition.
- C. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; Current edition.
- D. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; Current edition.
- E. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; Current edition.

- F. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; Current edition.
- G. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; Current edition.
- H. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; Current edition.
- I. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; Current edition.

1.04 SUBMITTALS

- A. See Section 01 3300 - for Submittal Procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.06 SEQUENCING

- A. Sequence work to ensure fireproofing and firestop materials are in place before beginning work of this section.

1.07 COORDINATION

- A. Coordinate the work with Section 09 2116, Gypsum Board Assemblies.

PART 2 - PRODUCTS

2.01 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene board.
- C. Insulation in Exterior Framed Walls: Expanded polystyrene board Insulation (EPS Board) or Batt insulation with integral vapor retarder (refer to drawings).
- D. Insulation in Interior Framed Walls: Batt insulation in sound rated interior stud walls, un-faced.
- E. Insulation Above Ceilings: Batt insulation with integral vapor retarder.
- F. Insulation for filling perimeter window & door shim spaces and crevices in exterior wall and roof.

- G. Insulation for filling roof curbs.
- H. Insulation for filling Hollow Metal frames: Spray Insulation.
- I. Foamed-In-Place Masonry Insulation: for thermal, sound and fire resistance values. Refer to Section 07 2140.

2.02 BATT INSULATION MATERIALS

- A. Batt Insulation: ASTM C 665; preformed batt glass fiber; friction fit, conforming to the following:
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E 136, except for facing, if any.
 - 4. Formaldehyde Content: Zero.
 - 5. Thermal Resistance: R-13 minimum for cavity walls as required for IECC 2018 compliance.
 - 6. Thickness: As required to achieve or exceed minimum R Values.
 - 7. Facing:
 - a. Aluminum foil, flame spread 25 rated; one side. For use in exterior stud walls, exposed ceilings, and above ceiling locations with taped seams at exterior stud walls for continuous vapor barrier.
 - 8. Acceptable Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. Owens Corning Corp: www.owenscorning.com.
 - 9. Substitutions: See Section 01 6000 - Product Requirements
- B. Acoustic Insulation: ASTM C 665; preformed glass fiber, friction fit type, un-faced. Thickness as required to achieve or exceed STC ratings as indicated on drawings.
 - 1. Product: CertainTeed "NoiseReducer" or equal approved by architect.
 - 2. Mineral Fiber Sound Attenuation Insulation (where indicated on drawings).
 - a. Manufacturers: Rockfon, Johns Manville, Owens-Corning

2.03 RIGID BOARD INSULATION MATERIALS

- A. Polyisocyanurate Board Insulation: Class A, closed cell polyisocyanurate (polyiso) foam core with a reinforced foil facer on one side and a white reinforced acrylic-coated aluminum facer on the other, complying with ASTM C 1289; Type I, Class 1 with water resistive barrier and vapor retarder used at above grade exterior walls/envelope as indicated on drawings.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
 - 3. Compressive Strength: 25 psi, when tested in accordance with ASTM D1621.
 - 4. Board Thickness: as indicated on drawings
 - 5. R-Value: R-5.7
 - 6. Moisture Vapor Transmission: <0.1 perms or less, when tested in accordance with ASTM E 96.

7. Water Absorption: 1% or less by volume, when tested in accordance with ASTM C 209.
 8. Board Edges: Square.
 9. Acceptable Manufacturers:
 - a. Atlas Roofing Corp.: wall.atlasrwi.com; EnergyShield Pro
 - b. Hunter Panels: www.hunterpanels.com; Product- Xci Foil (Class A)
 - c. GAF Materials Corporation: www.gaf.com.
 10. Substitutions: See Section 01 6000 - Product Requirements.
- B. Extruded Polystyrene Board Insulation (XPS Board): ASTM C 578; Type IV at perimeter foundation and under concrete slabs with the following characteristics:
1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E 84.
 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
 3. Board Size: minimum 24 x 96 inch.
 4. Board Thickness: As shown on drawings.
 5. Board Edges: Square.
 6. R-Value: 5 per inch
 6. Compressive Resistance: min 15 psi.
 7. Water Absorption: 0.3 percent by volume, maximum, when tested in accordance with ASTM D 2842.
 8. Acceptable Manufacturers:
 - a. Dow Chemical Co.; www.dow.com
 - b. Owens Corning Corp.; www.owenscorning.com
 - c. Kingspan Insulation LLC
 9. Substitutions: See Section 01 6000 – Product Requirements.
- C. Expanded Polystyrene Board Insulation (EPS Board): Rigid Cellular Polystyrene Thermal Insulation consisting of a closed-cell, expanded polystyrene with polymeric laminate facers - adhered metallic-reflective facer (outside face) [unless installed in assembly with dead air space, then reflective facer should face in] and white facer (back side) [unless installed in assembly with dead air space, then white facer should face out]. Shall conform to ASTM C578, Type IV used as Continuous Insulation at above grade exterior walls/envelope as indicated on drawings.
1. Basis of Design: R-Tech by Insulfoam, Carlisle Construction Materials, Inc., www.insulfoam.com.
 - a. Substitutions: See Section 01 6000 - Product Requirements.
 2. Physical Properties:
 - a. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
 - b. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
 - c. Compressive Strength: 25 psi, when tested in accordance with ASTM D1621.
 - d. Flexural Strength: 50 psi, when tested in accordance with ASTM C203.
 - e. Board Size: 4 ft x 8 ft, custom sizes available.
 - f. Board Thickness: as indicated on drawings.
 - g. Thermal Resistance: Minimum 4.4 per inch
 - h. Water Vapor Permeance: <1.1 perms, when tested in accordance with ASTM E 96.
 - i. Water Absorption: max 0.3% by volume, when tested in accordance with ASTM C 272.
 - j. Board Edges: Square.

2.04 FOAMED-IN-PLACE INSULATION

- A. Spray Polyurethane Foam Insulation (SPF): Fill wall and above ceiling crevices, exterior hollow metal frames, and interior hollow metal frames at sound rated walls. Basis-of-design: John Manville, JM Corbond III; 2.0 lbs/ft³ density, closed-cell polyurethane with NFPA 285 assembly approvals, and conforming to the following:
1. Other Manufacturers:
 - a. CertainTeed
 - b. BASF The Chemical Company; A resin Technology Division
 - c. Substitutions: See Section 01 6000 – Product Requirements
 2. Thermal Resistance (R-Value/inch): ASTM C518; 7.0 aged.
 3. Air Permeance @ 75 Pa (3.75"): ASTM E2178; 0.00055 (L/s)/m at 75 Pa
 4. Water Vapor Permeance: ASTM E96; 0.61 Perms @1.5", 1.1 Perms @ 1".
 5. Sound Transmission Coefficient: ASTM E2179; STC 36
 6. Closed cell content: ASTM D6226; >90%
 7. Compressive strength (1"): ASTM D1621; 36 psi.
 8. Bacterial or Fungal Growth: No growth; no material deterioration.
 9. Flame Spread and Smoke Developed Rating: ASTM E84; <25/<450.
 10. Surface Burning @ 4": ASTM E84; Class 1
 11. Air Infiltration: ASTM E283; 0.001 L/s/m² @ 75 Pa, 0.001 L/s/m² @ 300 Pa
 12. Core Density: ASTM D1622; 1.9 – 2.2 lbs/ft³
 13. Recycled Content of Side B: 11% (pre- and post-consumed)
- B. Foamed-In-Place Masonry Insulation: for thermal, sound and fire resistance values. Refer to Section 07 2140.

2.05 PROTECTION BOARD

- A. Extruded Polystyrene Board Insulation (XPS): ASTM C 578; Class A at perimeter foundation as shown on the plans. Basis-of-Design: Kingspan Insulation LLC, PB4, closed-cell extruded polystyrene with the following characteristics:
1. Flame Spread Index: 40 or less, when tested in accordance with ASTM E 84.
 2. Smoke Developed Index: 400 or less, when tested in accordance with ASTM E 84.
 3. Board Thickness: 1/4".
 4. Compressive Strength: min 16 psi, when tested in accordance with ASTM D 1621.
 5. Water Absorption: 0.6 percent by volume, max, when tested in accordance with ASTM C 272.
 6. Water Permeance: 0.6 perms by Desiccant Method, max, when tested in accordance with ASTM E 96.
 7. Must not contain any asphaltic materials.

2.06 ACCESSORIES

- A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.
- B. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate,

capable of securely and rigidly fastening insulation in place.

- C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Adhere a 6 inch wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
1. Tape seal joints.
 2. Extend sheet full height of joint.
- B. Apply adhesive to back of boards: Three continuous beads per board length. Full bed 1/8 inch thick.
- C. Install boards horizontally on foundation perimeter as shown on drawings.
1. Place boards to maximize adhesive contact.
 2. Install in running bond pattern.
 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- E. Extend boards over expansion joints, unbonded to foundation on one side of joint.

3.03 BOARD INSTALLATION UNDER CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.04 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall ceiling spaces without gaps or voids where shown on drawings. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services

within the plane of the insulation.

- E. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
- F. Mechanically fasten batts in place for STC rated partitions as required.
- G. Tape seal butt ends, lapped flanges, and tears or cuts in vapor membrane.
- H. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.
- I. Tape seal tears or cuts in vapor retarder.
- J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.05 FOAMED-IN-PLACE INSULATION INSTALLATION

- A. Follow manufacturers Installation Guide.

3.06 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 07 2100

SECTION 07 2413**EIFS REPAIR AND RE-FINISH****PART 1 - GENERAL****1.01 DESCRIPTION OF WORK - SUMMARY**

- A. The extent of the work includes repair, re-attachment, (if required) and re-finish of existing EIFS.
- B. This includes removal of damaged polystyrene, inspection of sheathing and replacement if necessary, re-install new Polystyrene, a new acrylic modified EIFS basecoat followed by a embedment of a new fiberglass mesh, followed by a new trowel applied textured acrylic based stucco finish over the entire project.
- C. Other areas of EIFS of sound EIFS shall be re-coated with a new acrylic based coating.
- D. Texture and color samples to be supplied to Owner/Architect or Owners representative showing manufacturers full range or to match existing.
- E. Notification: Contractor shall notify Architect for the inspection of the patchwork, prior to the application of the finish coat.

1.02 SUBMITTALS

- A. Submit a 2' x 2' panel color sample on durable substrate material to architect for color and texture selection. Submit manufacturer's technical information on products.

1.03 APPLICATOR QUALIFICATIONS

- A. Applicators must have a minimum of 5 years experience in the installation of stucco systems.
- B. Applicator should a Currently Listed Applicator of the system manufacturer.

1.04 JOB MOCK-UP (Including finish coat system)

- A. 4'x4' sample panel on same substrate as for project.
- B. Show color, texture and workmanship of finish work.
- C. Do not proceed with work until sample is reviewed and approved.
- D. Maintain sample panel on project site.

1.05 JOB CONDITIONS

- A. Environmental Requirements (Cold Weather):
 - 1. Do not use frozen materials in exterior wall finish.
 - 2. Do not apply exterior wall finish to frozen surfaces or surfaces containing frost, or when the forecast it to be less than 40 deg. F. within a 48 hour period following application.
- B. Environmental Requirements (Hot Weather):
 - 1. Do not apply exterior wall finish when ambient temperature is above 100 deg. F.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Polystyrene Foam: Meet requirements of ASTM C578 nominal 1lb minimum density polystyrene foam. Thickness as indicated on drawings or detailed in the scope of work.
- B. Skim coat/Basecoat Materials: Parex 121, acrylic modified cement based basecoat material for use as a basecoat for EIFS.
- C. Fiberglass Reinforcement: Parex standard Woven fiberglass mesh that is a minimum of 4.5oz has been treated for alkali resistance. Mesh must be stamped from manufacturer of EIFS assembly with name of manufacturer.
- D. Primer and Surface conditioner: *Tintable primer* – primer shall be tinted to the color of the proposed finish.
- E. Exterior Wall Finish Coat System: Acrylic based finish coat.
 - 1. Color & Texture to match approved samples in texture and color unless otherwise notified. Custom colors may be required.
- F. Exterior Wall Coating: For use on existing EIFS, acrylic based coating
- G. Water: Potable.
- G. Manufacturers:
 - 1. Basis of Design: Parex: 505-338-4433
 - 2. El Rey Stucco, Albuquerque, NM; 505-873-1180
 - 3. Sto Corp., Atlanta, GA; 800-221-2397
 - 4. TEIFS: 220 Burleson, San Antonio, TX; 800-358-4785
 - 5. Substitutions: Refer to Section 01 6300.
- H. Single Source responsibility: All stucco primer coats, patching materials, fiberglass mesh and finish coats to be from a single manufacturing source.

PART 3 – EXECUTION**3.01 SURFACE PREPARATION – Areas requiring repairs**

- A. Saw cut and remove any sections of EIFS that have been deemed to be damaged by impact; weed eaters etc... from the substrate.
- B. Inspect and replace damaged sheathings, utilizing fasteners long enough to penetrate substrate 1 inch and designed for substrate at a rate of one fastener per square foot, or one fastener every six inches vertically over studs.
- C. Install fasteners over all areas of EIFS if existing is delaminated from substrate, and these areas are deemed acceptable to for re-attachment - other wise remove and replace as described in section 3.01 A

- D. Install new pieces of polystyrene utilizing the same acrylic modified skim coat material as an adhesive. Ensure the new foam is installed tight, with no gaps at edges. If gaps are present, fill in with slivers of foam; do not fill with adhesive or basecoat.
- E. On existing and remaining EIFS, remove any loose flaking materials and prepare surface for new basecoat.
- F. Trowel apply the skim coat material over all surfaces of existing and new EIFS.
- G. While this material is still wet, embed the fiberglass mesh into surface of this skim coat.
- H. Overlap all edges of mesh a minimum of 2 inches at all seams etc., and remove all loose edges, wrinkles etc.
- I. Follow manufacturer's details for proper and approved installation of EIFS.

3.02 FINISH COAT APPLICATION: Over repaired areas and new basecoats

- A. Once all leveling/skim coats has been thoroughly cured and are dry, apply the primer coat by roller or brush or spray equipment at a coverage rate that is recommended by manufacturer. Allow to dry then trowel-apply the new acrylic stucco finish.
- B. Apply exterior walls finish coat to thickness recommended by manufacturer to achieve texture indicated, to match approved sample, using sufficient trowel pressure or spray velocity to bond finish coat to leveling coat.
- C. Apply in one pass, working from corner to corner and top to bottom, taking care to avoid staging marks, cold joints etc; these will not be acceptable, and will be required to be repaired.

3.03 FINISH COAT APPLICATION – No EIFS repairs needed

- A. If existing EIFS is in good condition and requires no repairs or patching then roll or spray apply a new acrylic based coating directly over properly prepared and clean existing EIFS.

3.04 ADJUST AND CLEAN

- A. Patching:
 - 1. Upon completion, point up exterior wall finish coat around trim and other locations where finish coat terminates or meets dissimilar materials.
 - 2. Cut out and replace defective or damaged exterior wall finish coat.
 - 3. Match pointing and patches to surrounding finish coat in form and texture.
- B. Curing:
 - 1. Wet cure any patchwork with clean potable water 2 times per day for 2-3 days minimum before application of any primer coats and subsequent finish coats.
 - 2. Do not Wet Cure the acrylic based elastomeric finish coats. Protect from wet weather and air cure only for 24 hours following application.
- C. Cleaning:
 - 1. Remove exterior wall finish and protective materials from perimeter trim and adjacent surfaces.

2. Remove all excess materials from the project site.

END OF SECTION

SECTION 07 8400**FIRESTOPPING****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Section 01 0100 - Execution and Closeout Requirements: Cutting and patching.
- B. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; current edition.
- B. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- C. FM 4991 - Approval of Firestop Contractors; Factory Mutual Research Corporation; current edition.
- D. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- E. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

- A. See Section 01 0100 - for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the specified fire ratings when tested in accordance with methods indicated.
 - 1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- C. Installer Qualifications:
 - 1. Company specializing in performing the work of this section, and

2. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors, and
3. With minimum 3 years documented experience installing work of this type.

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 - PRODUCTS

2.01 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 1. Fire Ratings: Use any system listed by UL or tested in accordance with ASTM E 814 that has F Rating equal to fire rating of penetrated assembly and T Rating Equal to F Rating and that meets all other specified requirements.

2.02 MATERIALS

- A. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
 1. Durability and Longevity: Permanent.
 2. Color: Red.
 3. Manufacturers:
 - a. A/D Fire Protection Systems Inc: www.adfire.com.
 - b. 3M Fire Protection Products: www.3m.com/firestop.
 - c. Hilti, Inc: www.us.hilti.com.
 - d. Specified Technologies, Inc: www.stifirestop.com.
 - e. Substitutions: See Section 01 6300 - Product Substitution Procedures.
- B. Foam Firestopping: Single component silicone foam compound; conforming to the following:
 1. Durability and Longevity: Permanent.
 2. Color: Red.
 3. Manufacturers:
 - a. 3M Fire Protection Products: www.3m.com/firestop.
 - b. Hilti, Inc: www.us.hilti.com.
 - c. Specified Technologies, Inc: www.stifirestop.com.
 - d. Substitutions: See Section 01 6300 - Product Substitution Procedures.
- C. Fibered Compound Firestopping: Formulated compound mixed with incombustible non-asbestos fibers; conforming to the following:
 1. Durability and Longevity: Permanent.
 2. Color: Red.
 3. Manufacturers:
 - a. A/D Fire Protection Systems Inc: www.adfire.com.
 - b. USG: www.usg.com.
 - c. Substitutions: See Section 01 6300 - Product Substitution Procedures.
- D. Reusable Firestopping: Removable intumescent compressible shapes, pillows, or blocks specifically tested in removable configuration; conforming to the following:

1. Durability and Longevity: Permanent.
2. Manufacturers:
 - a. Grace Construction Products: www.na.graceconstruction.com.
 - b. Hilti, Inc: www.us.hilti.com.
 - c. Nelson FireStop Products: www.nelsonfirestop.com.
 - d. Specified Technologies, Inc: www.stifirestop.com.
 - e. Substitutions: See Section 01 6300 - Product Substitution Procedures.
- E. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authority having jurisdiction.
- C. Install labeling required by code.

3.04 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9005**JOINT SEALANTS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Sealants and joint backing.
- B. Precompressed foam sealers.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping: Firestopping sealants.
- B. Section 08 8000 - Glazing: Glazing sealants and accessories.
- C. Section 09 2116 - Gypsum Board Assemblies: Acoustic sealant.

1.03 REFERENCE STANDARDS

- A. ASTM C 834 - Standard Specification for Latex Sealants; Current Edition.
- B. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications; 2008.
- C. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; Current Edition.
- D. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

- A. See Section 01 3300, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.
- C. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years' experience.

1.07 MOCK-UP

- A. Provide mock-up of sealant joints in conjunction with window under provisions of Section 01 4000, Quality Requirements.
- B. Construct mock-up with specified sealant types and with other components noted.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after

installation.

1.09 WARRANTY

- A. See Division 01 for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.01 SEALANTS

- A. Type A - General Purpose Exterior Sealant: Polyurethane; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single component.
 - 1. Color: Standard colors matching finished surfaces as selected by Architect.
 - 2. Applications: Use for:
 - a. Control, expansion, and soft joints in masonry.
 - b. Joints between concrete and other materials.
 - c. Joints between metal frames and other materials.
 - d. Other exterior joints for which no other sealant is indicated.
- B. Type B - Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
 - 1. Size as required to provide weathertight seal when installed.
 - 2. Applications: Use for:
 - a. Exterior wall expansion joints.
- C. Type C - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
 - 1. Applications: Use for:
 - a. Concealed sealant bead in sheet metal work.
- D. Type D - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component, paintable.
 - 1. Color: Standard colors matching finished surfaces as selected by Architect..
 - 2. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Joints between door and window frames and wall surfaces.
 - c. Other interior joints for which no other type of sealant is indicated.
- E. Type E - Bathtub/Tile Sealant: White silicone; ASTM C 920, Uses I, M and A; single component, mildew resistant.
 - 1. Applications: Use for:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between kitchen and bath countertops and wall surfaces.
- F. Type F - Acoustical Sealant: Butyl or acrylic sealant; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; single component, solvent release curing, non-skinning.
 - 1. Applications: Use for concealed locations only:
 - a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
- G. Type G - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C 920, Grade P, Class 25, Uses T, M and A; single component.

1. Color: Standard colors matching finished surfaces as selected by Architect..
 2. Applications: Use for:
 - a. Expansion joints in floors.
- H. Type H - Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C 920, Class 25, Uses T, I, M and A; single component.
1. Color: Gray.
 2. Applications: Use for: Joints in sidewalks and vehicular paving.

2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C 1193.
- C. Perform acoustical sealant application work in accordance with ASTM C 919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- E. Install bond breaker where joint backing is not used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- H. Tool joints concave.
- I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

END OF SECTION

Division Eight

OPENINGS

SECTION 08 1113**HOLLOW METAL DOORS AND FRAMES****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Non-fire-rated steel doors and frames.
- B. Steel frames for wood doors.
- C. Fire-rated steel doors and frames.
- D. Smoke-controlled steel doors and frames.
- E. Thermally insulated steel doors.
- F. Sound-rated steel doors and frames.
- G. Steel glazing frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 9000 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; current edition
- B. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; current edition
- C. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; current edition
- D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; current edition
- E. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; current edition
- F. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; current edition
- G. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; current edition
- H. DHI A115 Series - Specifications for Steel Doors and Frame Preparation for Hardware; Door and Hardware Institute; current edition (ANSI/DHI A115 Series).
- I. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; current edition
- J. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association; current edition
- K. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association; current edition
- L. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International

Conference of Building Officials; current edition

- M. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- N. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; current edition

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Samples: Submit two samples of metal, 2 x 2 inches in size showing factory finishes, colors, and surface texture.
- E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store in accordance with NAAMM HMMA 840.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Steel Doors and Frames:
 - 1. Assa Abloy: www.assaabloydss.com.
 - 2. Windsor Republic Doors: www.republicdoor.com.
 - 3. Steelcraft: www.steelcraft.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND FRAMES

- A. Requirements for All Doors and Frames:
 - 1. Accessibility: Comply with ANSI/ICC A117.1.
 - 2. Door Top Closures: Flush with top of faces and edges.
 - 3. Door Edge Profile: Smooth seamless.
 - 4. Door Texture: Smooth faces.
 - 5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
 7. Galvanizing for Units in Wet Areas: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.
 8. Finish: Factory primed, for field finishing.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

A. Exterior Doors:

1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 1, full flush, extra heavy duty.
2. Core: Polystyrene rigid insulation.
3. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A 653/A 653M, with manufacturer's standard coating thickness.
4. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C 1363 or C 236.
5. Weatherstripping: Separate, see Section 08 7100.
6. Finish: Factory primed, for field finishing.
7. Hardware Reinforcement:
 - a. Hinge: 7 gauge.
 - b. Lock: 16 gauge.
 - c. Closer: 14 gauge.

B. Interior Doors, Non-Fire-Rated:

1. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 1, full flush.
2. Core: Cardboard honeycomb.
3. Thickness: 1-3/4 inches.
4. Texture: Smooth faces.
5. Finish: Factory primed, for field finishing.

C. Interior Doors, Fire-Rated:

1. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 1, full flush.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
3. Fire Rating: As indicated on Door and Frame Schedule, with temperature rise ratings as required by code, tested in accordance with NFPA 252.
 - a. Provide units listed and labeled by UL.
 - b. Attach fire rating label to each fire rated unit.
4. Smoke and Draft Control Doors: In addition to required fire rating, comply with air leakage requirements of UBC Std 7-2, Part II; with "S" label; if necessary, provide additional gasketing or edge sealing.
5. Core: Mineral fiberboard.
6. Texture: Smooth faces.

7. Finish: Factory primed, for field finishing.
- D. Interior Smoke and Draft Control Doors: Same construction as fire-rated doors with indicated fire rating, plus:
 1. Gasketing: No added gasketing or seals allowed.
 2. Label: UL "S" label.
- E. Interior Doors, Sound-Rated:
 1. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 2, seamless.
 2. STC Rating of Assembled Door, Frame, and Seals: 35, calculated in accordance with ASTM E 413, tested in accordance with ASTM E 90 or ASTM E 1408.
 3. Core: Polystyrene foam.
 4. Sound Seals: Integral, concealed in door or frame.
- F. Panels: Same construction, performance, and finish as doors.

2.04 STEEL FRAMES

- A. General:
 1. Comply with the requirements of grade specified for corresponding door, except:
 - a. ANSI A250.8 Level 1 Doors: 16 gage frames.
 - b. ANSI A250.8 Level 3 Doors: 14 gage frames.
 - c. ANSI A250.8 Level 4 Doors: 12 gage frames.
 - d. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 18 gage
 - e. Frames for Sound-Rated Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage
 2. Finish: Same as for door.
 3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
 4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
 5. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.
 6. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.
- B. Exterior Door Frames: Face welded, seamless with joints filled.
 1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A 653/A 653M, with manufacturer's standard coating thickness.
 2. Weatherstripping: Separate, see Section 08 7100.
- C. Interior Door Frames, Non-Fire-Rated: Face welded type.
- D. Interior Door Frames, Fire-Rated: Face welded type.
 1. Fire Rating: Same as door, labeled.
- E. Sound-Rated Door Frames: Knock-down type.
- F. Mullions for Pairs of Doors: Removable type, of profile similar to jambs.
- G. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

- H. Transom Bars: Fixed, of profile same as jamb and head.

2.05 ACCESSORY MATERIALS

- A. Louvers: Roll formed steel with overlapping frame; factory-painted finish, color as selected; factory-installed.
1. In Fire-Rated Doors: UL-listed fusible link louver, same rating as door.
 2. Style: Standard straight slat blade.
 3. Fasteners: Concealed fasteners.
- B. Glazing: As specified in Section 08 8000, factory installed.
- C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- D. Astragals for Double Doors: Specified in Section 08 7100.
1. Exterior Doors: T-shaped.
 2. Fire-Rated Doors: Steel, shape as required to accomplish fire rating.
- E. **Grout for Exterior Door Frames**: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited. Apply a bituminous coating- asphalt emulsion or other high-build, water-resistant, resilient coating, prior to filling frames with grout. *(Only to be used in exterior doors in masonry or concrete walls).*
- E. **Foamed-In-Place Insulation for Interior Door Frames**: Fill hollow metal door frames with foamed-in-place insulation, see Section 07 2100. *(Refer to drawings).*
- F. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.
- G. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 FINISH MATERIALS

- A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Prepare existing frames for new doors and hardware.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
- B. Coat inside of other frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION

- A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.
- B. In addition, install fire rated units in accordance with NFPA 80.

- C. Coordinate frame anchor placement with wall construction.
- D. Grout Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.
 - 1. Apply a bituminous coating- asphalt emulsion or other high-build, water-resistant, resilient coating, prior to filling frames with grout.
 - 2. Brace frames so that pressure of grout before setting will not deform frames.
- E. Coordinate installation of hardware.
- F. Coordinate installation of glazing.
- G. Coordinate installation of electrical connections to electrical hardware items.
- H. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: As specified in ANSI A250.8.
- B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.
- B. Adjust sound control doors so that seals are fully engaged when door is closed.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 1416**FLUSH WOOD DOORS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Flush wood doors; flush configuration; fire rated, and non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 05 4000 - Cold Form Metal Framing
- B. Section 06 1000 - Rough Carpentry
- C. Section 08 1113 - Hollow Metal Doors and Frames.
- D. Section 08 7100 - Door Hardware.
- E. Section 08 8000 - Glazing.
- F. Section 09 2116 - Gypsum Board Assemblies.
- G. Section 09 9000 - Painting and Coating.

1.03 REFERENCE STANDARDS

- A. ASTM E 413 - Classification for Rating Sound Insulation; Current Edition.
- B. ASTM E 1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; Current Edition.
- C. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; Current Edition.
- D. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association; 2007.
- E. WDMA I.S.1-A -Architectural Wood Flush Doors; Window/ Door Manufacturers Association; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3300 - for submittal procedures.
- B. Product Data: For each type of door indicated.
 - 1. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
 - 2. Include data indicating that the product does not contain urea-formaldehyde resins.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire-protection ratings for fire-rated doors.

- D. Samples for Initial Selection: For factory-finished doors.
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of two samples showing typical range of color and grain to be expected in the finished work.
 - a. Provide samples for each species of veneer and solid lumber required.
 - b. Finish veneer-faced door samples with same materials proposed for factory-finished doors.
 - 2. Frames for light openings, 6 inches long, for each material, type, and finish required.
- E. Warranty: Sample of special warranty.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.05 QUALITY ASSURANCE

- A. Maintain a copy of the specified door quality standard on site for review.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Installed Fire Rated Assembly: Conform to NFPA 80 for fire rated class as indicated.
- D. Forest Certification: Where structural composite lumber core doors are required, provide doors made with wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Graham Wood Doors: www.grahamdoors.com.
 - 2. Eggers Industries: www.eggersindustries.com.
 - 3. Haley Brothers: www.haleybros.com.
 - 4. Marshfield Door Systems, Inc: www.marshfielddoors.com.
 - 5. Substitutions: See Section 01 6300 - Product Substitution Requirements.

2.02 DOORS

- A. All Doors: See drawings for locations and additional requirements.
 - 1. Quality Level: Custom Grade, Extra Heavy Duty performance with WDMA I.S.1-A.

2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
1. Provide solid core doors at all locations.
 2. Wood veneer facing with factory transparent finish where indicated on drawings.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.
- B. Fire Rated Doors: Mineral core, Type FD, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. Wood Veneer Facing for Transparent Finish: Veneer grade as specified above, plain sliced, book veneer match, running assembly match; unless otherwise indicated.
1. Vertical Edges: Any option allowed by quality standard for grade.
 2. Pairs: Match each pair set, match pairs within 10 feet of each other when doors are closed.
 3. Color: Refer to Finish Schedule for wood veneer type and stain color.

2.05 ACCESSORIES

- A. Glazing: As specified in Section 08 8000 - glazing. Refer to Door and Window Schedule.
3. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
 - a. Wood glazing stops with metal clips for fire rated doors.
- B. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, removable, only at exterior doors.
- C. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors, removable.
- D. All interior and exterior doors shall have a kick plate along the bottom 12" of the push side of the door.

2.06 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material indicated and coordinate openings with light kits and glazing for compatibility.
- F. Provide edge clearances in accordance with AWI Quality Standards Illustrated Section 1700.

2.07 FACTORY FINISHING - WOOD VENEER DOORS

- A. Factory finish doors in accordance with specified quality standard:

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Install vision lites with integral blind system per manufacturer's instructions for operable systems.
 - 1. Install controller per instructions and coordinated with architect. Controller shall be no higher than 48 inches above floor.
- D. Use machine tools to cut or drill for hardware.
- E. Coordinate installation of doors with installation of frames and hardware.
- F. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Conform to specified quality standard for fit, clearance tolerances, maximum diagonal distortion.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.05 SCHEDULE - See Drawings

END OF SECTION

SECTION 08 3100**ACCESS DOORS AND PANELS****PART 1 – GENERAL****1.01 SUMMARY**

- A. Access doors and frame units, fire-rated and non-rated, in wall and in ceiling locations.

1.02 RELATED REQUIREMENTS

- A. Section 09 2116 – Gypsum Board Assemblies: Openings in metal stud and gypsum board partitions and suspended gypsum board ceilings.
- B. Section 09 9000 – Painting and Coating.
- C. Section 22 0500 – General Plumbing Requirements.
- D. Section 23 0500 – General Mechanical Requirements.
- E. Section 25 0500 – General Electrical Requirements.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's Installation Instructions: Indicate installation requirements.
- C. Project Record Documents: Record actual locations of all access units.

PART 2 – PRODUCTS**2.01 MANUFACTURERS**

- A. Acudor Products Inc: www.acudor.com.
- B. Karp Associates, Inc: www.karpinc.com.
- C. Milcor Inc: www.milcorinc.com.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESS DOORS AND PANELS

- A. All Units: Factory fabricated fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units to be installed in.
- B. Fire Rated Assemblies: Equivalent to the fire rated assembly in which they are to be installed.

2.03 WALL AND CEILING UNITS

- A. Door and Frame Units: Formed steel. Frames and flanges: 0.058 inch steel.
 - 1. Hardware: Hinge: 175-degree stainless steel piano hinge with removable pin.
 - 2. Lock: Screw driver slot for quarter turn cam lock.
- B. Non-Fire Rated Door and Frame Units in Walls and Ceiling. Prime coat baked enamel finish.
 - 1. Door Material: Steel 16-gauge door; 16-gauge frame.
 - 2. Door: Flash to frame; rounded safety corners. Latch: Steel screw driver operator cam latch.
 - 3. Frame: One piece outer frame welded to mounting frame. Hinge: Continuous concealed.
- C. Fire Rated Door and Frame Units in Walls and Ceilings:
 - 1. Door Material: Steel 16-gauge door; 16 gauge frame. Prime coat baked enamel finish.
 - 2. Door: Flash to frame with reinforcing edges. Fire Rating: UL- 1-1/2 hour "B" label.
 - 3. Frame: Flanged, 1" wide. Hinge: Concealed. Latch: Universal self-latching bolt; flush key.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Verify rough openings are correctly sized and located. Install in accordance with manufacturer's instructions with frames plumb and level in openings and secured rigidly in place. Position units with convenient access for concealed work areas.

END OF SECTION

SECTION 08 4113**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS****PART 1 – GENERAL****1.01 SUMMARY**

- A. Related Documents: Conditions of the Contract, Division 1 – General Requirements, and Drawings apply to Work of this Section.
- B. Section Includes:
 - 1. Storefront framing, complete with reinforcing, fasteners, anchors, and attachment devices.
 - 2. Storefront doors, complete with reinforcing for hardware requirements.
 - 3. Accessories necessary to complete the work.
- C. Related Sections:
 - 1. Section 01 4000 – Quality Requirements
 - 2. Section 05 5000 – Metal Fabrications.
 - 3. Section 07 9200 – Joint Sealants
 - 4. Section 08 7100 – Door Hardware
 - 5. Section 08 8000 – Glazing

1.02 REFERENCES

- A. Aluminum Association (AA):
 - 1. DAF-45 Designation System for Aluminum Finishes.
- B. American Architectural Manufacturers Association (AAMA):
 - 1. 501 Methods of Test for Exterior Walls.
 - 2. 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of installed Storefront, Curtain Walls, and Sloped Glazing Systems.
 - 3. 611 Voluntary Specification for Anodized Architectural Aluminum
 - 4. 701 Voluntary Specifications for Pile Weather-stripping and Replaceable Fenestration Weather seals.
 - 5. 1503 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 - 6. CW-10 Care and handling of Architectural Aluminum from Shop to Site.
 - 7. SFM-1 Aluminum Storefront and Entrance Manual.
- C. American Society for Testing and Materials (ASTM)
 - 1. B209 Aluminum and Aluminum – Alloy Sheet and Plate
 - 2. B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

3. E283 Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors.
4. E330 Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
5. E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

D. Glass Association of North America (GANA):

1. Glazing Manual.

1.03 SYSTEM REQUIREMENTS

A. Design Requirements

1. Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this project. Failure includes the following:
 - a. Air infiltration and water penetration exceeding specified limits.
 - b. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.
2. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal of structural movement, glazing, anchorage, or moisture disposal.
3. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
4. Provide concealed fastening whenever possible.
5. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
6. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening, or fracturing connection between units and building structure or between units themselves.
7. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
8. Provide for expansion and contraction due to structural movement without detriment to appearance or performance.
9. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180 degrees F without causing buckling, stress on glass, failure of
10. joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.

B. Performance Requirements:

1. Wind loads: provide framing systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.
2. Air infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.

3. Water infiltration: No uncontrolled leakage when tested in accordance with ASTM E331 at test pressure of 8 psf as defined in AAMA 501.
 4. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E330.
 5. Seismic Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7, "Minimum Design Loads for Building and Other Structures," and "Earthquake Loads," whichever are more stringent.
 6. Dead Loads: Provide entrance and storefront system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.
 - a. Provide a minimum 1/8 inch clearance between members and top of glazing or other fixed part immediately below.
 - b. Provide a minimum 1/16 inch clearance between members and doors.
 7. Deflection: Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures for spans up to and including 13'-6" shall be limited to $[1/175]$ of its clear span and for spans greater than 13'-6" deflection shall be limited to $[1/240]$ of its clear span + 1/4", except that maximum deflection of members supporting plaster surfaces shall not exceed 1/360 of its span.
 8. Average Thermal Conductance: Provide storefront systems with average U-values of not more than 0.63 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.1.
 9. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 45.
- C. Testing Requirements: provide components that have been previously tested by an independent testing laboratory.

1.04 SUBMITTALS

- A. General: Submit in accordance with Section 01 30 00 – Submittal Procedures.
- B. Product Data:
1. Submit manufacturer's descriptive literature and product specifications.
 2. Include information for factory finishes, hardware, accessories, and other required components.
 3. Include color charts for finish indicating manufacturer's standard colors available for selection.
- C. LEED Submittals: (if required)
1. Product Data for Credit MR 4.1: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
 2. Product Data for Credit EQ 4.1: For adhesives and sealants used inside the weatherproofing system, including printed statement of VOC content.
- D. Shop Drawings:
1. Submit shop drawings covering fabrication, installation and finish of specified systems.

2. Include following:
 - a. Fully dimensioned elevation drawing with details coordination keys.
 - b. Locations of exposed fasteners and joints.
 3. Provide detailed drawings of:
 - a. Composite members.
 - b. Joint connections for framing systems and for entrance doors.
 - c. Anchorage.
 - d. System reinforcements
 - e. System expansion and contraction provisions.
 - f. Glazing methods and accessories.
 - g. Internal sealant requirements.
 - h. Thermal improvements.
 4. Schedule of finishes
- E. Samples:
1. Submit manufacturer's standard samples indicating quality of finish.
 2. Where normal texture or color variations are expected, include additional samples illustrating
 3. range of variation.
- F. Test Reports:
1. Standard systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting. Include other supportive data as necessary.
- G. Qualification Data:
1. Submit certification from storefront manufacturer verifying installer's qualifications, and verifying that installer has the required five years minimum experience installing aluminum-framed entrance and storefront systems.
- H. Manufacturer's instructions: Submit manufacturer's printed installation instructions.
- I. Sealant Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating that the materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants; include joint sealant manufacturer's written interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility:
1. To ensure quality of appearance and performance, obtain materials for systems from either a single manufacturer or from manufacturer approved by systems manufacturer.
- B. Installer Qualifications: Certified in writing by system manufacturer as qualified for installation of specified systems.
1. Engineering Responsibility: Installer shall assume engineering responsibility and shall prepare data for entrance and storefront systems, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this project.
- C. Perform work in accordance with AAMA SFM-1 and manufacturer's written instructions.

- D. Manufacturer's representatives shall inspect final installation and provide a written report of acceptance to be included with storefront installer's closeout documents.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Comply with requirements of Sections 01 60 00 – Product Requirements
- B. Protect finished surfaces as necessary to prevent damage.
- C. Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sun.
- D. Do not leave coating residue on any surfaces.
- E. Replace damaged units.

1.07 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract.
- B. Provide written warranties in form acceptable to Owner signed by manufacturer, installer and General Contractor, as follows:
 - 1. Manufacturer's Warranty shall cover the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Defective materials, defective manufacture, or glass breakage due to defective design.
 - d. Failure of operating components to function normally.
 - e. Agreement to replace components which fail within 2 years from date of Substantial Completion.
 - 2. Installer's Warranty shall cover the following:
 - a. All items listed above under Manufacturer's Warranty.
 - b. Water leakage through fixed glazing and frame areas.
 - c. Defective installation workmanship, or glass breakage due to defective installation.
 - 3. General Contractor's Warranty shall cover the following:
 - a. Items a) through d) listed above under Manufacturer's Warranty.
 - b. Items f) through h) listed above under Installer's Warranty.
 - c. Agreement to provide materials and labor for replacement of defective components that fail within 2 years from date of Substantial Completion.
- C. Warranty response time: The aluminum storefront installer shall respond to requests for warranty repairs within 24 hours of receiving notice that such repairs are required.

PART 2 – PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

- A. Subject to compliance with requirements indicated, provide products by one of the following:
 - 1. Oldcastle Building Envelope.

2. Kawneer Company.
 3. Tubelite, Inc.
- B. No Substitutions.
- C. Acceptable storefront framing system for exterior use: (2"x 4 1/2" center glazed storefront):
1. Oldcastle Series 3000 Thermal Multiplane.
 2. Kawneer VG451T.
 3. Tubelite T14000
 4. Storefront framing system must be conventionally center glazed. Offset, or structural, glazing systems are not acceptable.
- D. Acceptable storefront framing system for interior use: (1-3/4"x 4-1/2" center glazed storefront) (Interior storefront doors and framing systems shall have the same gage aluminum and same structural construction as the exterior systems.):
1. Oldcastle Series 2000 framing.
 2. Kawneer Trifab 450.
 3. Tubelite E4500 series.
- E. Acceptable entrance door systems:
1. Door construction: 2 inch overall thickness with minimum .188 inch thick extruded aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 2. Door design: Shall be Wide Stile with smooth surface, minimum 10" high, bottom rails and at least one intermediate mid-panel. Door top rail to be a minimum of 5" high for closer mounting. Mid-panel height to be coordinated with hardware requirements, specifically to be centered on exit devices, regardless of the dimensions shown on the drawings. Doors with full glass lites are not acceptable. Door height to be no taller than 7'-0".
 3. Door labeling: Doors shall have permanent labels on the hinge edge surface identifying the door manufacturer.
 4. Glazing stops and gaskets: Shall be snap-on, extruded aluminum stops and preformed gaskets. Provide non-removable glass stop to exterior of door.
 5. Door stops: Shall be integral to the door frame extrusion. Door stop must be a minimum of 1/2" high x 1" deep. Fin type, snap in, or screw applied door stops are not acceptable. Door stops must provide uninterrupted weathering the entire length of the stop.
 6. Reinforcing and Anchoring: Doors and door frames are to be properly reinforced with 1/4" min. thickness internal steel back up material sufficient for attaching hardware as specified. In addition to steel reinforcing, door frame extrusion is to be non-thermally broken with 3/16" minimum wall thickness for hardware mounting with integral door stops as part of the extrusion. Types of hardware include, but are not limited to: surface mounted door closers, handicap operators, hold open arms, lock or latch strikes, removable mullions, hinges or pivots, and any other hardware as called out in the finish hardware section of the specifications. Hardware must be anchored to the main sections of the storefront door or door frame and no hardware will be anchored into any snap on extrusion.
 7. Hardware reinforcement for hinging to run continuous the full length of the door jamb. Hardware reinforcement for lock strikes and closers to be a minimum of 16" in length and located within the door and frame to accommodate the specified hardware.

8. Door frames: Only aluminum, wood, or fiberglass doors are to be installed in aluminum door frames. Do not install hollow metal doors in aluminum door frames.
9. Door frame, and reinforcement requirements, described above, apply to both interior and exterior aluminum door frames. Door frames must be able to accommodate doors that are 1-3/4" or 2" thick as called for on the drawings, or in the specifications.

2.02 FRAMING MATERIALS AND ACCESSORIES

- A. Aluminum:
 1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommend by manufacturer appropriate for specified finish.
- B. Internal Reinforcing:
 1. ASTM A36 for carbon steel.
 2. Shapes and sizes to suit installation.
 3. Steel components factory coated with alkyd type zinc chromate primer complying with FS TT-P-645.
- C. Anchorage Devices:
 1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.
 2. Hot-dip galvanized steel assemblies after fabrication; comply with ASTM A123, 2.0 ounce minimum coating.
- D. Fasteners:
 1. Aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with items being fastened.
 2. Provide concealed fasteners wherever possible.
 3. For exposed locations, provide Phillips flathead screws with finish matching item fastened.
 4. For concealed locations, provide manufacturer's standard fasteners.
- E. Expansion Anchor Devices: lead-shield or toothed-steel, drilled-in, expansion bolt anchors.
- F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645
- G. Touch-Up primer for galvanized components: zinc oxide conforming with FS TT-P-641
- H. Glazing Gaskets:
 1. Compression type design, replaceable, molded or extruded, of neoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).
 2. Profile and hardness as required to maintain uniform pressure for watertight seal.
- I. Weatherproofing:
 1. Wool pile conforming to AAMA 701.2.
- J. Internal Sealants and Baffles.
- K. Adhesives and Sealants: Provide adhesives and sealants inside the weatherproofing system containing VOC content of 250g/L, or less when calculated according to 40CFR 59, Subpart D (EPA Method 24).

2.03 GLASS AND GLAZING

- A. Refer to Section 08 81 00 – Glass Glazing.

2.04 FABRICATION

- A. Coordination of Fabrication
 - 1. Check actual frame or door openings required in construction work by accurate field measurements before fabrications.
 - 2. Fabricate units to withstand loads that will be applied when system is in place.
- B. General
 - 1. Conceal fasteners wherever possible.
 - 2. Reinforce work as necessary for performance requirements, and for support to structure.
 - 3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or preformed separators, which will prevent contact and corrosion.
 - 4. Comply with Section 08 8000 – Glass Glazing, for glazing requirements.
- C. Aluminum Framing
 - 1. Provide members of size, shape and profile indicated, designed to provide for glazing from the exterior at the first level or ground floor level. Glaze system from the interior at any locations above the first level.
 - 2. Provide manufacturer's standard thermal break between exterior and interior aluminum surfaces.
 - 3. Fabricate frame assemblies with joints straight and tight fitting. Doors and door frames are to be shop fabricated. Field fabrication of frames will not be allowed.
 - 4. Reinforce internally with structural members as necessary to support design loads.
 - 5. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
 - 6. Seal horizontals and direct moisture accumulation to exterior.
 - 7. Provide flashings and other materials used internally or externally that are corrosive resistant, not-straining, non-bleeding and compatible with adjoining materials.
 - 8. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without detrimental to appearance or performance.
 - 9. Provide storefront manufacturer's standard high performance extruded sill flashing at all storefront framing.
 - 10. Fabricate door frames to accept specified hardware without compromising the weather seal around doors.
- D. Welding
 - 1. Comply with recommendations of the American Welding Society.
 - 2. Use recommended electrodes and method to avoid distortion and discoloration.
 - 3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.
- E. Flashings: Form from sheet aluminum with same finish as extruded sections, unless otherwise noted. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

2.05 FINISHES

- A. Clear Anodized:
 - 1. Conforming to AA-M12C22A31 and AAMA 611.
 - 2. Architectural Class II, etched, medium matte, clear anodic coating, 0.4 mil minimum thickness
- *OR*
- B. Color Anodized
 - 1. Conforming to AAMA 601, and either AA-M12C22A44 or AAM10C21A44.
 - 2. Architectural Class [1], etched, medium matte, [black] [dark bronze] [medium bronze] [light bronze] colored anodic coating, [0.7] mil minimum thickness.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine conditions and proceed with Work in accordance with Section 01 40 00 – Quality Requirements.

3.02 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight.
- B. Erection Tolerances:
 - 1. Limit variations from plumb and level:
 - a. 1/8 inch in 10'-0" vertically.
 - b. 1/8 inch in 20'-0" horizontally.
 - 2. Limit variations from theoretical locations; 1/4 inch for any member at any location.
 - 3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch from flush surfaces not more than 2 inches apart or out-of-flush by more than 1/4 inch.
- C. Install doors and hardware in accordance with manufacturer's printed instructions.
- D. Set units plum, level and true to line, without warp or rack of frame.
- E. Anchor securely in place, allowing for required movement, including expansion and contraction.
- F. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or preformed separators to prevent contact with masonry of concrete.
- G. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weather-tight construction.
- H. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07 92 00 – Joint Sealants.
- I. Glazing: refer to requirements of Section 08 8000 – Glass Glazing.

3.03 ADJUSTING

- A. Test door operating function. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

3.04 CLEANING

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
- B. Clean metal surfaces exercising care to avoid damage.

3.05 PROTECTION

- A. Provide final protection and maintain conditions, acceptable to manufacturer and installer, that ensure entrance and storefront systems are without damage or deterioration at Substantial Completion.

END OF SECTION

SECTION 08 6223**TUBULAR SKYLIGHTS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Tubular skylights, 21" in diameter consisting of skylight dome, reflective tube, and diffuser assembly; configuration and tube lengths as indicated on the drawings.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealers

1.03 REFERENCE STANDARDS

- A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.
- B. ASTM D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2006.
- C. ASTM D 1929 - Standard Test Method for Determining Ignition Temperature of Plastics; current edition.
- D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- F. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; current edition
- G. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; current edition

1.04 SUBMITTALS

- A. See Section 01 3300 - for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions, recommendations, and installation methods.
 - 2. Storage and handling requirements and recommendations.
- C. Shop Drawings.
- D. Test Reports: Independent testing agency reports verifying compliance with specified performance requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engaged in manufacture of tubular skylights in for 10 years.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions within limits recommended by manufacturer for optimum results. Do not install products under conditions outside manufacturer's absolute limits.

1.08 WARRANTY

- A. Skylights: Manufacturer's standard warranty for 10 years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Solatube, Inc.; www.solatube.com
- B. Velux Skylights: www.velux.com
- C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TUBULAR SKYLIGHTS

- A. Tubular Skylight: roof-mounted skylight dome and curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces.
1. Basis-Of-Design:
- a. SolaMaster Series- Model: S750 DS-O-DAIB-FC, Open Ceiling, 21" manufactured by Solatube.
- Dome: Acrylic outer dome + acrylic inner dome
Dome Options: Security Bar
Flashings: Curb Cap
Flashing Options: As required for complete installation
Extension Tubes: As required for complete installation (no angles)
Diffuser Lens: Prismatic Diffuser
Imperial Measurements
- B. Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.
1. All components made and assembled by one manufacturer in America.
2. Design with the following loads without breakage to any parts, tested with ASTM E 330:
- a. Positive and negative wind load of 10 psf. No permanent deflection in excess of 0.2 percent of span. Live load of 100 psf on dome with safety factor of 3.
4. Air Infiltration: Maximum 0.10 cfm per foot of crack length at 6.24 psf pressure differential when tested with ASTM E 283.
5. Water Resistance: No uncontrolled water leakage at 6.24 psf pressure differential with water rate of 5 gallons/h/sf, when tested with ASTM E 331.
6. Thermal Movement: Fabricate to allow for temperature differential from minus 30 to 180° F.
7. Flammability: Non-metal parts complying with the following:
- a. Roof-Top Components: Class B in accordance with ASTM E 108 or UL 790.
- b. Self-Ignition: Greater than 650° F when tested in accordance with ASTM D 1929.
- c. Smoke Developed Index: Maximum of 450, tested with ASTM E 84.
- d. Combustibility - Light Transmitting Parts: (Class CC-1), tested with ASTM D 635.
- e. Combustibility - Non-Light Transmitting Parts (Class CC-2), tested with ASTM D 635
- C. Roof Assemblies: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.

1. Glazing: Polycarbonate plastic, 0.125 inch minimum thickness.
 2. Metal Roof Flashing: Attached to top of base section; to prevent thermal bridging between base flashing & tubing and channel condensed moisture out of tubing; weather seal of medium density pile weather stripping.
- D. Reflective Tube: ASTM B 209 aluminum sheet, thickness between 0.015 inch and 0.020 inch;
1. Spectralight Infinity Extension tube by Solatube.
- E. Diffuser Assemblies: Supporting light transmitting surface at bottom termination of tube, with compression seal to minimize condensation and bug or dirt infiltration.
- F. Daylight dimmer and daylight switch shall be included.
1. One switch is required per set of synchronously controlled dimmers.

2.03 ACCESSORIES

- A. Fasteners: non-magnetic steel, non-corrosive metal of type recommended by manufacturer. Using Joint Sealant: As specified in Section 07 9500.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Do not begin installation until substrates are properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- B. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for the best results for the substrate in the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions. Seal joints exposed to weather using procedures specified in Section 07 9005. Conduct field test for water tightness; conduct water test in presence of Architect. Correct defective work and re-test until satisfactory.

END OF SECTION

SECTION 08 7100**DOOR HARDWARE****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes:
 - 1. Mechanical door hardware for:
 - a. Swinging doors.
 - b. Sliding doors.
 - c. Gates.
 - 2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:
 - 1. Windows
 - 2. Cabinets (casework), including locks in cabinets
 - 3. Signage
 - 4. Toilet accessories
 - 5. Overhead doors
- C. Related Sections:
 - 1. Division 01 Section "Alternates" for alternates affecting this section.
 - 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
 - 3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.

1.03 REFERENCES

- A. Fire/Life Safety
 - 1. NFPA - National Fire Protection Association
 - a. NFPA 70 – National Electric Code
 - b. NFPA 80 - Standard for Fire Doors and Fire Windows
 - c. NFPA 101 - Life Safety Code
 - d. NFPA 105 - Smoke and Draft Control Door Assemblies

B. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

C. Accessibility

1. ADA - Americans with Disabilities Act.
2. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

D. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

E. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI A156.31 - Standards for Hardware and Specialties

1.04 SUBMITTALS**A. General:**

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.
 - b. Type, style, function, size, and finish of each hardware item.
 - c. Name and manufacturer of each item.
 - d. Fastenings and other pertinent information.
 - e. Location of each hardware set cross-referenced to indications on Drawings.
 - f. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - g. Mounting locations for hardware.
 - h. Door and frame sizes and materials.
 - i. Name and phone number for local manufacturer's representative for each product.

3. Key Schedule:

- a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
 - b. Use ANSI A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete biting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1) Forward biting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
4. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Closeout Submittals:

1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 - e. Final approved hardware schedule, edited to reflect conditions as-installed.
 - f. Final keying schedule
 - g. Copies of floor plans with keying nomenclature
 - h. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
 - a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.
 2. Where products indicate "acceptable substitute" or "acceptable manufacturer", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity,

type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 2. Can provide installation and technical data to Architect and other related subcontractors.
 3. Can inspect and verify components are in working order upon completion of installation.
 4. Capable of producing wiring diagrams.
 5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- H. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
 2. Maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.

- b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
 - 4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.
- J. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
- 1. Attendees: Owner, Contractor, Architect, Installer, and Supplier's Architectural Hardware Consultant.
 - 2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.
- K. Coordination Conferences:
- 1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
 - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 - 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
 - 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 - 2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
 - 1. Promptly replace products damaged during shipping.

2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

1.07 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Direct shipments not permitted.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
 - a. Closers:
 - 1) Mechanical: 30 years.
 - b. Exit Devices:
 - 1) Mechanical: 5 years.
 - c. Locksets:
 - 1) Mechanical: 10 years.
 2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

- A. Maintenance Tools:
 1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Approval of manufacturers other than those listed shall be in accordance with QUALITY ASSURANCE article, herein.
- B. Approval of products from manufacturers indicated as "Acceptable Manufacturer" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

Item	Scheduled Manufacturer	Acceptable Manufacturer
Hinges	Ives (IVE)	McKinney, Bommer, Stanley
Flush Bolts & Coordinators	Ives (IVE)	Burns, Rockwood
Locksets & Deadlocks	Schlage (SCH)	Sargent, Corbin Russwin
Exit Devices & Mullions	Von Duprin (VON)	Sargent, Corbin Russwin
Cylinders & Keying	Schlage (SCH)	Owner's Standard
Door Closers	LCN (LCN)	Norton, Sargent
Auto Operators	LCN (LCN)	Horton, Besam
Electric Strikes	Von Duprin (VON)	HES, Folger Adam
Power Supplies	Schlage Electronics (SCE)	Sargent, Folger Adam
Door Trim	Ives (IVE)	Burns, Rockwood, Trimco
Protection Plates	Ives (IVE)	Burns, Rockwood, Trimco
Overhead Stops	Glynn-Johnson (GLY)	Rixson, Sargent, ABH
Stops & Holders	Ives (IVE)	Burns, Rockwood, Trimco
Thresholds & Weatherstrip	Zero (ZER)	Pemko, National Guard, Reese
Silencers	Ives (IVE)	Burns, Rockwood
Key Cabinets	Telkee (TEL)	HPC, Lund

- C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

A. Provide five-knuckle, ball bearing hinges.

1. Manufacturers and Products:
 - a. Scheduled Manufacturer and Product: Ives 5BB Series.

- b. Acceptable Manufacturers and Products: McKinney T4B Series, Bommer BB5000 series, Stanley FBB Series.

B. Requirements:

1. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight steel, 4-1/2 inches (114 mm) high as listed in hdw sets
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high as listed in hdw sets
2. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, steel, 5 inches (127 mm) high as listed in hdw sets
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high as listed in hdw sets
3. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze steel, 5 inches (127 mm) high as listed in hdw sets
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high as listed in hdw sets
4. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
5. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
8. Doors 36 inches (914 mm) wide or less furnish hinges 4 1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.

2.04 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.05 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND Series
2. Acceptable Manufacturers: Sargent 11-Line, Corbin Russwin CL3100 Series

B. Requirements:

1. Provide cylindrical locks conforming to the following standards and requirements:
 - a. ANSI/BHMA A156.2 Series 4000, Grade 1.
 - b. UL 10C for 4'-0" x 10'-0" 3-hour fire door.
 - c. Florida Building Code (ASTM E330, E1886, E1996) and Miami Dade (TAS 201, 202, 203) requirements for hurricanes.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
 - a. Abusive Locked Lever Torque Test – minimum 3,000 inch-pounds without gaining access
 - b. Cycle life - tested to minimum 10 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers.
4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Provide electrified options as scheduled in the hardware sets.
9. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.
 - a. Lever Design: Schlage Rhodes.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.06 EXIT DEVICES

A. Manufacturers:

1. Scheduled Manufacturer: Von Duprin 99 Series
2. Acceptable Manufacturers: Sargent 19-43-GL-80 Series, Corbin Russwin ED5000 Series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.
4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide end-cap with two-point attachment to door. Match exit device finish,

- stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.
5. Provide rim devices with a dual cylinder or inside thumb turn cylinder option with a visual security indicator that identifies the trims locked/unlocked status of the door from the inside of the room. Indicator in unlocked state presents a 1/2 inch x 1/2 inch white metal flag with black icon at top of device head. Indicator in locked state has no flag present. Provide rim devices without the dual cylinder or inside thumb turn cylinder option capable of being retrofitted with the visual security indicator.
 6. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.
 - a. Projection: maximum 1-5/8 inch (41mm) in the neutral position and 1-1/4 inch (32mm) when fully depressed.
 - b. Endcaps: die-cast aluminum with sloped design.
 - c. Fasteners: include for surface mounting to recessed door prep and through bolting to device trim.
 - d. Concealed Vertical Rod Devices: provide two-piece adjustable rods, 5/8 inch (16mm) throw latchbolt. Top and bottom latching standard with optional less bottom rod.
 - e. Mortise Lock Devices: provide 3/4 inch anti-friction latchbolt, field reversible
 7. Provide exit devices with manufacturer's approved strikes.
 8. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
 9. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
 10. Provide cylinder dogging at non-fire-rated exit devices, unless specified less dogging.
 11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.
 12. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
 - a. Lever Style: Match lever style of locksets.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
 13. Provide UL labeled fire exit hardware for fire rated openings.
 14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
 15. Provide electrified options as scheduled in the hardware sets.

2.07 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 6000 series
2. Acceptable Manufacturers and Products: Folger Adam 300 series, HES 1006 series

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary-resistant.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide fail-secure type electric strikes, unless specified otherwise.
5. Coordinate voltage and provide transformers and rectifiers for each strike as required.

2.08 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage Electronics or Von Duprin PS900 series
2. Acceptable Manufacturers and Products: Sargent 3500 series, Folger Adam FABPS series.

B. Requirements:

1. Provide power supplies, recommended and approved by manufacturer of electrified locking component, for operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring power supply.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Options:
 - a. Provide power supply, where specified, with internal capability of charging sealed backup batteries 24 VDC, in addition to operating DC load.
 - b. Provide sealed batteries for battery back-up at each power supply where specified.
 - c. Provide keyed power supply cabinet.
5. Provide power supply in an enclosure, complete, and requiring 120VAC to fused input.
6. Provide power supply with emergency release terminals, where specified, that allow release of all devices upon activation of fire alarm system complete with fire alarm input for initiating "no delay" exiting mode.

2.09 CYLINDERS

A. Manufacturer:

1. Scheduled Manufacturer: Schlage Primus – Owner's Standard

B. Requirements: Provide cylinders/cores complying with the following requirements.

1. Furnished by same manufacturer as locks.
2. Cylinders/cores compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated.

C. Full-sized cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.

1. Primus FSIC cylinder in keyway as selected by owner at all Doors.

- D. Nickel silver bottom pins.
- E. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
- F. Failure to comply with stamping requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - 1. Forward cylinders/cores to Owner, separately from keys, by means as directed by Owner.
- G. Replaceable Construction Cores..
 - 1. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a. 12 construction change (day) keys.
 - 2. Install permanent cores immediately prior to substantial completion and prior to owner occupancy.

2.10 KEYING

- A. Keying Requirements – General
 - 1. Permanent cylinders/cores keyed by the manufacturer according to the following key system.
- B. Keying system: Key to existing system as directed by the Owner.
 - 1. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
- C. Keys
 - 1. Material: Nickel silver; minimum thickness of .092-inch (2.3mm)
- D. Coordinate with cylinder/core and key identification requirements above.
- E. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
- F. Quantity: Furnish in the following quantities.
 - 1. Grandmaster Keys: 2
 - 2. Master Keys: 6
 - 3. Permanent Control Keys: 3
 - 4. Change Keys: 3 per cylinder/core
- G. Delivery: Individually tagged and delivered direct to "Director", Maintenance Building and Grounds, P.O. Box 20100, 6531 Boeing Drive, El Paso, Texas 79925 by registered mail.

2.11 KEY CONTROL SYSTEM

A. Key Control System Manufacturers:

1. Scheduled Manufacturer: Telkee
2. Acceptable Manufacturers: HPC, Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
 - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.

2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP Series
2. Acceptable Manufacturers: Sargent 281 Series, Norton 9500 Series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 3/4 inch (19 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 ELECTRO-MECHANICAL AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN Senior Swing.
2. Acceptable Manufacturers and Products: Besam Swingmaster MP, Horton 4000LE series.

B. Requirements:

1. Provide low energy automatic operator units that are electro-mechanical design complying with ANSI A156.19.
 - a. Opening: Powered by DC motor working through reduction gears.
 - b. Closing: Spring force.
 - c. Manual, hydraulic, or chain drive closers: Not permitted.
 - d. Operation: Motor is off when door is in closing mode. Door can be manually operated with power on or off without damage to operator. Provide variable adjustments, including opening and closing speed adjustment.
 - e. Cover: Aluminum.
2. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 2 to 30 seconds, and logic terminal to interface with accessories, mats, and sensors.
3. Provide drop plates, brackets, or adapters for arms as required to suit details.
4. Provide hard-wired motion sensors and/or actuator switches for operation as specified. Provide weather-resistant actuators at exterior applications.
5. Provide key switches, with LED's, recommended and approved by manufacturer of automatic operator as required for function as described in operation description of hardware sets. Cylinders: Refer to "KEYING" article, herein.
6. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
7. Provide units with inputs for smoke evacuation doors, where specified, which allow doors to power open upon fire alarm activation and hold open indefinitely or until fire alarm is reset, presence detector input, which prevents closed door from opening or door that is fully opened from closing, hold open toggle input, which allows remote activation for indefinite hold open and close second time input is activated, vestibule inputs, which allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.14 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood, Trimco

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.

3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as specified. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.

2.15 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood, Trimco

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.16 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers: Rixson, Sargent, ABH

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.17 DOOR STOPS AND HOLDERS**A. Manufacturers:**

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood, Trimco

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.18 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING**A. Manufacturers:**

1. Scheduled Manufacturer: Zero International.
2. Acceptable Manufacturers: Pemko, National Guard Products, Reese

B. Requirements:

1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.19 SILENCERS**A. Manufacturers:**

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.20 FINISHES

- A. Finish: BHMA 626/652 (US26D); except:
 - 1. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
 - 2. Protection Plates: BHMA 630 (US32D)
 - 3. Overhead Stops and Holders: BHMA 630 (US32D)
 - 4. Door Closers: Powder Coat to Match
 - 5. Wall Stops: BHMA 630 (US32D)
 - 6. Latch Protectors: BHMA 630 (US32D)
 - 7. Weatherstripping: Clear Anodized Aluminum
 - 8. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Where on-site modification of doors and frames is required:
 - 1. Remove existing hardware being replaced, tag, and store according to contract documents.
 - 2. Field modify and prepare existing door and frame for new hardware being installed.
 - 3. When modifications are exposed to view, use concealed fasteners, when possible.
 - 4. Prepare hardware locations in accordance with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as indicated in keying section.
- I. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- L. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- M. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- N. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- O. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Engage Architect's Architectural Hardware Consultant or Equivalent as defined in section 1.5 "Quality Assurance" and manufacturers' representative of locks, exits and closers to perform inspections and to prepare inspection reports.
 - 1. The two parties will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.05 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.06 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.07 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.08 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Hardware Sets: Not in this submission

END OF SECTION

SECTION 08 8000**GLAZING****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.
 - 3. Gym Mirrors.
 - 4. Storefront Glazing.
 - 5. Interior Borrowed Lites.
 - 6. Fire-Rated Glazing Products.
 - 7. Glazing Schedule.
- B. Related Sections:
 - 1. Division 06 Sections "Flush Wood Doors" for glass and glazing installed in wood doors, sidelite frames and borrow lite frames.
 - 2. Division 06 Section "Hollow Metal Doors and Frames" for glass and glazing installed in hollow metal doors, sidelite frames and borrow lite frames.
 - 3. Division 08 Section "Aluminum Framed Entrances and Storefronts".

1.03 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement, wind loads, dead loads, and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- C. Design Wind Pressures: As indicated on Drawings.

- D. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

1.05 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of the following products; provide (1 each) 12 inches square.
1. Clear glass.
 2. Tinted glass.
 3. Coated glass.
 4. Fire-resistive glazing products.
 5. Laminated glass.
 6. Insulating unit.
- E. Glazing Accessory Samples: For gaskets, sealants and colored spacers, in 12-inch lengths.
1. Frosted Window Film sample: 3" x 3" or larger
- F. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- G. Qualification Data: For manufacturers of insulating-glass units with sputter-coated, low-e coatings.
- H. Product Certificates: For glass and glazing products, from manufacturer.
- I. Warranties: Sample of special warranties.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Source Limitations for Glass: Obtain float glass and insulating glass from single source, from single manufacturer for each glass type.
- E. Source Limitations for Glazing Accessories: Obtain from single source, from single manufacturer for each product and installation method.
- F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."

4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- G. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- H. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.
- I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.09 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within

specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
 2. Thickness of Insulated Glass Lites: Provide same thickness for each lite indicated throughout Project.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Structural: Installed glazing systems shall withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7.
 1. Use the procedure specified in ASTM E 1300 to determine glass type and thickness.
 2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
- D. Building Enclosure: Provide completed assemblies that maintain continuity of building enclosure, vapor retarder, and air barrier:
 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
 2. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- E. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic-protection testing requirements in ASTM E 1996 for Wind Zone 2 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
 1. Large-Missile Test: For glazing located within 30 feet of grade.
 2. Small-Missile Test: For glazing located more than 30 feet above grade.
- F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick
 2. For laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.02 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
 - 1. Tinted Types: Color and performance characteristics as indicated.
 - 2. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - 2. For uncoated glass, comply with requirements for Condition A.
 - 3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.03 INSULATING GLASS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Guardian / Glaz-Tech
 - 2. OldCastle Glass
 - 3. PPG Industries
 - 4. Pilkington
 - 5. Solarban
 - 6. Viracon
 - 7. Substitutions: in accordance with Section 01 6000, Product Requirements.
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal; glass to elastomer with supplementary silicone sealant.
 - 2. Spacer: Aluminum, bent and soldered corners.
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both.
- C. Glass: Comply with applicable requirements in "Glass Types" Article.

2.04 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
- B. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.
 - 1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus.
 - b. Schott North America, Inc.; Pyran Platinum L.
 - c. Substitutions: in accordance with Section 01 6000, Product Requirements.

2.05 GLASS ACCESSORIES

- A. Frosted Window film: Basis of Design- 3M Glass Fasara finishes, "Milky" SH2MAMM

2.06 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C 864.
 - 2. EPDM complying with ASTM C 864.
 - 3. Silicone complying with ASTM C 1115.
 - 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.07 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. VOC Content: For sealants applied on-site, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
 - 4. Sealants applied on-site, inside the weatherproofing system, shall contain no carcinogen or reproductive toxicant components present at more than 1% of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled "Chemicals Known to the State to Cause Cancer" or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
 - 5. Colors of Exposed Glazing Sealants: Match Architect's samples.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 756 SMS, 791, 795.
 - b. GE Advanced Materials - Silicones; SilGlaze II SCS2800
 - c. Pecora Corporation; 864, 895, 898.
 - d. Sika Corporation, Construction Products Division; SikaSil-C995.
 - e. Tremco Incorporated; Spectrem 2, Spectrem 3.
- C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.08 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.09 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Grind smooth and polish exposed glass edges and corners.
 1. Fallout Resistance: Passes fallout-resistance test in ASTM C 1048 for an assembly of glass and adhered reinforcing material.
 2. Factory apply manufacturer's standard opacifier of the following material to coated second surface of lites, with resulting products complying with Specification No. 89-1-6 in GANA's Tempering Division's "Engineering Standards Manual":

- a. Manufacturer's standard opacifier material.
- b. Polyester film laminated to glass with solvent-based adhesive.

3.03 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.04 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.05 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.06 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- I. Install gaskets so they protrude past face of glazing stops.

3.07 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.08 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.09 GLAZING SCHEDULE (refer to drawings for Schedule of Glass Types and for locations)

Type A: Insulated, Tinted, Low-E Glass Units, Tempered/Laminated; Safety glazing, tinted, low-E.

- 1. Application(s): Exterior locations as noted on the drawings.
 - a. Other locations required by applicable federal, state, and local codes and regulations.
 - b. Other locations indicated on the drawings.
- 2. Outboard Lite: Laminated glass, tinted, 1/4 inch thick minimum.
 - a. Tint: Match Existing, Low-E
- 3. Inboard Lite: Fully tempered float glass, clear, 1/4 inch thick minimum.
 - a. Coating: Low-E type, on #3 surface.
- 4. Total Thickness: 1 inch (25mm) minimum.
- 5. Interspace Content: 1/2 inch Air Space
- 6. Visible Light Transmittance (VLT): 47% minimum
- 7. Visible Light Reflectance:
 - a. Outside: 8% maximum
 - b. Inside: 12% maximum
- 9. Solar Heat Gain Coefficient (SHGC): 0.24 maximum

Type B: Insulated Clear Glass Units, Tempered /Laminated

- 2. Application(s): Exterior hazardous locations as noted on drawings.
 - a. Other locations required by applicable federal, state, and local codes and regulations.
 - b. Other locations indicated on the drawings.
- 3. Outboard Lite: Laminated, fully tempered float glass, clear, 1/4 inch thick minimum
 - a. Coating: None
 - b. Tint: Clear
- 4. Inboard Lite: Fully tempered float glass, clear, 1/4 inch thick minimum
 - a. Coating: None
 - b. Tint: Clear

5. Interspace Content: 1/2 inch Air Space
6. Total Thickness: 1 inch (25mm) minimum.
7. Visible Light Transmittance (VLT): 64% minimum
8. Visible Light Reflectance:
 - a. Outside: 13%
 - b. Inside: 14%

Type C: Clear Fully Tempered Float Glass; Single Interior Safety glazing

1. Applications: Interior locations as noted on drawings.
 - a. Other locations required by applicable federal, state, and local codes and regulations.
2. Type: Fully tempered float glass.
3. Tint: Clear
4. Thickness: 1/4 inch (6.0 mm) minimum.

Type D: Fully Tempered Mirror Glass

1. Applications: Auxiliary Gym Wall.
2. Type: Fully tempered mirror glass, No. 1 quality, warranted against silver spoilage for 15 years.
3. Thickness: 1/4 inch minimum.

END OF SECTION

Division Nine

FINISHES

SECTION 09 2116**GYPSUM BOARD ASSEMBLIES****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Performance criteria for gypsum board assemblies.
- B. Non-structural metal framing.
- C. Metal channel ceiling framing.
- D. Gypsum wallboard.
- E. High Impact Gypsum Board.
- E. Fire rated assemblies.
- F. Tile backing board.
- G. Acoustic insulation.
- H. Joint treatment and accessories.
- I. Textured finish system.

1.02 RELATED REQUIREMENTS

- A. Section 05 4000 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.
- B. Section 07 2100 - Thermal Insulation: Wall insulation.
- C. Section 07 2726 - Liquid Applied Water & Air Membrane: Water-resistive barrier over sheathing.
- D. Section 07 8400 - Firestopping: At fire rated walls.
- E. Section 07 9200 - Joint Sealers: Fire and acoustic sealants.
- F. Section 09 3000 - Tiling

1.03 REFERENCE STANDARDS

- A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; current edition
- B. AISI SG-971 - Specification for the Design of Cold-Formed Steel Structural Members; current edition
- C. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; current edition
- D. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; current edition
- E. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; current edition
- F. ASTM C 36/C 36M - Standard Specification for Gypsum Wallboard; current edition
- G. ASTM C 475/C 475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; current edition
- H. ASTM C 630/C 630M - Standard Specification for Water-Resistant Gypsum Backing Board;

current edition

- I. ASTM C 645 - Standard Specification for Nonstructural Steel Framing Members; current edition
- J. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; current edition
- K. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; current edition
- L. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board; current edition
- M. ASTM C 954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. to 0.112 in. in Thickness; current edition
- N. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; current edition
- O. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; current edition
- P. ASTM C 1278/C 1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; current edition
- Q. ASTM C 1280 - Standard Specification for Application of Gypsum Sheathing; current edition
- R. ASTM C 1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets; current edition
- S. ASTM C 1396/C 139 - Standard Specification for Gypsum Board; current edition
- T. ASTM C 1629/C 1629 - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; current edition
- U. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; current edition
- V. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; current edition
- W. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; current edition
- X. GA-600 - Fire Resistance Design Manual; Gypsum Association; current edition
- Y. ICC (IBC) - International Building Code; current edition.
- Z. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, joint finishing system, accessories, and joint finishing system.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Test Reports: For all stud framing products that do not comply with ASTM C 645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

- F. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.
 - 1. Accepted sample shall be used as basis of acceptance for field applied texture.
 - 2. Provide additional samples as requested by Architect.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of all installation standards at project site.
- B. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.
- C. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire rated assemblies as indicated on drawings.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C 840 and GA-216.
- B. Interior Partitions: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.
- C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
 - 1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
 - 2. Acoustic Attenuation: STC as indicated on drawings calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.
- D. Fire Rated Assemblies: Provide completed assemblies complying with applicable code. See drawings for location and assembly information.
 - 1. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
 - 2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
 - 3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL Fire Resistance Directory.

2.02 MANUFACTURERS

- A. Gypsum Board:
 - 1. American Gypsum: www.americangypsum.com
 - 2. National Gypsum Company: www.nationalgypsum.com.
 - 3. CertainTeed Corporation: www.certainteed.com.
 - 4. Georgia-Pacific Gypsum LLC: www.gp.com/gypsum.
 - 5. Lafarge North America Inc: www.lafargenorthamerica.com.
 - 6. USG Corporation: www.usg.com.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.

- B. Metal Framing:
1. Clark Steel Framing Systems; Product : www.clarksteel.com.
 2. Dale/Incor; Product : www.daleincor.com.
 3. Dietrich Metal Framing, Inc; Product : www.dietrichindustries.com.
 4. Marino-Ware; Product : www.marinoware.com.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- C. Metal Framing Connectors and Accessories:
1. Same manufacturer as framing.
 2. The Steel Network Inc: www.SteelNetwork.com.
 3. Dietrich Metal Framing, Inc ; Product : www.dietrichindustries.com.
 4. Substitutions: See Section 01 6000 - Product Requirements.

2.03 METAL FRAMING MATERIALS

- A. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of $L/240$ at 5 psf.
- **** *NOTE: the above paragraph relates to interior partition walls that exceed 6 feet in height and have a brittle finish (as per IBC, table 1604.3).*
1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of **40 ksi** minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.
 2. Studs: "C" shaped with flat or formed webs, with knurled faces.
 3. Runners: U shaped, sized to match studs.
 4. Ceiling Channels: C shaped.
 5. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
- B. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 4000.
- C. Shaft Wall Studs and Accessories: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 and specified performance requirements.
- D. Ceiling Hangers: Type and size as specified in ASTM C 754 for spacing required.
- E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
 2. Material: ASTM A 653/A 653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
 3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
 4. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.
 5. Acceptable Products: VertiClip(r) or VertiTrack(tm) manufactured by The Steel Network Inc.
- F. Channel Bridging: Wall bracing for stud walls.

1. Channel bridging inside wall:
 - a. "BridgeBar/BuckleBridge" as manufactured by The Steel Network, Inc.;
www.steelnetwork.com.
 - b. "Spazzer Bar" as manufactured by Dietrich Metal Framing, Inc.;
www.dietrichindustries.com.
 - c. Provide bridging clips where required.
 - d. Substitutions: See Section 01600 - Product Requirements.

2.04 BOARD MATERIALS

- A. Gypsum board: Paper-faced gypsum wallboard as defined in ASTM C 1396; sizes to minimize joints in place.
 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Mold Resistance: Where indicated on drawings. Score of 10, when tested in accordance with ASTM D 3273.
 3. Type: Regular and Fire-resistance type, Type X where indicated.
 4. Thickness:
 - a. Vertical Surfaces: 5/8 inch, unless otherwise indicated on drawings.
 - b. Ceilings: 5/8 inch, unless otherwise indicated on drawings.
 5. Edges: Tapered for texture and paint finishes, square for plaster finishes.
- B. High Impact-Rated board: Tested to Level 3 soft-body impact, hard-body impact, and surface abrasion in accordance with ASTM C 1629. Paper-faced type gypsum wallboard as defined in ASTM C 1396.
 1. Application: In High-traffic areas and where indicated on drawings. Extend impact rated wallboard to height indicated on drawings. If not indicated on drawings, extend to 8 feet high.
 2. Core: Fire-resistance rated gypsum core, with additives to enhance mold/mildew resistance, surface indentation resistance, impact resistance and moisture and mold resistant. Mold Resistance: Where indicated on drawings. Score of 10, when tested in accordance with ASTM D 3273.
 3. Surface paper: Abrasion resistant, 100 percent recycled content moisture/mold/mildew resistant paper on front, back and long edges
 4. Long Edges: Tapered
 5. Embedded fiberglass mesh
 6. Type: Regular and Fire-resistance type, Type X where indicated.
 7. Thickness: 5/8 inch, unless otherwise indicated on drawings.
 8. Edges: Tapered for texture and paint finishes, square for plaster finishes.
 9. Indentation Resistance: Classification Level 1 in accordance with ASTM C 1629.
- C. Backing Board for Wet Areas **WITH** and **WITHOUT** Tile: Coated glass mat (each side) water-resistant gypsum backing panel as defined in ASTM C 1178.
 1. Application:
 - a. Surfaces with wall tile scheduled.
 - b. Surfaces in wet areas including, sinks (including sinks in base cabinets), utility sinks, mop sinks, drinking fountains, tub and shower surrounds, and other areas as indicated on drawings.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
 3. Type: Regular and Fire-resistance type, Type X where indicated.
 4. Thickness: 1/2 inch minimum.
 5. Products:
 - a. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
 - b. Substitutions: Comply with Section 01 6000 - Product Requirements.
- D. Moisture and Mold Resistant Board for **NON**-Wet Areas (in areas with moisture and humidity):

Coated glass mat moisture-resistant gypsum panel as defined in ASTM C 1658, ASTM C1396 Section 7, and ASTM C1177.

1. Application: Wall and Ceiling surfaces (without tile) where moisture is likely in Restrooms, Shower/Locker rooms, Kitchens, Janitorial/Custodial, spaces below grade, and other areas as indicated on drawings.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
 3. Type: Regular and Fire-resistance type, Type X where indicated.
 4. Thickness: 1/2 inch minimum.
 5. Edges: Tapered for texture and paint finishes, square for plaster finishes.
 6. Products:
 - a. Georgia-Pacific Gypsum LLC; DensArmor Plus.
 - b. Substitutions: Comply with Section 01 6000 - Product Requirements.
- E. Fire Resistant Board: Complying with Type X requirements; UL or WH rated.
1. Applications: At assemblies indicated with Fire-Rating, use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
 - a. Other Applications: Use at all vertical and horizontal surfaces, where indicated.
 - b. Thickness: 5/8 inch minimum.
- F. Shaftwall and Coreboard: Fire Resistant Type X; 1 inch minimum thick, edges beveled, square or tongue-and-groove.
1. Paper Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C 1396; water-resistant faces.
 2. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C 1658.
 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
- G. Exterior Sheathing Board: Glass mat faced gypsum substrate as defined in ASTM C 1177. Sizes to minimize joints in place.
1. Application: Exterior sheathing at walls (including roof walls), unless otherwise indicated.
 2. Type: Regular and Fire-resistance type, Type X where indicated.
 3. Thickness: 5/8 inch minimum, unless otherwise indicated on drawings.
 4. Edges: Square.
 5. Products:
 - a. Exterior Sheathing: Georgia-Pacific Gypsum LLC; DensGlass Gold Sheathing.
 - b. Roof walls with TPO or PVC: Georgia-Pacific Gypsum LLC; DensDeck.
 - c. Substitutions: Comply with Section 01 6000 - Product Requirements.
- H. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C 1396; sizes to minimize joints in place.
1. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.
 2. Types: Regular and Fire-resistance type, Type X where indicated.
 3. Thickness:
 - a. Type X: 5/8 inch minimum.
 - b. Regular Type: 1/2 inch minimum, unless otherwise indicated.
 4. Edges: Tapered for texture and paint finishes, square for plaster finishes.
 5. Products:
 - a. Georgia-Pacific Gypsum LLC; ToughRock Soffit Board.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORIES

- A. **Acoustic Insulation:** ASTM C 665; preformed glass fiber, friction fit type, un-faced. Thickness

as required to achieve or exceed STC ratings as indicated on drawings. Product: CertainTeed "NoiseReducer" or equal approved by architect.

- B. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
- C. Weather and Water-Resistive Barriers: As specified in Division 07.
- D. Corner Beads: Galvanized steel, as detailed.
- E. Edge Trim: Bead type(s) as detailed.
- F. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.
 - 1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 3. Ready-mixed vinyl-based joint compound.
 - 4. Powder-type vinyl-based joint compound.
 - 5. Chemical hardening type compound.
- G. Textured Finish Materials: Latex-based compound; plain.
- H. Screws for Attachment to Steel Members Less Than 0.03 inch (0.7 mm) in Thickness, to Wood Members, and to Gypsum Board: ASTM C 1002; self-piercing tapping type; cadmium-plated.
- I. Screws for Attachment to Steel Members From 0.033 to 0.112 inch (0.8 to 2.8 mm) in Thickness: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel members.
- J. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.
- K. Screws: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C 754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as permitted by standard.
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
 - 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs as permitted by standard.
 - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 - 3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not

less than double studs at jambs.

- E. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board as indicated on drawings.
- F. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.
- G. Blocking: Install mechanically fastened steel sheet blocking for support of:
 - 1. Framed openings.
 - 2. Wall mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet partitions.
 - 5. Toilet accessories.
 - 6. Wall mounted door hardware.
 - 7. Where required or as indicated on drawings
- H. Bridging: Attach wall stud bridging when required in a manner to prevent stud rotation.
 - 1. Space bridging rows according to manufacturer's recommendations (maximum 4 feet on center).
 - 2. Install bridging in stud walls with cladding on one-side only and other framing where recommended by manufacturer and code requirements.
 - 3. Avoid bracing interference with thermal break of rigid wall board insulation on exterior walls.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place one bead continuously on substrate before installation of perimeter framing members.
 - 2. Place continuous bead at perimeter of each layer of gypsum board.
 - 3. Place at tops and bottoms and at each side of walls.
 - 3. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes with acoustic sealant.

3.04 BOARD AND GLASS MAT FACED BOARD INSTALLATION

- A. Comply with ASTM C 840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Single-Layer Fire-Rated: Install gypsum board vertically, with edges and ends occurring over firm bearing.
- D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exterior Sheathing (Glass- Mat-Faced): Comply with ASTM C 1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
- F. Exterior Soffit Board: Install perpendicular to framing, with staggered end joints over framing members or other solid backing.
- G. Tile Backing Board: Install over steel framing members where indicated, in accordance with

ANSI A108.11 and manufacturer's instructions.

- H. Installation on Metal Framing: Use screws for attachment of all gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.
- I. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.
- J. Provide sizes to minimize joints and cut edges square and straight.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
 - 2. At exterior soffits, not more than 30 feet (10 meters) apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- C. Finish gypsum board in scheduled areas in accordance with levels defined in ASTM C 840.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
 - 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
- E. Fill and finish joints and corners of tile backing board as recommended by manufacturer.
- F. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.07 TEXTURE FINISH

- A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.
- B. Texture: Orange Peel, medium

3.08 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.09 BOARD FINISH LEVEL SCHEDULE

- A. Level 1: Above finished ceilings concealed from view.
- B. Level 2: Utility areas and areas behind cabinetry.
- C. Level 3: Walls scheduled to receive textured wall finish.

END OF SECTION

SECTION 09 5100**ACOUSTICAL CEILINGS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealers: Acoustical sealant.
- B. Section 08 3100 - Access Doors and Panels: Access panels.
- C. Section 21 0000 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

1.03 REFERENCE STANDARDS

- A. ASTM C 635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; Current Edition.
- B. ASTM C 636/C 636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2006.
- C. ASTM E 580/E 580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2008a.
- D. ASTM E 1264 - Standard Classification for Acoustical Ceiling Products; 2008.
- E. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 3300 for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning. Center grid in room, but do not cut tile rows smaller than 4".
- C. Product Data: Provide data on suspension system components.
- D. Samples: Submit two samples 12 x 12 inches in size illustrating material and finish of acoustical units.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Division 1 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 3 percent of total installed packaging each type of material separately, distinctly marked, and adequately protected against deterioration.

1.06 QUALITY ASSURANCE

- A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL for the fire resistance indicated.

- B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- D. Acoustical Unit Installer Qualifications: Installer specializing in installation of products specified with minimum three years documented experience and licensed in the State of New Mexico.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 - PRODUCTS

2.01 ACOUSTICAL UNITS

- A. Basis-of-Design: Armstrong.
- B. Manufacturers
 - 1. Armstrong World Industries, Inc: www.armstrong.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. Pinta Acoustic, Inc: www.pinta-acoustic.com/link.
 - 4. USG: www.usg.com.
 - 5. Substitutions: See Section 01 6300 - Product Substitution Procedures.
- C. Acoustical Units - General: ASTM E 1264, Class A.
 - 1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly the suspension system is a part of.
 - 2. 30 year guarantee against visible sag, and mold/mildew & bacteria
 - 3. Composition: Wet felted.
 - 4. Surface Color: White.
- D. Acoustical Tile: Painted mineral fiber, ASTM E 1264 Type III, with the following characteristics and as indicated on drawings:
 - 1. Product: Fine Fissured School Zone by Armstrong.
 - a. Thickness: 3/4 inches, square lay-in
 - b. Light Reflectance: 85 percent, determined as specified in ASTM E 1264.
 - c. Octave Band Minimum NRC: 0.70 at 500Hz, 0.66 at 1000Hz, 0.53 at 2000Hz, determined as specified in ASTM E 1264.
 - d. Ceiling Attenuation Class (CAC): 40, determined as specified in ASTM E 1264.
 - f. Fire Rating: Class A
 - g. Suspension System: 15/16": exposed tee grid.
 - h. Size: 24" x 24" #1713, 24" x 48" #1714

2.02 SUSPENSION SYSTEM(S)

- A. Manufacturers: Same as for acoustical units.
 - 1. Substitutions: See Section 01 6300 - Product Substitution Procedures.
- B. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- C. Project is located in **Seismic Design Category B** Ceiling shall be designed and installed in accordance with the IBC, ASTM C635, ASTM C636, ASCE 7-02, and CISCA. All local codes and regulations for seismic design shall be followed.

- D. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; intermediate-duty.
 - 1. Profile: Tee; Match existing.
 - 2. Construction: Double web.
 - 3. Finish: White painted.
- E. Fire-Rated Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; intermediate-duty.

2.03 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Trim (where shown on drawings):
 - 1. Axiom – Classic Straight aluminum trim by Armstrong. 6" wide, white to match to grid.
- C. Perimeter Moldings: Same material and finish as grid.
 - 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
 - 2. At Concealed Grid: Provide exposed L-shaped molding.
- D. Gypsum Board: Fire rated type; 5/8 inch thick, ends and edges square, paper faced.
- E. Acoustical Sealant For Perimeter Moldings: Specified in Section 07 9005.
- F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C 636/C 636M, ASTM E 580/E 580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
Center on grid. No tile rows to be cut less than 4 inches.
- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.
- J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.
 2. Overlap and rivet corners.
- K. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- L. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units with pattern parallel to longest room axis.
- D. Fit border trim neatly against abutting surfaces.
- E. Install units after above-ceiling work is complete.
- F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- G. Cutting Acoustical Units:
1. Make field cut edges of same profile as factory edges.
- H. Where round obstructions occur, provide preformed closures to match perimeter molding.
- I. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.
- J. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.

3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 5113.13**ACOUSTICAL CEMENTITIOUS WOOD FIBER SHAPES & CLOUDS CEILINGS****PART 1 GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Cementitious wood fiber plank acoustical ceiling system
 - 2. Exposed Suspension System
- B. Related Sections:
 - 1. Section 09 5100 – Acoustical Ceilings
 - 2. Section 09 2116 – Gypsum Board Assemblies
 - 3. Divisions 23 – HVAC Air Distribution
 - 4. Division 26 – Electrical
- C. Alternates
 - 1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products that have not been approved by Addenda, the specified products shall be provided without additional compensation.
 - 2. Submittals that do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low-Alloy with Improved Formability
 - 2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - 3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
 - 4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
 6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
 7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
 8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
 9. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
 10. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
 11. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation between Rooms Sharing a Common Ceiling Plenum
 12. ASTM E 1264 Classification for Acoustical Ceiling Products
- B. International Building Code
- C. ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"
- D. NFPA 70 National Electrical Code
- E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures
- F. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of nonstructural components
- G. International Code Council-Evaluation Services Report – Seismic Engineer Report
- H. ESR 1308 – Armstrong Suspension Systems
- I. ICC-ES Evaluation Report ESR-1112.
- J. California Department of Public Health CDPH/EHLB Emission Standard Method Version 1.1 2010
- K. LEED - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each type of Tectum® Shapes and or Clouds and suspension system required.
- B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of suspension system.
- C. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with, or supported by the ceilings.
- D. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- E. If the material supplied by the acoustical subcontractor does not conform to manufacturer's current published values it must be removed, disposed of and replaced with complying

product at the expense of the Contractor performing the work.

1.05 SUSTAINABLE MATERIALS

- A. **Transparency: Manufacturers will be given preference when they provide** documentation to support sustainable requirements for the following: Material ingredient transparency, Removal of Red List Ingredients per LBCV3, Life Cycle impact information, Low-Emitting Materials, and Clean Air performance.
- B. **Health Product Declaration.** The end use product has a published, complete Health Product Declaration with disclosure at a minimum of 1000ppm of known hazards in compliance with the Health Product Declaration open Standard.
- C. **Declare Label.** The end use product has a published Declare label by the International Living Future Institute with disclosure of 100 ppm with a designation of Red List Free or Compliant (less than 1% proprietary ingredients).
- D. **Low Emitting products with VOC emissions data.** Preference will also be given to manufacturers that can provide emissions data showing their products meet CDHP Standard Method v1.1 (Section 01350).
- E. **Life cycle analysis.** Products that have communicated lifecycle data through Environmental Product Declarations (EPDs) will be preferred.
- F. **End of Life Programs/Recycling:** Where applicable, manufacturers that provide the option for recycling of their products into new products at end-of-life through take-back programs will be preferred.
- G. **Products meeting LEED V4 requirements including (If required);**
 - 1. Storage & Collection of Recyclables
 - 2. Construction and Demolition Waste Management Planning
 - 3. Building Life-Cycle Impact Reduction
 - 4. Building Product Disclosure and Optimization Environmental Product Declarations
 - 5. Building Product Disclosure and Optimization Sourcing of Raw Materials
 - 6. Building Product Disclosure and Optimization Material Ingredients
 - 7. Construction and Demolition Waste Management

1.06 QUALITY ASSURANCE

- A. **Single-Source Responsibility:** Provide Tectum® Shapes and or Clouds and grid components by a single manufacturer.
- B. **Fire Performance Characteristics:** Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
 - 1. **Surface Burning Characteristics:** As follows, per ASTM E 84 and complying with ASTM E 1264 Classification.
- C. **Tectum® Shapes and or Clouds,** as with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

- D. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.07 DELIVERY, STORAGE & HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Provide labels indicating brand name, style, size and thickness.
- C. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- D. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.08 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
- B. Do not install ceiling panels until building is closed in and HVAC system is operational.
- C. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.
- D. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:
 - 1. Relative Humidity: 65 - 75%.
 - 2. Uniform Temperature: 55 - 70 degrees F (13 - 21 degrees C).

1.09 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
 - 1. Defects in Material or factory workmanship
- B. Tectum® Shapes and or Clouds and suspension systems one source manufacturer is Thirty (30) years from date of substantial completion.
- C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.10 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Tectum® Shapes and or Clouds: Furnish quantity of full-size units equal to 5.0 percent of amount installed.
 - 2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS**2.01 MANUFACTURER**

- A. Tectum® Shapes and or Clouds: Tectum® by Armstrong World Industries, Inc.
- B. Suspension System: Armstrong World Industries, Inc.

2.02 ACOUSTICAL CEILING UNITS

- A. Acoustical Panels Type AP-1:
 - 1. Surface Texture: Coarse
 - 2. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
 - 3. Color: Refer to color & Material Schedule in drawings
 - 4. Size: Refer to drawings
 - 5. Thickness: Refer to drawings
 - 6. Edge Profile: (square or radius edges)
 - 7. Noise Absorption; (up to 0.41 Sabins S/F)
 - 8. Flame Spread: ASTM E 1264; (Fire Class)
 - 9. Light Reflectance (LR) White Panel: ASTM E 1477; (Light Reflectance)
 - 10. Dimensional Stability: HumiGuard Plus
 - 11. Sustainable: EPD (Environmental Product Declaration) and HPD (Health Product Declaration)
 - 12. Acceptable Product: Tectum® Shapes and or Clouds as manufactured by Armstrong World Industries

2.03 METAL SUSPENSION SYSTEMS

- A. Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A653. Main beams and cross tees are double-web steel construction with 15/16" type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
 - 1. Structural Classification: ASTM C 635 (Heavy) duty
 - 2. Color: Selected by Architect from the manufacturer's full range.
 - 3. Acceptable Product: Prelude XL 15/16" as manufactured by Armstrong World Industries
- B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- C. Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft annealed, with a yield stress load of at least three times design load, but not less than 12 gauge.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.02 PREPARATION

- A. Measure ceiling area and establish layout of Tectum® Shapes and or Clouds. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.
- B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
 - 1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.03 INSTALLATION

- A. Install Tectum® Shapes and or Clouds in accordance manufacturer's installation instructions. Follow the requirements of the International Building Code, ASCE 7 and ASTM E580 and in install in accordance with the authorities having jurisdiction.

3.04 ADJUSTING AND CLEANING

- A. Replace damaged and broken Tectum® Shapes and or Clouds.
- B. Clean exposed surfaces of Tectum® Shapes and or Clouds and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

END OF SECTION

SECTION 09 6513**RESILIENT BASE****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Resilient wall base.
- B. Related Sections:
 - 1. Division 09 Flooring Sections (All) for flooring that receives base and accessories.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples but not less than 6 inches long, of each resilient product color, texture, and pattern required.
- C. Product Schedule: For resilient products, use same designations indicated on Drawings.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 55 deg F. or more than 85 deg F.
- B. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- C. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 F deg or more than 85 deg F.

1.05 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than three percent (3%) of each type, color, pattern, and size of resilient product installed. Minimum (1) one box of each type and color specified or scheduled. Also, one gallon of each type of adhesive used, label specific use on the cover.

PART 2 - PRODUCTS

2.01 PRODUCTS, GENERAL

- A. Manufacturers: Subject to compliance with Basis of Design product indicated on the drawings (refer to Finish and Material Schedule) for physical and performance characteristics as well as aesthetics; color, pattern, and textures, provide products indicated or by one of the following as approved by the Architect:
 - 1. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
 - 2. Flexco, Inc.
 - 3. Johnsonite.
 - 4. Roppe Corporation, USA.

2.02 RUBBER WALL BASE

- A. Material: 100% Rubber, thermoset. PVC and Phthalate free. No vinyl chloride, plasticizers, asbestos, or CFCs. Does not shrink. Surface Burning Characteristics - **Class B**
 - 1. Performance: Meets ASTM F 1861 Standard Specification for Resilient Wall Base Type TS, Group 1 (solid, homogeneous).
 - 2. Fire-Test-Response Characteristics: As determined by testing identical products by a qualified testing agency:
 - a. ASTM E 648 (NFPA 253) - Critical Radiant Flux Classification: > 0.45 W/cm² or greater, Class I.
 - b. ASTM E84 (NFPA 255) - Surface Burning Characteristics: **Class B**
 - c. ASTM E662 (NFPA 258) - Smoke Density: Passes, <450
 - 3. Flexibility: ASTM F 137 Standard Test Method for Flexibility of Resilient Flooring Materials.
 - 4. Color Stability: Meets or exceeds ASTM F 1861 requirements for color stability when tested to ASTM F 1515 Standard Test Method for Measuring Light Stability of Resilient Flooring.
 - 5. Minimum Thickness: 0.125 inch
 - 6. Style: Standard Cove Base (toe)
 - 7. Height: As indicated on Drawings.
 - 8. Lengths: In manufacturer's standard length.
 - 9. Outside Corners: Job formed; install as per manufacturer recommended.
 - 10. Inside Corners: Job formed; install as per manufacturer recommended.
 - 11. Color: As selected by Architect from manufacturer's full range of finishes.
 - 12. Finish: Matte finish.

2.03 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: (for porous surfaces) Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: (for non-porous surfaces) Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Colored Caulk: by same manufacturer, color to match accessories.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Install resilient products after other finishing operations, including painting, have been completed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces where indicated, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use continuous, straight pieces of maximum lengths possible.

3.04 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
 - 4. Fill any voids with matching Colored Caulk by same manufacturer.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover and protect resilient products from marking or damage until Substantial Completion.

END OF SECTION

09 6513

SECTION 09 6566**RESILIENT ATHLETIC FLOORING****PART 1 – GENERAL****1.01 SUMMARY****A. Products Supplied**

1. Resilient athletic flooring.
2. Accessories required for installation, maintenance and repair.

1.02 REFERENCES**A. ASTM International (ASTM)**

1. ASTM D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
2. ASTM D2047: Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as measured by the James Machine.
3. ASTM D2240: Standard Test Method for Rubber Property (Durometer Hardness).
4. ASTM D3389: Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader).
5. ASTM E492: Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine.
6. ASTM E648: Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
7. 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.
8. ASTM E1745: Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
9. ASTM E2180: Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials.
10. ASTM F386: Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces.
11. ASTM F710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
12. ASTM F925: Standard Test Method for Resistance to Chemicals of Resilient Flooring.
13. ASTM F970: Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading.
14. ASTM F1514: Standard Test method for Measuring Heat Stability of Resilient Flooring by Color Change.
15. ASTM F1515: Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change.

16. ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
17. ASTM F2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

B. State of California (CA)

1. CA Section 01350. Standard Method for the Testing and Evaluation of Volatile Organic Compound Emissions from Indoor Sources Using Environmental Chambers.

C. Grenelle Environment Forum

1. Decree № 2011-321. French decree on labeling requirement for construction materials, wall and floor coverings, and paint and varnishes, as it pertains to their emissions of volatile pollutants.

D. GREENGUARD Environmental Institute (GEI)

1. GREENGUARD Certification. Compliant with stringent emission levels for over 360 VOCs, plus a limit on the total of all chemical emissions combined (TVOC).
2. GREENGUARD Gold. Compliant with safety factors to account for sensitive individuals (such as children and the elderly) and ensures that a product is acceptable for use in environments such as schools and healthcare facilities.

E. International Organization for Standardization (ISO)

1. ISO 9001: Quality management systems – Requirements.
2. ISO 16000-9: Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method.
3. ISO 22196: Measurement of antibacterial activity on plastics and other non-porous surfaces.

1.03 SUBMITTALS

A. Action Submittals

1. Provide copies of Original Equipment Manufacturer (OEM)'s ISO 9001 certification.
2. Provide current printed data sheets for all Products Supplied.
3. Provide samples, 6 inches x 6 inches, for verification of such characteristics as color and surface texture for each Manufactured Product specified.
4. As necessary, provide shop drawings prepared for project illustrating layouts, details, dimensions and other pertinent data.

B. Informational Submittals

1. Provide Manufacturer's current printed substrate surface preparation guidelines.
2. Provide Manufacturer's current printed installation guidelines for Products Supplied.

C. Closeout Submittals

1. Provide Manufacturer's current printed maintenance guidelines for Manufactured Product.
2. Provide Manufacturer's current printed standard warranty for Manufactured Product.

D. Maintenance Material Submittals

1. Provide extra stock materials from original dye lots, for use in facility operations and maintenance (approximately 2% of the total floor surface for each color, surface texture and format of Manufactured Product specified).

1.04 QUALITY ASSURANCE

- A. Manufacturer must be certified ISO 9001.
- B. Manufacturer must have a minimum of fifteen (15) years of experience in the manufacturing of prefabricated resilient rubber flooring.
- C. Manufactured Product must have undergone a vulcanization process; factory lamination should not be accepted as equivalent.
- D. Surfacing Contractor to be recognized and approved by the Manufacturer.
- E. Surfacing Contractor shall be fully acquainted with the existing facility and utilities and shall fully understand the difficulties and restrictions attending the execution of the work under contract. Surfacing Contractor to advise the Owner of any restrictions or anticipated difficulty, in writing and before submitting bids.
- F. Installer must be approved by the Surfacing Contractor and must have performed installations of the same scale in the last three (3) years.
- G. A mock-up installation is highly recommended; always follow the same procedures and use the same materials that have been specified for the actual project. The Owner or Architect will be responsible for deeming the mock-up acceptable.
 1. Mock-up size: 36 inches x 36 inches

1.05 DELIVERY, STORAGE AND HANDLING

- A. Products Supplied must be delivered in Manufacturer's original, unopened and undamaged packaging with identification labels intact.
- B. Products Supplied must be protected from exposure to harmful weather conditions and must be safely stored on a clean, dry, flat surface. Store rolls of resilient athletic flooring upright; store tiles of resilient athletic flooring on a flat surface, carefully protecting corners and edges.
- C. Climate controlled storage is recommended. Storage temperature must not be below 40oF (4oC) and must not exceed 100oF (38oC). Materials must be delivered to site a minimum of 24 hours before work is scheduled to begin so that they may acclimate.
- D. Avoid storing Manufactured Product for extended periods of time or additional material trimming may be required.
- E. Products Supplied need not suffer damage during delivery, storage and handling (i.e. dents/scratches, excessive compression or warping, chipped edges, etc.).

1.06 SITE CONDITIONS

- A. The General Contractor or Construction Manager shall be responsible for ensuring all site conditions meet the requirements of the Manufacturer, as referenced herein at sections 3.2 and 3.3. Refer to current version of ASTM F710 for additional information.

- B. Concrete slabs, on or below grade, must be installed over a permanent effective vapor retarder, respecting current versions of the standard practice ASTM E1643 and the standard specification ASTM E1745. The vapor retarder must be placed directly underneath the concrete slab, above the granular fill, per Manufacturer's instructions. The vapor retarder must have a perm rating of 0.1 or less and must have a minimum thickness of 10 mil (0.010 in).
- C. No sealers or curing compounds are applied to or mixed into the concrete (refer to Section 03 3000 – Common Work Results for Concrete of Division 3).
- D. Installation of the resilient athletic flooring to be carried out no sooner than the specified curing time of the concrete (normal density concrete curing time is approximately 28 days for development of design strength, having a minimum 3500 psi or 25 MPa in compressive strength).
- E. Substrate surface must be free of all contaminants that can inhibit bond (paint, wax, dust, oil or grease, sealer, curing compound, solvent, asphalt, old adhesive residues, etc.). All contaminants must be removed from the surface via mechanical abatement. Use of abatement chemicals is not recommended.
- F. Concrete must have a smooth finish, proper density and be highly compacted with a tolerance of 1/8th of an inch in a 10-foot radius (3.2 mm in 3.05 m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.
- G. Moisture and alkalinity tests must be performed on all concrete substrates, under in-service conditions. It is recommended to turn on the HVAC unit prior to performing moisture testing, in order to ensure stable testing conditions and accurate results. The concrete's surface pH should be between 7 and 10. Relative humidity of the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F2170 (in situ probes). Moisture vapor emissions from the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F1869 (anhydrous calcium chloride).
- H. Maintain stable room and substrate temperatures prior to moisture testing and flooring installation, during the flooring installation, as well as a minimum of 48 hours after the flooring has been completely installed. Recommended ambient temperature range is between 65oF and 86oF and recommended ambient humidity range is between 35% and 55%.
- I. If installing over wood substrates, ensure exterior grade plywood with at least one good side, such as: APA (Engineered Wood Association) Exterior grade plywood (A-A Exterior, A-B Exterior or A-C Exterior) and CANPLY (Canadian Plywood Association) Exterior certified plywood (Canada: Grade G2S A-A or G1S A-C. USA: G2S A-A, A-B, B-B, or G1S A-C, B-C). There must be proper underfloor ventilation, plywood must be dry and should have a moisture content ranging between 6 and 12%, when measured with a quality wood moisture meter (electronic hygrometer).
- J. Installation of resilient athletic flooring will not commence until the building is enclosed and all other trades have completed their work. It is the General Contractor or Construction Manager's responsibility to maintain a secure and clean working area before, during and after the installation of the resilient athletic flooring.

1.07 WARRANTY

- A. The resilient athletic flooring is warranted to be free from manufacturing defects for a period of one (1) year from the date that is 30 days from shipment from the Manufacturer, per the terms and conditions of the Manufacturer's written Limited Warranty.

- B. For standard applications, the resilient athletic flooring is warranted against excessive wear under normal usage for a period of ten (10) years from the date that is 30 days from shipment from the Manufacturer, per the terms and conditions of the Manufacturer's written Limited Warranty. For applications in ice arenas/ice skate use, the resilient athletic flooring is warranted against excessive wear under normal usage for a period of five (5) years from the date that is 30 days from shipment from the Manufacturer, per the terms and conditions of the Manufacturer's written Limited Warranty.
- C. Refer to current copy of Manufacturer's written Limited Warranty for all terms and conditions, which shall be obtained directly from Manufacturer. In no event shall any warranties provided by any third parties (including distributors, insurance and/or private label providers) be considered a valid.

PART 2 – PRODUCTS

2.01 MANUFACTURED PRODUCT

A. Basis-Of-Design Manufacturer

1. Mondo Luxembourg S.A.: Z.I. Foetz - Rue de l'Industrie, L-3895 Foetz, Luxembourg.

B. Description

1. Sport Impact is prefabricated resilient athletic flooring, calendered and vulcanized, with a base of natural and synthetic rubbers, stabilizing agents and pigmentation, as manufactured by Mondo Luxembourg S.A. or approved equal.
2. Dual durometer construction, vulcanized into a single prefabricated sheet/tile for optimal performance and durability. The Shore hardness of the top layer (wear layer) will be greater than that of the bottom layer (backing); Shore hardness of layers to be recommended by the Manufacturer and to respect limits specified.
3. Health-Conscious Production: Sport Impact is free from red listed ingredients (LBC Red List) and is manufactured without bisphenol A (BPA), formaldehyde, halogens, heavy metals, isocyanates, phthalates and polyvinyl chloride (PVC).
4. Thickness: 0.394" (10 mm).
5. Colors: Provided in standard, solid background colors with randomly dispersed colored chips throughout the wear layer's entire depth.
6. Surface Texture: Sealskin.
7. Formats: Available in sheets that are 6'1" (1.86 m) wide and 29'6" (9 m) long [min. 19'8" (6 m)/max. 36'1" (11 m)]; available in tiles that are 36" x 36" (91.35 cm x 91.35 cm).

C. Performance

1. Performance of the Manufactured Product to conform to the following criteria:

Performance Criterion	Test Method	Requirement	Result*
Elongation at Break	ASTM D412	≥100%	≥120%
Tensile Strength	ASTM D412	≥300 psi	≥550 psi
Static Coefficient of Friction (neolite heel)	ASTM D2047	≥0.50 (dry)	≥0.80 (dry)
Hardness of Top Layer (Shore A)	ASTM D2240	80 ± 5	80

Hardness of Bottom Layer (Shore A)	ASTM D2240	70 ± 8	75
Abrasion Resistance (H18 wheel, 1000g, 1000 cycles)	ASTM D3389	≤1.0 g	≤0.4 g
Impact Insulation Class	ASTM E492	-	≈ 59 dB (IIC)
Critical Radiant Flux	ASTM E648	≥0.22 W/cm ² (Class 2)	≥0.45 W/cm ² (Class 1)
Reduction of Bacterial Activity - <i>MRSA (ATC 43300)</i>	ASTM E2180	-	≥99,99% reduction
Thickness	ASTM F386	10 mm (±0.2 mm) 0.394" (±0.008")	Compliant
Resistance to Chemicals	ASTM F925	≤Slight Change	Compliant **
Static Loading (Tested at 250psi)	ASTM F970	≤0.008 in	0.002 in
Heat Resistance	ASTM F1514	ΔE ≤8.0	Compliant
Light Resistance	ASTM F1515	ΔE ≤8.0	Compliant
Reduction of Bacterial Activity - <i>MRSA (ATC 43300)</i>	ISO 22196	-	≥99,999% reduction
Indoor Air Quality (IAQ) Certifications			
CA Section 01350	CA: V1.1-2010	-	Compliant
Greenguard Gold	Greenguard	-	Compliant
Greenguard Certification	Greenguard	-	Compliant
French Decree № 2011-321	ISO 16000-9	-	Compliant (Class A+)

*Results obtained from manufacturing controls can vary between production lots and do not constitute representations or warranties as to any particular production lot. Mondo reserves the right to modify product design and/or specifications at any time without notice.

**For complete list of chemicals tested, concentration and contact time, please communicate with Mondo's Technical Department.

D. Limitations

- For areas subject to surface impacts, such as designated free weight areas, it is recommended to adhere the resilient athletic flooring directly to the concrete substrate for optimal performance. Whenever possible, avoid installing resilient athletic flooring on weaker surfaces that may offer less resistance to continuous impacts.

E. Materials

- Provide Sport Impact rubber flooring manufactured by Mondo Luxembourg S.A. or approved equal.
- Provide Manufactured Product as specified in section 2.1.2 Description.

2.02 ACCESSORIES

- Provide adhesive certified by Manufacturer: Mondo PU 105 (polyurethane) adhesive is recommended for installations over concrete. For suitability, recommendations and use, please refer to Manufacturer's current printed adhesive data sheets. In some cases, Mondo EP 55 (epoxy) may be used in areas that have not been specified for use of Mondo Everlay products, and that will not be subject to surface impacts or heavier dynamic loads (bleachers, equipment, etc.). For acceptable installations over wood or Mondo Everlay products (where surface impacts are not a concern), please consult Mondo's Technical Department for current adhesive recommendations.

- B. Portland cement based patching or leveling compound to be supplied or recommended/approved by Manufacturer.

PART 3 – EXECUTION

3.01 INSTALLERS

- A. Refer to section 1.04 of this document for information on installers.

3.02 EXAMINATION

- A. Prior to resilient athletic flooring installation, ensure substrate is ready to receive resilient flooring and has been prepared according to Manufacturer's current substrate surface preparation guidelines. Refer to current version of ASTM F710 for additional information.
- B. Ensure that concrete slabs, on or below grade, are installed over a permanent effective vapor retarder, respecting current versions of the standard practice ASTM E1643 and the standard specification ASTM E1745. The vapor retarder must be placed directly underneath the concrete slab, above the granular fill, per Manufacturer's instructions. The vapor retarder must have a perm rating of 0.1 or less and must have a minimum thickness of 10 mil (0.010 in).
- C. Ensure that no concrete sealers or curing compounds have been applied to or mixed into the concrete (refer to Section 03 0500 – Common Work Results for Concrete of Division 3).
- D. Installation of the resilient athletic flooring to be carried out no sooner than the specified curing time of the concrete (normal density concrete curing time is approximately 28 days for development of design strength, having a minimum 3500 psi or 25 MPa in compressive strength).
- E. Ensure that concrete surface is free of any contaminant that could inhibit bond (paint, wax, dust, oil or grease, sealer, curing compound, solvent, asphalt, old adhesive residues, etc.). All contaminants must be removed from the surface via mechanical abatement. Use of abatement chemicals is not recommended.
- F. Confirm concrete has a smooth finish, proper density and is highly compacted with a tolerance of 1/8th of an inch in a 10-foot radius (3.2 mm in a 3.05 m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.
- G. Moisture and alkalinity tests must be performed on all concrete substrates, under in-service conditions. It is recommended to turn on the HVAC unit prior to performing moisture testing, in order to ensure stable testing conditions and accurate results. The concrete's surface pH should be between 7 and 10. Relative humidity of the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F2170 (in situ probes). Moisture vapor emissions from the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F1869 (anhydrous calcium chloride).
- H. Ensure room and substrate temperatures are maintained prior to moisture testing and flooring installation, during the flooring installation, as well as a minimum of 48 hours after the flooring has been completely installed. Recommended ambient temperature range is between 65oF and 86oF and recommended ambient humidity range is between 35% and 55%.
- I. If installing over wood substrates, ensure exterior grade plywood with at least one good side, such as: APA (Engineered Wood Association) Exterior grade plywood (A-A Exterior, A-B

Exterior or A-C Exterior) and CANPLY (Canadian Plywood Association) Exterior certified plywood (Canada: Grade G2S A-A or G1S A-C. USA: G2S A-A, A-B, B-B, or G1S A-C, B-C). There must be proper underfloor ventilation, plywood must be dry and should have a moisture content ranging between 6 and 12%, when measured with a quality wood moisture meter (electronic hygrometer).

- J. Installation of resilient athletic flooring will not commence until the building is enclosed and all other trades have completed their work. It is the General Contractor or Construction Manager's responsibility to ensure that a secure and clean working area is maintained before, during and after the installation of the resilient athletic flooring.

3.03 PREPARATION

- A. Prepare substrate surface in accordance with Manufacturer's current printed guidelines.

3.04 INSTALLATION

- A. Install sheets of resilient athletic flooring following Manufacturer's current printed guidelines.
- B. Install all accessories following Manufacturer's current printed guidelines.

3.05 REPAIR

- A. Refer to section 1.3.4 for extra stock materials. Repair material must come from the same original dye lot as the Manufactured Product initially installed.
- B. Repairs are to be performed by Surfacing Contractor's qualified installers/technicians only.

3.06 CLEANING

- A. Always wait at least a minimum of 72 hours after the resilient athletic flooring has been completely installed before performing initial maintenance. Always maintain the resilient athletic flooring following Manufacturer's current printed guidelines.

3.07 PROTECTION

- A. As needed, protect resilient athletic flooring with 1/8" Masonite during and after the installation, prior to its acceptance by the Owner.
- B. Preserve the integrity of the installation and protect against direct sunlight/UV exposure; always ensure that windows and glass doors have inherent UV protection and/or are fitted with blinds/UV film.

END OF SECTION 09 6566

SECTION 09 6800**MODULAR CARPET TILE****PART 1 – GENERAL****1.01 SUMMARY**

- A. Related Documents: Drawings and general provisions of the Contract.
- B. As part of the organization's sustainability strategy, the owner intends to create a circular economy for as much of its facilities supply chain as possible. A key part of that circular economic model includes the owner's aim to recycle 100% of their existing and future flooring inventory as it becomes available for replacement. Depending on the deferred maintenance cycle (10-15 years), the effort will ideally result in the institution moving the physical footprint to a carbon neutral and landfill and incineration-free flooring program.
- C. The owner recognizes the embodied carbon impact of the building material supply chain and is intent on working to lower those Scope 3 (purchased goods) emissions whenever possible.
- D. The successful manufacturer will have implemented a focused and systematic effort to reduce their overall environmental footprint. In order to eliminate greenwash, the manufacturer must be able to clearly articulate their company-wide goals and achievements with specific performance against historical benchmarks.
- E. This is a *non-proprietary* specification. However, owner reserves the right to analyze all products using criteria that align with their sustainability goals, and ultimately use the most appropriate option submitted that still meets performance requirements.

1.02 SUBMITTALS

- A. 3rd party verified, product-specific Environmental Product Declarations (EPDs) for all specified products.
- B. Shop drawings shall be submitted to Architect/Owner for approval prior to installation of floor. Copy of approved shop drawings to be available on job site during installation.
- C. Randomly installed modular products are preferred due to elimination of dye lots, minimization of waste and ease of repair/replacement. Manufacturer will inform Architect/Owner of projected trim waste on project prior to bid.
- D. Floor schedule using same room designations indicated on drawings.
- E. Product Data: Provide data on specified products, describing physical and performance characteristics, sizes, patterns, colors available, method of installation and sustainability attributes.
- F. Verification Samples: Submit samples illustrating color and pattern for each carpet material specified.
- G. Manufacturer's Installation Instructions
- H. Maintenance Data: Include maintenance procedures, recommendations for maintenance materials, equipment, and suggested schedule for cleaning.

- I. Manufacturer's Product Warranty
- J. ~~Carbon Neutral Impact Estimate stating how many tons of greenhouse gas emissions will be offset (high quality verified carbon offsets to be purchased by manufacturer).~~

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications

- 1. Company specializing in manufacturing specified carpet with minimum 15 years documented experience in the production of modular carpet.
- 2. Manufacturer must provide verification of management systems in compliance with ISO 9001 Quality Management System and ISO 14001 Environmental Management System.

B. Installer Qualifications

- 1. Flooring contractor to be a specialty contractor normally engaged in this type of work and shall have prior experience in the installation of modular carpet.
- 2. Flooring contractor possessing Contract for the product installation shall not sub-contract the labor without written approval of the Project Manager.
- 3. Flooring contractor will be responsible for proper product installation, including floor testing and preparation as specified by the manufacturer.
- 4. Flooring contractor to provide Owner a report of all recycling activity prior to final payment.

1.04 DELIVERY, STORAGE, & HANDLING

- A. Deliver materials to the site in manufacturer's original packaging listing manufacturer's name, product name, identification number, and related information.
- B. Store in a dry location, between 65 degrees F and 90 degrees F and a relative humidity below 65%. Protect from damage and soiling.
- C. Make stored materials available for inspection by the Owner's representative.
- D. Store materials in area of installation for minimum period of 48 hours prior to installation.

1.05 PROJECT CONDITIONS

- A. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document and Manufacturer's installation instructions.
- B. The installer shall ensure that all material used in sub-floor preparation and repair is as provided in the carpet manufacturer's installation instructions.
- C. Maintain minimum 65 degrees F ambient temperature and 65% Relative Humidity for 72 hours prior to, during, and 48 hours after installation.
- D. Do not install flooring until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1.06 EXTRA MATERIALS

- A. Provide additional 5% carpet for “maintenance stock”

PART 2 – PRODUCTS**2.01 RECYCLED & BIOBASED CONTENT**

- A. The highest post-consumer recycled content and/or bio-based content (per ASTM-D6866 testing and/or USDA Certified Biobased) is preferred .
- B. Manufacturer must clearly itemize the amount of post-consumer/pre-consumer/bio-based content.

2.02 RECYCLABILITY & RECYCLING PROGRAM

- A. Product should be designed for recycling back into flooring, preferably in a 3rd party verified closed loop system.
- B. Products whose removal requirements or processes may materially damage sub-floor will not be considered.
- C. Manufacturer must maintain and operate a recycling effort capable of reclaiming installed carpet. Manufacturers with a 3rd party verified recycling operation preferred. A written plan must be approved by owner in writing prior to award.

2.03 CERTIFICATION

- A. Product must be certified at the Gold or Platinum level to NSF/ANSI-140, the Sustainable Carpet Assessment Standard (SCAS). Product certification must be conducted by an independent, third party organization with documentation.

2.04 PRODUCT WARRANTY

- A. Warranty to be sole source responsibility of the Manufacturer.
- B. If the product fails to perform as warranted when properly installed and maintained, the affected area will be repaired or replaced at the discretion of the Manufacturer.
- C. Chair pads should not be required as a condition of warranty.
- D. The 15-year non-prorated warranty shall specifically warrant:
 - 1. Against loss of more than 10% by weight of face fiber
 - 2. Against edge ravel, backing separation, shrinking, stretching, cupping, doming and excessive static electricity
 - 3. 100% solution dyed yarns against excessive color loss

2.05 FIBER

- A. Nylon Fiber: 100% Solution Dyed Bulk Continuous Filament (BCF) Nylon Type 6 or Type 6,6
- B. Modification ratio of 2.2 or less

- C. 50-100% recycled nylon fiber with post-consumer content is preferred
- D. No topical stain resistance coatings, preference for integrally stain resistant nylon (i.e., cationic/sulphonated)

2.06 BACKING CHARACTERISTICS

- A. Primary Backing: Non-woven synthetic (no SBR pre-coat)
- B. Secondary Backing: Thermoplastic with fiberglass reinforcement. An operational recycling technology of this backing system must be in place and commercially available for consideration.
- C. Impervious to moisture
- D. No delamination

2.07 PERFORMANCE CHARACTERISTICS

- A. Test reports for the following performance assurance testing to be submitted upon request. Submitted results shall represent average results for production goods of the referenced style. Requirements listed below must be met by all products.

Characteristic	Test Method	Requirement
Appearance Retention Rating	ASTM D-5252 (Hexapod) or ASTM D-5417 (Vettermann) or EN 1307	³ 3.5 Severe Traffic (Heavy Contract) ³ 3.0 Heavy Traffic (General Contract)
Tuft bind	ASTM D – 1335	Minimum average value, 8.0 pounds
Dimensional Stability	ASTM D7330/ISO2551	Maximum dimensional change $\pm < 0.15\%$
Delamination Resistance of Secondary Backing	ASTM D – 3936	Not less than 3 pounds per inch
Color Fastness	Light Fastness AATCC 16E	≥ 4.0 after 60 hours
	Crock Fastness AATCC 8/AATCC 165	Wet ≥ 4.0 , Dry ≥ 4.0
	Ozone Fade AATCC 129	≥ 4.0
	Water AATCC107	≥ 4.0
	Burnt Gas Fade AATCC 23	≥ 4.0
Flammability	Pill Test: Complies with federal flammability standard CPSC FF-1-70 Tested per ASTM D 2859.	Passes
	Radiant Panel Test (ASTM E648)	Critical radiant flux ³ 0.22 watts/cm ²
	Smoke Density (ASTM E662)	< 450 flaming mode
Soil/Stain Protection	AATCC 175-1991	³ 8.0 on the Red 40 Stain Scale Meet - mostly some lighter colors such as white, ivory, may not meet
Static Generation at 70° F	AATCC 134	US is < 3.5 kV at 20% R.H. (£3.0 in Interface spec is 3.0)

2.08 PRODUCT MANUFACTURING SPECIFICATIONS

- A. Manufacturer will meet the following construction requirements:
 - 1. Construction: Tufted
 - 2. Dye Method: 100% Solution Dyed
 - 3. Carbon Footprint: Neutral, as certified by 3rd party, across the full product life cycle using carbon offsets verified to the Gold Standard, VCS, CAR, or equivalent standard.
- B. Substitutes/Alternates
 - 1. Subject to compliance with all requirements, "or equal" must also match the selected colors, have similar aesthetic appearance. Substitution sample and submittals must be submitted for written approval of quality and color at least ten days prior to bid to be considered.

2.09 PRODUCT EMBODIED CARBON SPECIFICATIONS (When required)

- A. Manufacturer will provide data establishing the fact that their products are below the 80% threshold for carpet tiles produced in the Americas (with a preference for below 20% threshold) according to the free Embodied Carbon in Construction Calculator (EC3) tool which is based on publicly available third party verified Environmental Product Declarations following ISO 14025 guidelines with Product Category Rules (PCR) for Building-Related Products and Services - Part A: Calculation rules for the LCA and Requirements Project Report.
- B. Substitutes/Alternates
 - 1. Subject to compliance with all requirements, "or equal" must have similar sustainability characteristics. Substitution sample and submittals must be submitted for written approval of quality and color at least ten days prior to bid to be considered.

2.10 ACCESSORIES

- A. Materials recommended by Manufacturer for patching, priming, etc.
- B. Transition strip free installation desired. Carpet and hard surface of comparable total thickness should be installed adjacent to each other free of transition strips.

PART 3 - EXECUTION**3.01 EXAMINATION / PREPARATION**

- A. Prepare sub-floor to comply with criteria established in Manufacturer's installation instructions. Use only preparation materials that are acceptable to the Manufacturer.
 - 1. Remove all substances from sub-floor that would interfere with or be harmful to the installation.
 - 2. Remove sub-floor ridges and bumps. Fill cracks, joints, holes, and other defects.
- C. Verify that sub-floor is smooth, level, and flat within specified tolerances and ready to receive carpet
- D. Verify that substrate surface is dust-free

- E. Verify that concrete surfaces are ready for installation by conducting moisture and pH testing. Results must be within limits recommended by Manufacturer.
- F. There will be no exceptions to the provisions stated in the Manufacturer's installation instructions.

3.02 INSTALLATION - GENERAL

- A. Install product in accordance with Manufacturer's installation instructions.
- B. Adhesive must be third party certified in compliance with California Department of Public Health (CDPH) Standard Method v1.2-2017. Provide documentation using one of the following certifications: Green Label Plus, Greenguard Gold, or SCS Indoor Advantage Gold.
- C. Installation methodology will lower exposure to VOC emissions for both installers & occupants of building with no use of seam sealing chemistry, which is often high-VOC solvent-based chemistry (even when water-based sealant is specified, due to faster curing times)
- D. Trim carpet neatly at walls and around interruptions.

3.03 PROTECTION & CLEANING

- A. Remove excess adhesive and/or seam sealer from floor and wall surfaces without damage.
- B. All rubbish, wrappings, debris, trimmings, etc. to be removed from site and recycled or disposed of properly.
- C. Clean and vacuum surfaces using a beater brush/bar dual motor commercial vacuum.
- D. After each area is installed, protect from soiling and damage by other trades. Do not use self-adhering films.

3.04 RECYCLING

- A. Scope of Work: Owner requires that existing carpet being removed and carpet trim waste from new installation be recycled in the best possible manner. A reclamation plan will be submitted to owner for approval at start of work. Said plan will provide directions for the reclamation of recyclable carpet at the job site.
 - 1. First choice is repurposing, provided carpet is in usable condition
 - 2. Second choice is closed loop recycling, turning carpet into carpet
 - 3. Third choice is recycling into another product type
- B. Description of Services Collection (Labor): Carpet must be removed from the existing installation and prepared for pickup based on the type of material and reclamation option selected. Specifications for removal from the job site are as follows:
 - 1. Carpet tile must be palletized and secured for shipping; shrink wrapped, banded, strapped.
 - 2. Pallets must be a minimum size of 40"x40" and material stacked approximately 54" high.

3. Pallets cannot be double stacked in the trailer.
 4. Tile must be kept dry and free of any moisture damage.
 5. Trailers must be free of any non-carpet debris, construction waste, cardboard boxes, trash.
 6. Material must not contain mold or mildew.
 7. Wet carpet will not be accepted.
 8. Material must not contain vinyl asbestos or adhesives containing asbestos.
- C. Material Loading: Shipper must load material on the carrier; drivers will not assist. Notification must be given prior to quote submittal of any special requirements such as liftgate, small trucks, etc. Additional fees will apply. Processing: All possible recycling options must be clearly presented and/or submitted on paper subsequent to job start. The accepted reclamation option must be approved in writing by the party requesting the services.
- D. Certification: A certificate verifying the reclamation of the carpet and the pounds of material diverted from the landfill will be furnished upon request.

END OF SECTION

09 6800

SECTION 09 9123**INTERIOR PAINTING****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- B. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Galvanized metal.
 - 5. Aluminum (not anodized or otherwise coated).
 - 6. Wood.
 - 7. Gypsum board.
- C. Related Requirements:
 - 1. Section 05 1200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this section.
 - 2. Division 09 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates; and "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates; and "High-Performance Coatings" for tile-like coatings.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Label each coat of each Sample.
 - 3. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Indicate VOC content.

1.04 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Paint: 5 gallons of the field wall color, and 1 gallon of each material and color applied.

1.06 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:
 1. Product name and type (description).
 2. Batch date.
 3. Color number.
 4. VOC content.
 5. Environmental handling requirements.

6. Surface preparation requirements.
 7. Application instructions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Lead Paint: It is not expected that lead paint will be encountered in the Work.
1. If suspected lead paint is encountered, do not disturb; immediately notify Architect and Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); products indicated or comparable product from one of the following:
1. Benjamin Moore & Co: www.benjaminmoore.com
 2. Dunn-Edwards Paint: www.dunnedwards.com
 3. PPG Paints: www.ppgpaints.com
 4. Sherwin-Williams: www.sherwin-williams.com
 5. Substitutions: As per Section 01 6000.
- B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:
- C. Products are approved by manufacturer in writing for application specified.
1. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.
- D. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.02 PAINT, GENERAL**A. Material Compatibility:**

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall provide materials that comply with VOC limits of authorities having jurisdiction and for interior paints and coatings applied at Project site, the following VOC limits exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
5. Floor Coatings: 100 g/L.

C. Colors: As indicated in a color schedule.

1. 10 percent of surface area will be painted with deep tones.

2.03 SOURCE QUALITY CONTROL**A. Testing of Paint Materials:** Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A.** Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.

1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Substrate Conditions:
 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Wood: 15 percent.
 - d. Gypsum Board: 12 percent.
 - e. Plaster: 12 percent.
 2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
 3. Plaster Substrates: Verify that plaster is fully cured.
 4. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could 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.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
 1. Concrete Floors: Remove oil, dust, grease, dirt, and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.03 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.04 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 INTERIOR MICROBICIDAL PAINTING SCHEDULE

- A. Gypsum Board, Concrete, CMU, and Wood Substrates: (Locker Rooms, Restrooms, Hallways, Lobbies, etc.).
 - 1. Microbicidal Latex Finish System: With topcoat EPA registered No. 64695-1.
 - a. Prime Coat: Primer, latex, interior:
 - 1) Manufacturer's Recommended Primer.
 - b. First Coat: Microbicidal Latex, interior, matching topcoat.
 - c. Topcoat: Microbicidal Latex, interior, semi-gloss (gloss in restrooms walls and ceilings):
 - 1) S-W Paint Shield Interior Latex Microbicidal Paint, D12W51, at 4.0 mils wet, 1.8 mils dry, per coat. Brush and roll application only.

3.07 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces (walls):
 - 1. Latex System:
 - a. Prime Coat: Primer, latex, interior. Eggshell
 - 1) S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss.
 - 1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
- B. Concrete Substrates, Pedestrian Traffic Surfaces (floors):
 - 1. Concrete Floor Sealer: Transparent finish. Application per manufacturer's instructions.
 - a. Two coats: Water-based coating such as Okon Seal & Finish - Concrete & Masonry Sealer or approved equal.
- C. CMU Substrates:
 - 1. Latex System:
 - a. Block Filler: Block filler, latex, interior/exterior:
 - 1) S-W PrepRite Block Filler, B25W25, at 75-125 sq. ft. per gal.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss:
 - 1) S-W ProMar 200 Zero VOC Latex, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.
 - d. Topcoat: Latex, interior, semi-gloss:
 - 1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

2. Water-Based Light Industrial Coating System: (For added durability)
 - a. Block Filler: Block filler, latex, interior/exterior:
 - 1) S-W PrepRite Block Filler, B25W25, at 75-125 sq. ft. per gal.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based, semi-gloss:
 - 1) S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K46-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 3. Epoxy System: Wet Area's Immersion Grade (Showers, Wet Areas)
 - a. Prime Coat: Epoxy, Block Filler
 - 1) S-W Kem Cati-Coat HS Epoxy Filler/Sealer, B42W400 Series (10-20 mils DFT)
 - b. Epoxy, high-build matching topcoat.
 - c. Topcoat: Epoxy, high-build, semi-gloss:
 - 1) S-W Macropoxy 646-100, B58-600 Series, at 5.0 to 10 mils dry, per coat
- D. Metal Substrates (Aluminum, Steel, Galvanized Steel):
1. Waterbased Acrylic System: (Standard system for doors & frames).
 - a. Prime Coat: Primer, rust-inhibitive, water based:
 - 1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
 - b. Intermediate Coat: Water-based Acrylic, interior, matching topcoat.
 - c. Topcoat: Water-based Acrylic, semi-gloss, interior:
 - 1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.
 2. Waterbased/Alkyd Urethane System: (Simple upgrade for interior metals 5h pencil hardness)
 - a. Prime Coat: Primer, rust-inhibitive, water based:
 - 1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
 - b. Intermediate Coat: Water-based acrylic-alkyd, interior, matching topcoat.
 - c. Topcoat: Water-based alkyd-urethane, semi-gloss, interior:
 - 1) S-W Pro Industrial Waterbased Alkyd Urethane Semi-Gloss, B53-1150 Series, at 4.0 mils wet, 1.4 mils dry, per coat.
 3. Water-Based Dry-Fall System: Exposed Ceilings
 - a. Top Coat: Dry-fall latex, flat:
 - 1) S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-181 Series, at 6.0 mils wet, 1.5 mils dry.
 - b. Top Coat: Dry-fall latex, eggshell:
 - 1) S-W Pro Industrial Waterborne Acrylic DryFall Eg-Shel, B42-82, at 6.0 mils wet, 1.9 mils dry.

4. Water-Based High Performance: Exposed Ceilings (Pools, Wet Areas)
 - a. Prime Coat: Zinc: (call out in Division 5, commercial blast required for zinc)
 - 1) S-W S-W Zinc Clad III HS – 100 (refer to data sheet), omit if factory primed
 - b. Intermediate Coat: Hi-Build Epoxy
 - 1) S-W Macropoxy® 646-100 Fast Cure Epoxy, B58-600 Series, 5-10 mils dry per coat.
 - c. Top Coat: Urethane Gloss:
 - 1) S-W Waterbased Acrolon 100, B65-720 Series, 2-3 mils dry per coat.
- E. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.
 1. Waterbased/Alkyd Urethane System:
 - a. Prime Coat: Primer sealer, latex, interior:
 - 1) S-W Premium Wall & Wood Primer, B28W8111, at 4.0 mils wet, 1.8 mils dry.
 - b. Intermediate Coat: Water-based Acrylic, interior, matching topcoat.
 - c. Topcoat: Water-based Acrylic, semi-gloss, interior:
 - 1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.
- F. Wood Substrates: Stain and Waterbased Urethane finish.
 1. Transparent System: Low VOC Finish
 - a. Stain Coat: interior: Manufactures Recommended Stain.
 - b. Intermediate Coat: WB Polyurethane, matching topcoat.
 - c. Topcoat: Clear, interior, satin, Gloss Level 3:
 - 1) S-W Wood Classics WB Polyurethane, A68 Satin.
- G. Gypsum Board Substrates:
 1. Latex System: Select Topcoat Sheen – Semi-gloss for is standard for APS
 - a. Prime Coat: Primer, latex, interior:
 - 1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat:
 - 1) S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
 - d. Topcoat: Latex, interior, eggshell:
 - 1) S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils) dry, per coat.
 - e. Topcoat: Latex, interior, semi-gloss:
 - 1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

2. Water-Based Light Industrial Coating System: (Consider for added durability and burnish protection, hallways, bathrooms, kitchens)
 - a. Prime Coat: Primer sealer, latex, interior:
 - 1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 wet, 1.0 mils dry.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based, eggshell:
 - 1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss:
 - 1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
3. Epoxy System: Wet Area's Immersion Grade (Showers, Wet Areas)
 - a. Prime Coat: Epoxy, Block Filler
 - 1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 wet, 1.0 mils dry Epoxy, high-build matching topcoat.
 - b. Intermediate Coat: Epoxy, high-build, semi-gloss.
 - c. Topcoat: Epoxy, high-build, semi-gloss:
 - 1) S-W Macropoxy 646-100, B58-600 Series, at 5.0 to 10 mils dry, per coat
4. Gypsum Board Projection Walls:
 - a. Prime Coat: Primer sealer, latex, interior:
 - 1) S-W ProMar 200 Primer, B28 Series, at 4.0 mils wet, 1.5 mils dry.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat, (Gloss Level 1):
 - 1) S-W SuperPaint Interior Latex, at 4.0 mils wet, 1.6 mils dry, per coat. SW 7757 High Reflective White.

END OF SECTION

Division Ten
SPECIALTIES

SECTION 10 1100**VISUAL DISPLAY UNITS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Markerboards and Tackboards.
- B. Tackable wall surfacing.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.
- B. Section 09 2116 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; Current Edition.
- B. ASTM A 424 - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2006.
- C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.
- D. ASTM F 793 - Standard Classification of Wall Covering by Use Characteristics; 2007.
- E. FS CCC-W-408 - Wall Covering, Vinyl-Coated; Federal Specifications and Standards; Current Edition.
- F. FS L-P-1040 - Plastic Sheets and Strips (Polyvinyl Fluoride); Federal Specifications and Standards; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3300 - for submittal procedures.
- B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, accessories, and display case.
- C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.
- D. Samples: Submit two samples 2 by 2 inch in size illustrating materials and finish, color and texture of markerboard, tackboard, tackboard surfacing, trim, and display case finishes.
- E. Manufacturer's printed installation instructions.
- F. Maintenance Data: Include data on regular cleaning, stain removal.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Comply with Kindergarten & Elementary School Standards.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Visual Display Boards:
 - 1. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
 - 2. Newline: <http://usa.newline-interactive.com/>
 - 3. Polyvision Corporation (Nelson Adams): www.polyvision.com
 - 4. Substitutions: See Section 01 6300 - Product Requirements.

2.02 VISUAL DISPLAY BOARDS

- A. Markerboards: Porcelain enamel on steel, laminated to core.
 - 1. Color: As selected from manufacturer's full range.
 - 2. Metal Face Sheet Thickness: 0.024 inch, 24 gage.
 - 3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
 - 4. Backing: Aluminum foil, laminated to core.
 - 5. Size: As indicated on drawings.
 - 6. Frame: Extruded aluminum, with concealed fasteners.
 - 7. Frame Profile: Manufacturer's standard
 - 8. Frame Finish: Anodized, natural.
 - 9. Accessories: Provide chalk tray, flag pole holder and map hooks.
- B. Tackboards: Fabric laminated to cork.
 - 1. Cork Thickness: 1/4 inch.
 - 2. Fabric: Vinyl coated fabric.
 - 3. Color: As selected from manufacturer's full range.
 - 4. Backing: Fiberboard, 3/8 inch thick, laminated to tack surface.
 - 5. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E 84.
 - 6. Size: As indicated on drawings.
 - 7. Frame: Extruded aluminum, with concealed fasteners.
 - 8. Frame Profile: Manufacturer's standard
 - 9. Frame Finish: Anodized, natural.
- C. Map Rail w/ Hooks and Flag Holder:
 - 1. Size: As indicated on drawings.
 - 2. Frame Profile: Manufacturer's standard
 - 3. Frame Finish: Anodized, natural.
- D. Combination Units and Units Made of More Than One Panel: Factory-assembled markerboards, and tackboards in a single frame, of materials specified above.
 - 1. Join panels of different construction with H-shaped extruded aluminum molding finished to match frame.
 - 2. Join panels of similar construction with butt joints, aligned and secured with steel spline concealed in edge of core.
 - 3. Configuration: As indicated on drawings.
 - 4. Units Too Large to Ship Assembled: Fully assembled in factory, then disassembled for shipping.
- A. Tackable Wall Surfacing: Seamless, 1/4 inch thick single-layer, resilient homogenous, self sealing, tackable material; bulletin board quality; shall be of all natural materials consisting of linseed oil, granulated cork, rosin binders and dry pigments, mixed and calendered onto a natural jute backing. Uni-color shall extend through the full thickness. Product shall contain a minimum of 50% pre-consumer recycled content, and 75% rapidly renewable materials content.
 - 1. Manufacturers: Forbo Linoleum Inc., or Walltalkers Tac Wall; www.walltalkers.com, or approved equal.
 - 2. Installation: Follow manufacturer's recommended instructions.

2.03 MATERIALS

- A. Porcelain Enameled Steel Sheet: ASTM A 424, Type I, Commercial Steel, with fired-on vitreous

finish.

- B. Vinyl Coated Fabric: ASTM F 793 Category VI; clear top overcoat of polyvinyl fluoride in accordance with FS L-P-1040 Type 1, Grade B, Class 2, 0.0005 inch thick.
- C. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.
- D. Foil Backing: Aluminum foil sheet, 0.005 inch thick.
- E. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

- A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall, full width of frame.
- B. Map Supports: Formed aluminum sliding hooks and roller brackets to fit map rail.
- C. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
- D. Flag Holders: Cast aluminum bored to receive 1 inch diameter flag staff, bracketed to fit top rail of board.
- E. Marker Tray: Aluminum, manufacturer's standard profile one piece the full length of marker board, closed ends; concealed fasteners, same finish as frame.
- F. Mounting Brackets: Concealed.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.
- C. Verify flat wall surface for frameless adhesive-applied boards.

3.02 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
- B. Install with top of chalk tray at 24 inches above finished floor.
- C. Secure units level and plumb.
- D. Butt Joints: Install with tight hairline joints.
- E. Carefully cut holes in boards for thermostats.

3.03 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION

SECTION 10 1400**SIGNAGE****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Interior signage of the following types:
 - 1. ADA compliant interior signage.
 - 2. Room Signs.
 - 3. Restroom Signs.
 - 6. Door Exit Signs (non-illuminated at egress doors).
- B. Interior Dimensional Letters.
- C. Interior Vinyl Graphics

1.02 REFERENCES

- A. 2010 ADA Standards for Accessible Design.
- B. ANSI/ICC A117.1 - Accessible and Useable Buildings and Facilities; current edition.
- C. ATBCB ADAAG - Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG); U.S. Architectural Transportation Barriers Compliance Board.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature.
- C. Shop Drawings: List sign styles, letterform and letter heights, locations and dimensions of each interior sign. Submit manufacturer's product data and installation methods for each type of sign required.
- D. Submit supplier's standard color samples for purposes of color selection of ADA appliqué. Color samples must be actual materials used in signage, printed color charts are not acceptable.
- E. Submit copy of manufacturer's product warranty.
- F. Selection Samples: One complete set of color chips representing manufacturer's full range of available colors.
- G. Verification Samples: One full size samples, representing type, style and color specified including method of attachment.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements of ANSI/ICC A117.1 and ADAAG.
- B. Printed background inserts must be created with the approval of architect and end user and may include use of graphic content such as logos or graphic motifs and may also require matching of colors from approved interior finishes palette.
- C. Printed background inserts must be manufactured in color managed work flow with the following capacities:
 - 1. All printing must be done using a profiled printer with transmissible ICC profile.
 - 2. All approved colors used in final design must have LAB values recorded and submitted to

architect/owner for future reference

3. Printing must be performed on calibrated printer such that future orders of insert can be reproduced within 5 Delta E of recorded LAB values.
- D. Manufacturer must provide template for changeable (transparency) inserts in MS Office Word format. Template file must include cut lines to indicate proper size of finished insert.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inspect products upon receipt. Store products in manufacturer's packaging until ready for installation.

1.06 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. SPELLING OF ALL INTERIOR DIMENSIONAL LETTERING AND ALL EXTERIOR LETTERING MUST BE VERIFIED WITH OWNER PRIOR TO ORDERING.

2.02 MANUFACTURERS

- A. ARI Graphix & Signs; www.arigraphix.com
- B. Century Sign Builders; www.csbsigns.com
- C. Gemini Incorporated, www.signletters.com; 800-538-8377
- D. Vista System Inc., www.vistasystem.com
- E. Substitutions: See Section 01 6000 - Product Requirements.

2.03 INTERIOR SIGNS

- A. ROOM IDENTIFICATION, and RESTROOM SIGNS: shall be constructed to be ADA-Compliant (ANSI A117.7) with changeable message inserts and conform to a curved extruded aluminum frame of the sizes specified. This sign/product includes assembly with the following characteristics:
- B. Basis of Design: Vista System, Inc.
 1. ADA Insert.
 - a. Tactile lettering and symbols shall be formed using rotary engraving method and bonded to sign plaque using 3M Scotch 467HP adhesive. Lettering and symbols must have 1/32" return cut to 22 Degree angle. Letters, and symbols must be constructed with materials having embedded coloration that is the final approved color for the signs. Products with painted or otherwise applied coloration method are not acceptable.
 - b. Text shall be accompanied by Grade 2 Braille on signs requiring Braille.
 - c. Lettering color black.
 - d. Room Numbers shown. Information provided by Architect.
 - e. Letter Style: Avant Garde Medium
 - f. Sign plaques, lettering, and symbols shall have a matte or eggshell finish.
 - g. Insert Base shall be constructed using 0.0625" single-ply non-glare acrylic multipolymer material with either continuous embedded pigment or a micro-surfaced color layer (depending on color selection).
 2. Transparency Insert

- a. Changeable message insert will be fabricated from commonly available transparency media no less than 5 mil thick that is compatible with inkjet or laser printers.
 - b. Manufacturer is to provide all changeable inserts for signs during initial installation.
 - c. Room names shown. Information provided by Architect.
 - d. Manufacturer will provide template file to end-user/client allowing for new inserts to be created for changeable (transparency) inserts. Provided file must integrate with client's already existing software environment and not require the implementation of new or proprietary software.
 - e. Printed background inserts must be created with the approval of architect and end user and may include use of graphic content such as logos or graphic motifs and may also require matching of colors from approved interior finishes palette.
3. Opaque (Printed) Insert
 - a. Opaque graphic insert will be created using a standard printing process. Insert material may include: Printed paper, artistic papers, velum, etc.
 - b. Graphic element as designed by Architect. Color selected from manufacturers full range.
 - c. Printed insert must be of high quality and perform within the known limitations of the selected printing process.
 - d. Printed background inserts must be manufactured in color managed workflow with the following capacities:
 - 1) Printing must be done using a profiled printer.
 - 2) Approved colors used in final design must have LAB values recorded and submitted to Architect / Owner for future reference.
4. Curved Aluminum Sign Frame
 - a. Provide curved aluminum sign frame as provided by Vista Systems Inc. Produce smooth, curved aluminum-based panel sign surfaces with interchangeable faceplates constructed to remain flat under installed conditions and within tolerance of plus or minus .015" when measured diagonally.
 - b. Aluminum frame shall be constructed from curved aluminum extrusions and contoured frame edge profiles with two (2) interlocking screw mounted end caps.
 - c. Aluminum frame shall be capable of containing both the opaque insert and changeable insert behind the clear ADA insert (which it also must contain)
 - d. Aluminum frame allow that inserts are changeable but cannot be accessed without a tool or implement, and do not require any part of the frame to be disassembled to change the insert. Inserts may be removed with a suction cup.
 - e. Aluminum sign frame shall be silver, clear anodized.
 - f. End caps, provided with matching screws, shall be brushed aluminum, clear anodized.
 - g. Clear cover for extrusion thick polycarbonate, glossy one side, non-glare one side.
5. Sign Sizes:
 - a. Room identification signs, 8.5" W by 5.5"H (all rooms).
 - b. Restroom signs, 8" W by 8"H (all restrooms).
 - c. Door exit signs, 4.5" W by 3" H (all egress doors).
 - d. Directional signs: 8 by 8 inches.
 - e. Directional arrows: 4-3/4 by 4-3/4 inches.
6. Text and Numbers: To be selected by Architect.

2.04 INTERIOR DIMENSIONAL LETTERS

- A. INTERIOR DIMENSIONAL LETTERS locations as shown in drawings:
 1. Basis of Design: Gemini, Inc.; www.geminimade.com
 2. Type: Individual mounted letters.
 3. Construction: One-piece; Cast Metal.

4. Lettering Style: TBD
5. Wall Mount: Concealed mounting.
6. Install per manufacturer's recommendation. Contractor shall install recommended backing at each location as required to securely mount lettering. Coordinate required backing substrate and locations prior to shop submittal.
6. Color of Metal: Clear anodized.
7. Finish: Brushed.
8. Letter Sizes: Refer to drawings.
9. Title: TBD
10. Installation Locations: Refer to drawings.

B. INTERIOR VINYL GRAPHICS

1. Provide graphics made of cut vinyl graphic film applied directly to the mounting surface (glass, smooth wall, doors, etc.).
2. Material & Colors:
 - a. Opaque & Translucent: To be constructed of high performance cast vinyl graphic film products such as 3M Scotchcal or equal with a 5 year or greater warranty.
3. All graphics must be computer cut from professional quality artwork. No hand cut vinyl film shall be installed.
4. Graphic images shall be cut from sufficiently large rolls of material to minimize seams or joining of material to create one graphic.
5. Graphic images shall be provided in the sizes & quantities indicated on the shop drawings.
6. Installation method:
 - a. Graphic images shall be installed free of bubbles, wrinkles or other anomalies.
 - b. Provide signs as reverse applied (second surface) where required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine installation areas to ensure that conditions are suitable for installation.
- B. Examine signage for defects prior to installation. Do not install damaged signage.

3.02 PREPARATION

- A. Verify mounting heights and locations for interior signage will comply with referenced standards.
- B. Clean mounting locations of dirt, dust, grease or similar conditions that would prevent proper installation.

3.03 INSTALLATION

- A. Install signs level, plumb, without distortion, and in proper relationship with adjacent surfaces using manufacturer's recommended standard mounting system.
- B. Remove adhesive from exposed sign surfaces as recommended by manufacturer.
- C. Clean signs after installation as recommended by manufacturer.
- D. Replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 1500**VIDEO DISPLAY SYSTEMS****PART 1 – GENERAL****1.01 SECTION INCLUDES**

- A. Panelized LED video display systems (Electronic Marquee Sign).

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 – Grounding and Bonding for Electrical Systems.
- B. Section 26 0535 – Raceways and Boxes for Electrical Systems

1.03 REFERENCE STANDARDS

- A. ANSI/Infocomm 10 – Audiovisual Systems Performance Verification; 2013.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Conduct a pre-installation meeting two weeks prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. Product Data: Product Data: Provide manufacturer's data sheets on panelized LED display systems including recommendations for preparation, storage and handling, and installation.
- B. Shop Drawings: Indicate cable routing, connections between equipment, anchor and support details, and adjacent construction.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in compliance with manufacturer instructions.

1.08 WARRANTY

- A. See Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 – PRODUCTS**2.01 MANUFACTURERS**

- A. Basis of Design: Model Number: GS6-80x150-18.85-RGB-2V, by Daktronics, Inc, Brookings, SD; 4'8" H x 8'1" W x 5" D, Full Color, Double Sided; www.daktronics.com

2.02 PANELIZED LED VIDEO DISPLAY

- A. Performance Requirements:
 - 1. Comply with performance standards based on tests conducted in accordance with ANSI/Infocomm 10.
- B. System Type: Flat.
 - 1. Line Spacing: 15.85mm
 - 2. LED Colors: RGB; 281 trillion colors
 - 3. Horizontal Viewing Angle: 140 degrees.
 - 4. Vertical Viewing Angle: 160 degrees (plus/minus 80 degrees off center).
 - 5. Brightness: 12,000 adjustable
 - 6. Mount Type: Free Standing/Self Supporting.
 - 7. Location: Outdoor.
 - 8. Total Height: 4 feet 8 inches. Total Length: 8 feet 1 inches .
 - 9. Data Connections: Ethernet Bridge Radio and Ethernet CAT7 or CAT6a (coordinate with Electrical data specifications).

2.03 CONTROLS

- A. Interface Unit:
 - 10. Working Voltage: 120, 120/240 VAC Single Phase
 - 11. Control Suite Software
 - 12. Coordinate software installation with District Representative

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that substrates and support structure is in place and properly prepared.
- B. Verify that required power and data sources are provided.
- C. Verify that space is available for centrally located components.
- D. Notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Prepare substrates using the methods recommended by the manufacturer for achieving the best result under the project conditions.
- B. Do not proceed with installation until support structure and substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install message center and signs level and plumb with fasteners recommended by the manufacturer.
- C. Record any necessary changes to the system design

3.04 CLOSEOUT ACTIVITIES

- A. Demonstrate proper operation and maintenance of equipment to Owner's designated representative.
- B. Review service and support contacts.

3.05 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

SECTION 10 2613**CORNER GUARDS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Corner guards.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking for corner guard anchors.
- B. Section 09 2116 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; Current Edition.
- B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.
- C. Samples: Submit two sections of corner guard, 4 inch long, illustrating component design, configuration, color and finish.

1.05 PROJECT CONDITIONS

- A. Coordinate the work with wall or partition sections for installation of concealed blocking or anchor devices.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Corner Guards:
 - 1. Construction Specialties, Inc, Acrovyn: www.c-sgroup.com.
 - 2. InPro Corporation: www.inprocorp.com.
 - 3. Koroseal Wall Protection Systems; www.koroseal.com
 - 4. Pawling Corp.; www.pawling.com
 - 5. Substitutions: See Section 01 6300 - Product Requirements.

2.02 COMPONENTS

- A. Corner Guards - Surface Mounted: Extruded one-piece unit, installed with screws.
 - 1. Material: Type 304 stainless steel, 16 gauge, No. 4 finish, ASTM A 176.

2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E 84.
 3. Size: 2 inches.
 4. Length: One piece, 96 inches unless otherwise indicated on drawings.
- B. Corner Guard - Surface Mounted (where noted on drawings): High impact vinyl with extruded aluminum full height retainer and integral impact absorbing device.
1. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
 2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E 84.
 3. Size: 2 inches.
 4. Corner: Square.
 5. Color: As selected from manufacturer's standard colors.
 6. Length: One piece, 48 inches.
 7. Preformed end caps.
- C. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.
- B. Corner guards are to be installed at outside corners in corridors, halls, and where shown on drawings.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

END OF SECTION

SECTION 10 4400**FIRE PROTECTION SPECIALTIES****PART 1 – GENERAL****1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers; 2010.
- B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

- A. See Section 01 3300 - for submittal procedures.
- B. Shop Drawings: Indicate cabinet physical dimensions.
- C. Product Data: Provide extinguisher operational features.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 QUALITY ASSURANCE

- A. Extinguisher, cabinets, and accessories shall be products of a single manufacturer.
- B. Extinguisher shall conform to ANSI/NFPA and bear UL label in accordance ANSI/UL 711 testing.
- C. Fire rated cabinets shall meet the requirements of ASTM E814 and be certified and labeled for use in one and two hour wall systems.

1.06 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 – PRODUCTS**2.01 MANUFACTURERS**

- A. Basis of Design Fire Extinguishers, Cabinets, and Accessories: Larsen's Manufacturing Co.; www.larsensmfg.com
- B. Other manufacturers:
 - 1. Ansul, Inc.: www.ansul.com.
 - 2. JL Industries, Inc.: www.jlindustries.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.
- B. Multi-purpose **DRY** chemical; Larsen Number MP10.
 - 1. UL rating: 4A-80B:C
 - 2. Capacity: 10 pounds.
 - 3. Size: 5 inches diameter by 20 inches high (overall width, 7 3/4 inches).
 - 4. Product: MP Series by Larsen's
- C. **WET** chemical type, bracket mounted for Kitchens:
 - 1. UL rating: 2A:K
 - 2. Capacity: (1) 2.5 gallons (9 L) minimum **OR** (2) 1.5 gallons (6 L) minimum.
 - 3. Size: **2.5 gallon is** 7 inches diameter by 24.5 inches high (overall width 9 inches) **OR 6 liters is** 7 inches diameter by 25 inches high (overall width 9 inches)
 - 4. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to security fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 5. Product: WC Series by Larsen's

2.03 FIRE EXTINGUISHER CABINETS

- A. Products: Provide recessed, semi-recessed, or surface-mounted type cabinets **as indicated on drawings**.
 - 1. Basis of Design Products: Semi-recessed; Larsen's Architectural Series AL 2712-RA.
- B. **Fire-Rated Cabinets:** Where cabinets are shown in rated assemblies for Recessed and Semi-recessed type cabinets:
 - 1. Cabinets shall meet the requirements of ASTM E814 and be certified and labeled for use in one and two-hour wall systems.
 - 2. Constructed of double wall, 18 gage cold-rolled steel with 5/8 inch core of fire barrier material. Mounting holes shall be pre-drilled at factory.
- C. **Semi-Recessed Cabinets:** Boxes constructed of 18 gauge, formed steel, with white baked enamel finish.
 - 1. Door and Trim: 1/2 inch thick, formed **Aluminum** with **[clear satin] [color]** anodized finish.
 - 2. Accessories: Aluminum pull handle and continuous hinge in finish matching door and trim, with self-adjusting roller catch and lock.
 - 3. Trim Projection: 4 inch, rolled edge.
 - 4. Glazing: Narrow light with clear, tempered safety glass.
- A. Fabrication:
 - 1. Form body of cabinet with tight inside corners and seams. Drill holes for anchorage.
 - 2. Fire rated cabinets to be constructed of double wall, 18 gage cold-rolled steel with 5/8 inch core of fire barrier material. Mounting holes shall be pre-drilled at factory.
 - 3. Form perimeter trim and door stiles by welding, filling, and grinding smooth.
 - 4. Hinge doors for 180 degree opening with continuous hinge.
 - 5. Glaze doors with resilient channel gasket.

2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.

- B. Verify rough openings for cabinet are correctly sized and located, and blocking has been provided.

3.02 INSTALLATION

- A. Install cabinets in metal stud and gypsum board partitions and CMU walls and other locations indicated on Drawings.
- B. Install fire rated cabinets in fire rated walls and partitions.
- C. Install cabinets plumb and level in wall openings.
- D. Secure rigidly in place in accordance with manufacturer's instructions.
- E. Place extinguishers and accessories in cabinets.

END OF SECTION

Division Twenty Two

PLUMBING

SECTION 22 0000**PLUMBING INDEX****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Plumbing Work, as indicated on the Drawings, and specified herein. Plumbing work indicated on the Drawings and/or specifications covering other trades shall conform to Division 22 of these Specifications.
- B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Plumbing systems, shall be accomplished without additional cost to the Owner.
- C. Furnish all labor and materials required for plumbing service connections to all the various items of equipment requiring plumbing or piping throughout the project shown on the Contract Drawings (even if not shown on Plumbing Drawings). Coordinate with other trades for the installation of required connections and service.

1.3 PLUMBING DIVISION INDEX

220500	GENERAL PLUMBING REQUIREMENTS
220523	VALVES
220700	PIPING INSULATION
221000	PIPE AND PIPE FITTINGS
221113	DOMESTIC WATER SYSTEMS
221313	SOIL AND WASTE PIPING SYSTEMS
224200	PLUMBING FIXTURES

PART 2 - PRODUCTS - NOT USED**PART 3 - EXECUTION - NOT USED****END OF SECTION****22 0000**

SECTION 22 0500**GENERAL PLUMBING REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes: General Plumbing Requirements specifically applicable to Division 22 sections in addition to Division 1- General Requirements.
- B. Scope:
 - 1. The work covered by this division consists of performing all operations in connection with the installation of plumbing including site utility work as indicated under this section. This entire section applies to all plumbing work and all plumbing sections of these specifications. This Contractor shall read and comply with all sections of these specifications, including all General and Special Conditions.

1.2 REFERENCES

- A. Standard Requirements:
 - 1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. All work shall be executed in accordance with the local and state codes, ordinances, and regulations governing the particular class of work involved. This Contractor shall be responsible for the final execution of the work under this heading to suit these requirements. In the event of a conflict between the various codes and standards, the more stringent shall govern. Where these specifications and accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect/Engineer. The Architect/Engineer shall prepare any supplementary drawings required, illustrating how the work may be installed so as to comply. On approval of the change by the Architect/Engineer, the Contractor shall install the work in a satisfactory manner without additional cost to the Owner. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved. On completion of the work, this Contractor shall obtain and deliver to the Owner final certificates of acceptance. This Contractor shall furnish copies of each certificate to the Architect/Engineer.
- C. The Contractor shall secure all permits and licenses for his work and shall pay all fees in connection with such permits and licenses.
- D. The contractor shall hold and save the Owner free and harmless from liability of any nature or kind arising from his failure to comply with codes and ordinances.
- E. Any and all meter deposits and all utility extension costs shall be paid by the Contractor whose work is done in connection with the service that the meter is connected to.
- F. Schedule of Referenced Organizations: The following is a list of the acronyms of organizations referenced in these Specifications:
 - 1. AGA American Gas Association
 1515 Wilson Boulevard
 Arlington, VA 22209
 - 2. ANSI American National Standards Institute
 1430 Broadway
 New York, NY 10018

3. ASHRAE American Society of Heating Refrigerating and Air Conditioning Engineers
345 East 47th Street
New York, NY 10017
4. ASME American Society of Mechanical Engineers
345 East 45th Street
New York, NY 10017
5. ASPE American Society of Plumbing Engineers
960 Illuminating Building
Cleveland, OH 44113
6. ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103
7. AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235
8. AWS American Welding Society
2501 NW 7th Street
Miami, FL 33125
9. CISPI Cast Iron Soil Pipe Institute
1499 Chain Bridge Road
McLean, VA 22101
10. FM Factory Mutual System
1151 Boston-Providence Turnpike
Norwood, MA 02062
11. FS Federal Specification
General Services Administration
Specifications and Consumer Information Distribution
Section (WFSIS)
Washington Navy Yard, Building 197
Washington, DC 20407
12. NBFU National Board of Fire Underwriters
5530 Wisconsin Avenue, Suite 750
Chevy Chase, Maryland 20815
13. NEC National Electric Code (of NFPA)
14. NEMA National Electrical Manufacturer's Association
2101 L Street, NW
Washington, DC 20037
15. NFPA National Fire Protection Association
Battery March Park
Quincy, MA 02269
16. NSF National Sanitation Foundation
Box 1468
Ann Arbor, MI 48106
17. OSHA Occupational Safety and Health Administration
U.S. Department of Labor
18. PDI Plumbing and Drainage Institute
5342 Boulevard Place
Indianapolis, Indiana 46208
19. TIMA Thermal Insulation Manufacturers Association
Technical Services
1420 King Street

Alexandria, VA 22314

20. UL

Underwriters Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

- G. Underwriters Laboratories Inc. (UL): All materials, appliances, equipment, devices, or appurtenances shall conform to the applicable standards of Underwriters Laboratories Inc., where such standards have been established.

1.3 DRAWINGS

- A. Drawings and specifications shall be considered as cooperative, and work or materials called for by one and not mentioned in the other, or vice versa, shall be done and furnished as though treated by both.
- B. In the cases of discrepancies in figures, drawings, or specifications, the Architect/Engineer shall be notified immediately, and his decision shall determine the necessary adjustment. Without such decision, said discrepancies shall not be adjusted by the Contractor save only at his expense, and, in case of any settlement or any complication arising from such adjustment to the Contractor, he shall bear all extra expense involved.
- C. Should it appear that the work intended to be done, or any of the matters relative thereto, are not sufficiently detailed or explained on the drawings or specifications, the Contractor shall apply to the Architect/Engineer for such further drawings or explanations as may be necessary, allowing a reasonable time for the Architect/Engineer to supply same, and the Contractor shall conform to same as part of the Contract.
- D. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, reference shall be made to the Architect/Engineer whose decision shall be final and conclusive. No alleged oral admission, condonation, or inadvertent neglect on the part of the Architect/Engineer will be accepted as an excuse for inferior work.
- E. The mechanical and plumbing plans do not give exact details as to elevations of piping, exact locations for installation, and do not show all offsets, control lines, pilot lines, or other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, provide proper grading of lines, avoid all obstructions, conform to details of installation supplied by the manufacturer of the equipment to be installed, and thereby provide an integrated, satisfactory operational installation.
- F. Should the particular equipment which any Bidder proposes to install, require other space conditions than those indicated on the drawings, the Bidder shall arrange for such space with the Architect/Engineer before submitting his bid. Should changes become necessary on account of failure to comply with these details, the Contractor shall make such necessary changes at his (the Contractor's) own expense.
- G. The Contractor shall submit working scale drawings of all his apparatus and equipment which in any way varies from these specifications and plans which shall be checked by the Architect/Engineer and approved before the work is started, Contractor before work proceeds. Interference with structural conditions shall be corrected by the Contractor.
- H. All equipment shall be installed in accordance with the manufacturer's recommendations. Provide all accessories and components for optimum operation as recommended by the manufacturer.
- I. Utilities: The location, size, and pressure of utility lines are shown in accordance with the data given to this office by others. As Architect/Engineers, we cannot and do not guarantee the accuracy of this data. Each Bidder shall check and verify this data. The points of connection to utility lines are approximate only and shall be verified by each Bidder prior to submitting his Bid.

- J. Site visit: The Contractor shall visit the site prior to bidding and satisfy himself as the conditions under which the mechanical systems are to be installed. No subsequent allowance shall be made in his behalf for failure to make such a visit. Contractor shall examine all work noted under the demolition drawings and all new work and shall satisfy himself as to the extent of work required to be completed.

1.4 PRIOR APPROVALS

- A. Each equipment item for which the Contractor desires to install equipment other than the specific item identified in the equipment schedule or equivalent equipment by manufacturers specifically named in the schedule, the Contractor shall bear full responsibility to prove to the Engineer that the furnished equipment is equivalent to or better than the specified item. Failure to provide such proof will result in rejection of the shop drawing submittal by the Engineer. Prior written or verbal approval by the Engineer of equipment by other manufacturers will not relieve the Contractor of responsibility to provide equivalence. Prior approvals are required. Prior approvals are intended only to provide preliminary agreement that the alternate manufacturer may make equipment that complies with the specification requirements and not that all equipment manufactured by him is acceptable.

1.5 SHOP DRAWINGS

- A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this Contract. This shall include piping, ductwork, mechanical equipment, plumbing equipment, control items, etc. The Contractor shall submit to the Architect/Engineer a sufficient number of copies of all such shop drawings or catalog data to provide him with as many review copies as he may need, plus three (3) copies for retention by the Architect/Engineer. No materials or equipment shall be installed until officially approved by the Architect/Engineer.
- B. Before submitting Shop Drawings to the Architect/Engineer for review, the Contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of Shop Drawings is not intended to take the place in any way of the official review of the Architect/Engineer, and the Shop Drawings which have not been reviewed by the Architect/Engineer shall not be used in fabrication or installing any work.
- C. The review of Shop Drawings or catalog data by the Architect/Engineer shall not relieve the Contractor from responsibility for deviations from the plans and Specifications unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Architect/Engineer thereon, nor shall it relieve him from the responsibility for errors of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Architect/Engineer, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra costs are involved for making the change.
- D. After receiving approval on the make and type of materials, the Contractor shall order such materials in sufficient time so that no delay or changes will be caused. This is done to facilitate progress on the job, and failure on the part of the Contractor shall render him liable to stand the expense of any and all delays occasioned by failure on this part to provide necessary details. All shop drawings shall be delivered to the Architect/Engineer's office within thirty (30) days from the date of the contract.
- E. Shop drawings will be returned rejected unless the following information is included: name of the project, reference to all pertinent data in the Specifications or on the Drawings, size and characteristics of the equipment, and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings.

1.6 SUBMITTALS

- A. Submittal data shall be organized in commercial quality, three ring binders with durable and cleanable covers. Product information for each piece of equipment shall be separated by an indexing leaf with clear label tabs. The product name and symbol (e.g., AHU-1/Air Handling Unit) shall be presented for each item within the submittal. Complete data must be furnished showing performance, quality, and dimensions. A signed review by the Architect/Engineer must be obtained before purchasing any equipment.
- B. The following items shall be submitted for review by the Architect/Engineer but are not limited to:
 - 1. Pipe Insulation
 - 2. Coils
 - 3. Plumbing Fixtures and Trim
 - 4. Hydronic Air Control Devices
 - 5. Plumbing Equipment
 - 6. Flexible Pipe Connections
 - 7. Heating Terminal Equipment
 - 8. Vibration Equipment and Calculations

1.7 QUALITY ASSURANCE

- A. General: Comply with Division 1.
- B. Welder Qualifications: Welders shall be certified by the American Society of Mechanical Engineers (ASME) National Certified Pipe for the type of work being performed. Current operators' certificates in accordance with ASME standards shall be on file at the site and shall be available to the Architect/Engineer for examination. Coupons shall be available for review by the Architect and Engineer.
- C. Locations of all pipes, ducts, outlets, fixtures, etc., as shown on the drawings, are approximate only and are understood to be subject to such revisions as may prove necessary or desirable at the time the work is installed. Each Contractor will be required to install his work with relation to existing building conditions and shall be entirely responsible for the correctness of his work with reference to finished elevations, etc. Piping shown on the drawings is diagrammatic only and their exact locations, depths, and invert elevations shall be as required for proper flow and coordination with other trades.
- D. The contract drawing depicts graphically the arrangement of piping and ductwork. Should local conditions necessitate a rearrangement, or if any of the piping or ductwork can be installed to better advantage in a different manner, the Contractor shall, before proceeding with the work, prepare and submit three (3) copies of Drawings of the proposed arrangement for the Architect/Engineer's review.
- E. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such change shall be accompanied by Shop Drawings of the space in question.
- F. Each Contractor shall coordinate his work with that of all other trades to ensure that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines which require a stated grade for proper operation. Drainage lines shall take precedence over water lines in determination of elevations. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

- G. Equipment and Materials: The materials and equipment shall be new and shall be the standard products of the manufacturers regularly engaged in the production of Plumbing Equipment and shall be the manufacturer's latest standard design. Where two or more units of the same class of equipment are required, these units shall be the products of the same manufacturer. However, the component parts of the systems need not be the products of the same manufacturer. Specific equipment specified hereinafter is to be considered a standard of quality and operation. In general, all capacities and performance of equipment are shown in schedules on the drawings. Reference shall be made to the schedules for specific information. The capacities and performance shown are minimum capacities. Variations in the characteristics will be permitted only on written approval of the Architect/Engineer. All equipment shall be shipped to the job with not less than a prime coat of paint or as specified hereinafter. Insofar as is possible all items of the same type (i.e., pumps, fans, etc.) shall be by the same manufacturer. Where installation instructions are not included in these specifications or on the plans, the manufacturer's instructions shall be followed. All equipment affected by altitude shall be rated to operate at the altitude where it is to be installed.
- H. Excavation and Backfilling: This Contractor shall do all necessary excavation and backfill for the installation of the Mechanical systems as may be required. Curb cuts, asphalt and concrete patching, cutting and patching existing floor, etc., shall be part of this Contractor's responsibility. No extra payment will be made for rock excavation. Trenches for all underground piping shall be excavated to the required depths. The bottoms of trenches shall be tamped hard and graded to secure maximum fall. Bell holes shall be excavated to assure the pipe resting for its entire length on solid ground. Should rock be encountered, it shall be excavated to a depth of 6 inches below the bottom of the pipe, and before laying the pipe, the space between the bottom of the pipe and the rock surface shall be filled with gravel and thoroughly tamped. Pipe laid in trenches dug in fill shall be supported down in the trenches and shall be filled. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. The backfill material shall be identical to the surrounding fill material and shall be placed in 6-inch layer, wetted, and compacted to the density of the adjacent soil. See Division 2 for additional information for site utilities. All surplus materials shall be hauled from the project by the Contractor at his expense.
- I. Cutting and Repairing:
1. Responsibility lies with the Contractor whose work is involved. Coordinate with other trades to prevent unnecessary cutting and repairing.
 2. Lay out and locate equipment, openings, and chases. Install sleeves, inserts, and supports. Arrange with those whose work is involved to do cutting and replacing caused by negligence or error with costs reimbursed by the Contractor at fault. Cutting and replacing of existing work shall be the responsibility of the Contractor whose work is being installed.
 3. Removal or terminating connections of existing work which is abandoned or replaced shall also be done hereunder to provide correct and finished work.
- J. Foundations: All equipment shall be provided with suitable foundations and supports. It shall be the responsibility of the Contractor to provide for the proper locations of these foundations and supports. This applies to all rooftop equipment also.
1. All concrete foundations required by equipment furnished by the Mechanical Contractor shall be constructed by them (except where otherwise noted) the conformity with the recommendations of the manufacturer of the respective equipment, and with the approval of the Architect/Engineer. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow 1 inch below the equipment base for alignment, leveling and grouting with non-shrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed.
 2. Unless otherwise noted, foundations shall be a minimum of 6-inch high. All concrete work performed by these Contractors shall conform entirely to the requirements of the Concrete Specifications which describe this class of work.

- K. Code Requirements: Comply with state and local code requirements and ordinances. Call for inspections required by responsible building inspection authority.
- L. Applicable Building Codes and Ordinances: Including the latest edition of each code, but not limited to the following:
 - 1. International Building Code.
 - 2. Uniform Mechanical Code.
 - 3. Uniform Plumbing Code.
 - 4. Governing Fire Department Requirements
 - 5. Utility Company Requirements
 - 6. National Fire Protection Association Standards
 - 7. NFPA 70 - National Electrical Code
 - 8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
 - 9. NEPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
 - 10. NFPA 13 - Sprinkler Systems
 - 11. NFPA 101 - Life Safety
 - 12. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment
 - 13. International Energy Conservation Code 2018
- M. Access Panels
 - 1. Similar to Milcor, or as noted on the drawings, size as required for concealed expansion joints, valving, gauges, balancing dampers, valves, traps, pitot stations, equipment, and similar items requiring accessibility. Notify the General Contractor of each access panel location and the required size. Panels shall be proper type for the ceiling or wall in which they are installed. The panels shall be furnished under this section of the Specifications, unless otherwise directed, but shall be coordinated to be compatible with walls and ceilings furnished under other sections.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with Division 1.
- B. Large Items: Arrange with other trades on the job for introduction into the building of equipment too large to pass through finished openings.
- C. Acceptance: Check and sign for materials to be furnished by others for installation under Division 22 upon delivery. Contractor shall be responsible for the storage and safekeeping of such materials from time of delivery until final acceptance.
- D. Protection: Close ends of pipe at the close of each working day during construction to prevent entry of foreign material. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Protect fixtures and equipment against damage during mechanical work with heavy paper or plastic until final clean-up.
- E. Storage: Store equipment in covered enclosure or wrap with weather tight 6 mil Visqueen.
- F. Shipping Protection: Protective casings, crating, and coverings to remain in place until start-up of equipment.

1.9 PROJECT CONDITIONS

- A. Performance: All systems are to be rated at 3,900 ft. elevation.

1.10 SEQUENCING AND SCHEDULING

- A. General: Comply with Division 1.

- B. Schedule: Coordinate and order the progress of plumbing work to conform to the progress of the work of the other trades. Complete the entire installation as soon as the condition of the building will permit.
- C. Utility Interruptions: Schedule plumbing utility interruptions with the Architect/Engineer/Owner minimum of seven (7) days prior to the requested outage. Plan work so that the duration of the interruptions is as short as reasonably possible.

1.11 PROTECTION AGAINST HAZARDOUS CONDITIONS

- A. The Contractor shall take precautions against hazardous construction conditions at all times during construction. The final condition of the facilities shall be safe. Where safety to operating personnel is jeopardized, suitable signage shall be posted.
- B. Protruding metal (bolts, steel angles, etc.) potentially hazardous to maintenance and operating personnel, shall be cut back and/or protected to reduce the risk of injury. All openings between floors shall be protected with barriers around the openings, gratings across the openings, or steel bars through the openings to avoid and protect against injury.

1.12 HAZARDOUS SIGNS

- A. Any equipment room that contains moving or rotating parts, floor openings, or other potentially hazardous environments and shall include a sign on the door entering it that shall read similar to the following: **Hazardous Area - Authorized Personnel Only.**

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. The Mechanical Contractor shall furnish to the Owner a bound (three (3) ring binder) manual in triplicate, containing complete repair parts lists and operating, service, and maintenance instructions on all mechanical equipment, fixtures, and systems as noted below:
 - 1. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Engineer, Sub-consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
 - 2. For Each Product System: List names, addresses, and telephone numbers of Sub-contractors and suppliers, including local source of supplies and replacement parts.
 - 3. Product Data: Mark each sheet to clearly identify specific product and component parts, and data applicable to installation. Delete inapplicable information.
 - 4. Warranties and Bonds: Bind in copy of each.
 - 5. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves with engineering data and tests and complete nomenclature and model number of replaceable parts.
 - 6. Include color-coded wiring diagrams as installed for control system.
 - 7. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and any special operating condition instructions.
 - 8. Maintenance Requirements: Include routine procedures and guide for troubleshooting, disassembly, repair, reassembly, alignment, adjustment, balancing, and verification instructions.
 - 9. Provide servicing and lubrication schedule and list of lubricants required.
 - 10. Include manufacturer's printed operation and maintenance instructions.
 - 11. Include sequence of operation by controls manufacturer.
 - 12. Provide original manufacturer's part list, illustrations, assembly drawings, and diagrams required for maintenance.
 - 13. Provide control diagrams by controls manufacturer as installed.

14. Provide charts of valve tag numbers, with locations and functions of each valve, keyed to flow, and control diagrams.
15. Provide list of original manufacturer's spare parts and recommended quantities and to be maintained in storage.
16. Include Test and Balance (T&B) Reports as specified in Section 230593.

1.14 WARRANTY AND SERVICE PROGRAM

- A. Due to the critical performance requirements and to clearly establish warranty responsibility for this project, the Contractor shall provide a full-service maintenance and warranty program to the Owner for one full year after beneficial occupancy (substantial completion).
- B. This service program shall be included as part of the base bid and shall include service, maintenance, repair, replacement, lubrication, temperature control calibration and repairs, and documenting proof for all service and maintenance work on all equipment and system furnished by the Contractor.
- C. A single representative in the employment of the Contractor shall be responsible for coordination and follow through of this program. This representative's name and phone number shall be submitted to the Owner as part of the maintenance manuals and supportive data. The Contractor shall respond to a request for service with 24 hours if so requested.
- D. During this first year of operation, the following sequence of maintenance service shall be performed as a minimum:
 1. Clean strainers in piping.
 2. Lubricate and oil fans and/or pumps once every four (4) months.
 3. Calibrate controls throughout the facility at the end of six (6) months (following substantial completion). Any leaks in the piping systems shall be repaired.
 4. Follow all equipment manufacturer's service recommendations.

1.15 FLUSHING AND DRAINING

- A. It shall be the responsibility of this Contractor to properly drain and flush all pipes before use or acceptance to ensure that all debris is completely removed. Damage caused by such debris remaining in the pipes shall be repaired by this Contractor at his expense. This Contractor shall demonstrate to the Architect/Engineer's representative that all piping is clean.

1.16 CLEANING

- A. This Contractor shall remove from the building construction site all rubbish and dirt as it accumulates under the contract. At completion, all areas shall be broom cleaned, and all obstructions, surplus materials, etc. shall be removed.

1.17 GUARANTEE

- A. The Contractor shall guarantee all materials, equipment, and workmanship furnished and installed by him under this Contract to be free from any defects of workmanship and materials and shall agree to replace, at his expense, any and all defective equipment, parts, etc., that may be found at any time within one year after installation is accepted by the Architect/Engineer. This excludes normal maintenance and daily servicing of equipment, which is the Owner's responsibility.

1.18 FLOOR, WALL, AND CEILING PLATES

- A. Where exposed pipes pass through floors, finished walls, or finished ceiling, they shall be fitted with chromium-plated escutcheons of an approved pattern. Escutcheons and plates in Mechanical Rooms do not require chrome finish.
- B. This Contractor shall be responsible for providing and installing all counter-flashing. All openings in the roof shall be flashed and counter-flashed. Use four-pound lead flashing

materials for all vent lines and welded flashing in steel lines passing through roof. The Mechanical Contractor shall notify the General Contractor where each roof penetration is and the size of the opening.

1.19 PIPE SLEEVES

- A. Schedule 40 steel pipe sleeves or pipe sleeves made of 20-gauge galvanized steel shall be provided for all pipes passing through concrete floors, roofs, and masonry walls. Properly secure in place with approximately 1/4" space between each sleeve and the surface of the pipe or insulation passing through it. All pipe sleeves shall be fixed in place as the walls and floors are built up. The Contractor shall furnish and locate all sleeves and pipes passing through concrete floors, exterior masonry walls, and roofs. These penetrations shall be made watertight with approved non-hardening plastic material. Sleeves through pipe chase or equipment room floors shall project a minimum of 2 inches above the floor and shall be of black steel pipe with waterproof flange at center of floor thickness. Each sleeve through a fireproof wall shall be packed with approved fireproof rope in the annular space.

1.20 PIPE HANGERS

- A. Pipe hangers shall be Fee and Mason of a type suitable for each use. Perforated straps shall not be used in any work. For ferrous pipes up to and including 4 inches in size, use Fee and Mason Figure 199 malleable iron, adjustable, split ring, swivel hanger. For plumbing piping larger than 4 inches, use Fee and Mason Figure 239 steel clevis hanger. Where several pipes are parallel at the same elevation, trapeze hangers may be used. Where trapeze hangers are used, the pipes shall be supported on rollers where indicated on the Drawings. For copper pipes up to and including 3 inches in size, use Fee and Mason Figure 360 malleable iron, copper plated hangers. For copper pipes larger than 3 inches, use Fee and Mason Figure 364 copper plated clevis hanger.
- B. Hanger rod sizes shall conform to the following schedule:
- | | |
|--------------------------------|-----------|
| 1. Pipe up to and including 2" | 3/8" rods |
| 2. Pipe 2-1/2", 3" and 3-1/2" | 1/2" rods |
| 3. Pipe 4" and 5" | 5/8" rods |
| 4. Pipe 6" | 3/4" rods |
| 5. Pipe 8", 10", and 12" | 7/8" rods |
- C. Unless shown otherwise on the Plans, all horizontal runs of ferrous piping shall be suspended from the floor or roof construction as the case may be by means of hangers with the following spacing:
- | | |
|------------------------------------|-----|
| 1. Pipe up to and including 1-1/4" | 8' |
| 2. Pipe 1-1/2" and 2" | 10' |
| 3. Pipe 2-1/2" and 3" | 12' |
| 4. Pipe 3 1/2" and 4" | 14' |
| 5. Pipe 5" and 6" | 16' |
| 6. Pipe 8" and 10" | 20' |
- D. Unless shown otherwise on the Plans, all horizontal runs of copper piping shall be suspended from the floor or roof construction as the case may be by means of hangers with the following maximum spacing:
- | | |
|----------------------------|-----|
| 1. Pipe up to 3/4" in size | 5' |
| 2. Pipe 1" and 1-1/4" | 6' |
| 3. Pipe 1-1/2" and larger | 10' |
- E. There shall be a hanger within 2 inches of each elbow or tee. Additional supports shall be provided for valves, strainers, etc. Cast iron pipe shall have not less than one hanger per length

of pipe. Vertical risers shall be supported by approved riser clamps at each floor. Vertical pipes within a space shall have not less than two supports.

- F. Supports and hangers shall be installed to permit free expansion and contraction in the piping systems. Hangers shall permit vertical adjustment to maintain proper pitch. Where necessary to control expansion and contraction, the piping shall be guided and firmly anchored. No piping shall be self-supporting, nor shall it be supported from equipment connection.
- G. Expansion bolts shall be Ackerman-Johnson or Hilti.
- H. Beam clamps suitable for use with this type of steel construction involved shall be Grinnell.

1.21 ISOLATION

- A. Excessive vibration or objectionable noise created in any part of the building by the operation of any equipment furnished and/or installed under the Mechanical Contract will be extremely objectionable and the Contractor shall take all precautions against the same by isolating the various items of equipment from the building structure and by such other means as may be necessary to eliminate all excessive vibration and objectionable noise produced by any equipment installed by them. Consequently, they shall design all foundations, supports, etc., for their equipment, and all piping with this end in view. In addition, these Contractors shall supervise the construction of all foundations and supports, whether they build them or not, in order that they may be constructed in such a manner as to prevent the transmission of objectionable noise and/or excessive vibration. Submit calculations on all vibration isolation equipment.
- B. All equipment having moving parts shall be isolated from the building structure by means of Korfund isolation materials, unless specifically noted otherwise. All isolators shall be the same brand and shall be supplied from the same source. Equipment manufacturer's recommendations shall be followed in the isolation of equipment.
- C. Vibration isolators shall have sufficient resilience to meet the following minimum efficiencies:

<u>Motor HP</u>	<u>Equipment Room</u>
Up to 5	90%
7-1/2 to 15	93%
20 to 40	95%
50 to 100	97.5%
- D. Spring isolators shall be of the housed type with ribbed pads bonded to the underside of the baseplate or may be unboxed stable springs. Isolators shall be furnished with snubbers and limit stops where so recommended by the equipment manufacturer.
- E. The Supplier of the isolating equipment shall, upon completion of the job, check all isolating materials, verify that they are installed properly, and submit a report in writing to the Architect/Engineer.

1.22 TESTING

- A. Before completion of this project, the Mechanical Contractor shall test all materials and equipment which normally require testing. All piping, etc., shall be tested to meet code requirements or the Specification requirements, whichever is more stringent.
- B. All equipment shall be operated sufficiently long enough to prove to the Architect/Engineer that the equipment performs satisfactorily and meets the requirements set forth on the Plans or in these Specifications.

1.23 CERTIFICATIONS

- A. Before receiving final payment, the contractor shall verify that all equipment furnished, and all work done complies with all applicable codes mentioned in these Specifications. Submit certifications and acceptable certificates to the Architect/Engineer.

1.24 GENERAL PIPING INSTALLATION REQUIREMENTS

- A. Provisions for Drainage: All piping systems shall be installed so that they may be easily drained. Drain caps, plugs, or hose bibbs shall be installed at low points. Grade piping toward drain locations.
- B. Alignment: All installed pipelines shall be straight and shall remain straight against strains. Proper allowance shall be made for expansion and contraction.
- C. Clean as Installed: All piping shall be kept free from scale or loose dirt when installed and must be kept clean during the completion of the installation. All openings in the piping system shall be capped or plugged while awaiting further connections. All detergents, solvents and other cleaning agents shall be compatible with the materials of fabrication of the system in which they are used. They shall not adversely affect the materials of mechanisms in the systems and they shall be acceptable to equipment manufacturers. All detergents, solvents, and other cleaning agents shall also be compatible with the process streams to be handled by the systems in which they are used.
- D. Insulated Fittings: Install between any dissimilar metals such as steel and copper.
- E. Expansion and Contraction: The Contractor shall make all necessary provisions for expansion and contraction with proper fittings, anchors, dresser couplings, loops, etc. Install flexible connectors on each pipe at each building expansion joint.
- F. Welding: Refer to Paragraph 1.25 of this section of these specifications.
- G. Bending: No bending of pipe will be permitted.
- H. General: The installation shall be coordinated with respect to space available with heating, cooling, ventilating, and electrical installation. In every instance where there is a conflict in the routing of the piping and the ducting, the routing of the ducting shall govern. Installed piping shall not interfere with the operation or accessibility of doors or windows; shall not encroach on aisles, passageways, and equipment; and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping above ground shall be run parallel with the lines of the building unless otherwise noted on the drawings. Unless otherwise shown on the drawings, horizontal piping shall pitch down in the direction of flow with grade of not less than 1 inch in 40 feet. Piping connections to equipment shall be in accordance with details shown on the drawings or as recommended by the equipment manufacturer. Service pipe valves and fittings shall be kept a sufficient distance from other work to permit finished covering not less than 1/2 inch from such other work, and not less than 1/2 inch between finished covering on the different services.
- I. Installation of Valves: Valves shall be installed at the locations shown on the drawings and where specified and where directed at site. Gate valves shall be used unless otherwise shown, specified, or directed. All valves shall be installed with their stems horizontal or above. Where tight shutoff is required, a composition seat globe valve or resilient seat ball valve shall be used.
- J. All valves which must be used during operation, all control valve assemblies, instrument control cases, liquid level controls, gage glasses, orifices, relief valves, and other equipment which must be observed, adjusted, or serviced during operation shall be located conveniently accessible from an operating platform or grade.
- K. In general, relief valves within processing unit limits shall be located conveniently accessible from an operating platform or grade.
 - 1. Those in non-hazardous service, such as water, shall discharge directly to outside.

2. Relief valves should have no piping between the vessel or line and the valve inlet, except as shown on the drawings.
 3. Relief valves shall be installed in a vertical position. Vent piping shall be braced and supported in a manner that will not produce excessive stresses in the relief valve and will permit removal of the relief valve without necessary temporary supports for the vent lines.
- L. Equipment Connections: All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment. The contractor shall be required as directed to remove the bolts in flanged connections or disconnect piping to demonstrate that the piping has been so connected. Pipe connections to equipment shall be made with unions or flanged fittings. Provide removable headers for large equipment for service access.
- M. Joints
1. Flanged Joints: All flanged joints shall be face matched. Raised face flanges shall not be mated to flat-faced cast-iron flanges on valves or equipment. The raised face must be turned off. All flanged bolt holes shall straddle the horizontal and vertical center line unless otherwise noted.
 2. Screwed Joints: Screwed pipe joints shall have American Standard Taper Pipe Threads ANSI-B2.1 Latest Edition. Burrs formed when cutting pipe shall be removed by reaming. Care shall be taken that the inside of pipe is thoroughly clean and free of cutting oil and foreign matter before installation. Joints shall be made perfectly tight by the use of Teflon tape or approved Teflon thread sealing and lubricating compound.
 3. Solder-Joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool or wire brush before seating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for serrated fittings on water, compressed air below 60 psig, and vacuum lines shall be made with a 95 percent tin and 5 percent antimony. Cored solder or solder containing lead will not be permitted.
- N. Reducers: Reduction in pipe size shall be made with one piece reducing fittings. Bushings reducing at least two pipe sizes will be acceptable only when there is no room for reducing couplings or swaged nipples.
- O. Unions: All piping unions shall be of the ground joint type constructed from materials equivalent in alloy composition and strength to other fittings specified with which they are used. Union Pressure classes and end connections shall be the same as the fittings used in the lines with the unions. Steel unions shall have hardened stainless steel seating surfaces on both faces.
- P. Hanger Supports:
1. All hanger rods used to support piping, conduit, mechanical units, equipment, trapezes, and other items shall be straight and installed plumb, regardless of length. Do not bend rods to adapt to sloped or rotated structural members, secondary support members, or to sloped mounting holes on supported equipment. Contractor shall utilize available swivel, hinged, or rigid mounting techniques designed to accommodate a slope or rotation, or shall design a custom solution. Selected techniques for each application shall be submitted for approval prior to use.
 2. Do not bend rods to circumvent an obstruction.
 3. Loads on hanger rods shall be applied in direct tension. Do not apply compression, lateral or moment loads to hanger rods. Install bracing or additional supports to prevent hanger rod from incurring non-tension loading.
 4. Do not create offsets in rods; use only in-line couplers, and only when length of coupled rod exceeds standard available length (typically 12 feet) or when full lengths cannot be placed in position. Provide additional horizontal bracing to prevent swaying of supported piping or equipment.
 5. Do not straighten bent rods for subsequent use. If a rod becomes bent, cut off and discard the bent portion. The remaining straight portion of rod may be used.

1.25 WELDING

- A. All welding of piping covered by this specification, regardless of condition of service shall be accompanied as follows:
1. The welding shall be in accordance with the recommendations of the American Welding Society. Mitering of pipe to form elbows, notching to form these, or any similar construction will not be permitted. Welding fittings shall be installed on all welded lines. Joints to be welded shall be properly aligned and spaced, using special welding clamps where necessary. All welders to be employed shall have passed qualification tests prescribed by the National Certified Pipe Welding bureau (or by another reputable testing laboratory or agency) using procedures approved by the American Society of Mechanical Engineers or the American Welding Society. The welders will be required to pass qualification tests when the work of the welder creates a reasonable doubt as to his proficiency. Tests shall be conducted at no additional expense to the Owner.
 2. Each welder shall, in addition to having passed the prescribed qualification tests (as noted in Paragraph 1.26.A.1), prepare sample coupons at the job site on a portion of pipe that is cut such that the cross section of the weld is open to view. The sample weld should be prepared using a 6-inch diameter pipe. The sample shall reflect a continuous weld with perpendicular cut out to show the weld in cross sectional view. This sample, when accepted and approved by a certified welding inspector, shall be used as a standard of quality to compare to other welds that this welder will be performing on the job. This same sample weld will also be a basis for accepting or rejecting the welder for working on this project. The sample weld shall be identified with a date and the welder's name and shall be kept at the site throughout the project.
 3. All welding on pressure piping shall conform to all of the requirements of the American Society of Mechanical Engineers Code for Pressure Piping - B31.1 (An American National Standards Institute publication), as defined in the latest edition of the ANSI Power Piping B31.1 Manual. All welding shall also conform to all of the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. All chapters, current addenda and supplements of these manuals shall apply. This code shall be used to establish standards of performance and quality of welds. However, the Owner reserves the right to perform radiographic testing of all welds, to compare any of the welds to the approved "standard" sample welds of each welder, and to compare the welds to the welding diagrams and sketches of those recommended in the ANSI B31.1 Power Piping Manual. The intent is to obtain the highest quality welding job possible. The cost of any initial radiographic testing, for random inspection, shall be paid for by the Owner. If radiographic random testing reveals that a weld is defective, the Contractor shall bear the cost of all repairs and re-testing necessary to be made to subject weld until conformance with radiographic tests is reached. The potential for random radiographic testing and welding quality control applies to all pressure piping systems in this project, including systems below 100 psig. If a question should arise regarding the possibility of faulty welding or if there are obvious visual defects in the welding, the Contractor shall be required to correct such deficiencies to a quality level consistent with the recommendations, welding diagrams and sketches in the ANSI B31.1 Manual. The quality level shall also reflect that of the approved sample welds accomplished by each welder for this particular project.

1.26 TESTING FOR PIPING SYSTEMS

- A. General: Before insulation is applied, all piping, equipment, and accessories installed under this contract shall be inspected and tested by the Contractor. All labor, material, and equipment required for testing shall be furnished by the Contractor. The Contractor shall be responsible for all repairs and retesting as required. All instruments and other equipment whose safe pressure range is below that of the test pressure shall be removed from the line or blanked off before applying tests. Prior to performing tests, all lines shall be "blown" free of all loose dirt and foreign particles. The lines shall then be thoroughly flushed with water (liquid lines only) at a

sufficient flow rate and period of time, to ensure complete cleaning of the lines of all dirt, scale, and foreign matter. Satisfactory flushing of the lines shall be subject to approval. After testing and flushing lines, all filters and strainers shall be cleaned.

- B. Safety: Since the risk of failure is appreciably greater with further testing with the attendant possibility of injury, all safety measures required by codes or ordinance or reasonable applicable to the situation shall be taken.
- C. Concealment: Equipment or piping to be pressure tested shall not be insulated, covered, or concealed prior to that test. Compression joint underground piping may be backfilled prior to pressure test except that joints shall remain exposed until after the test, but tie rods, clamps, etc., shall be in place and fastened.
- D. Pressure Ratings: These tests shall not be used to establish pressure ratings.
- E. System Protection: Protect all piping and equipment against overpressure, collapse from vacuum, and hydraulic shock during the filling, testing, and draining procedures. Seats of iron valves shall not be subjected to a pressure in excess of the maximum cold working pressure of the valve. Pressure tests against other closed valves shall not exceed twice the normal rating. Note that where significant differences in elevation exists, there is a risk of overpressure in the lower portions of the system in order to attain test pressure in the upper portion of the system
- F. Test Temperature: Apply test pressure only after the system and test medium are at approximately the same temperature, preferably not less than 60°F. Note that some applicable codes require testing above a specified minimum temperature.
- G. Sectionalizing: Systems may be separated into sub-systems for testing if such action will expedite or simplify the testing.
- H. Temporary Supports: During hydrostatic testing of lines provide temporary supports to prevent oversteering supports or hangers. When tests are completed, remove all temporary supports, locks, stops, etc., and adjust supports for their cold load and alignment.
- I. Testing: Domestic hot and cold water piping and heating water piping shall be tested hydrostatically at the test pressures specified and shall show no drop in pressure in a 2 hour period. Leaks shall be located by soap testing
 - 1. Test Pressures:
 - a. Natural gas piping: as required by governing code
 - b. Domestic Hot and Cold Water: 100 psig or 50% more than operating pressure, which ever is greater.
 - c. Condenser or Tower Water Supply & Return: 100 psig.
 - d. Heating Water Supply and Return: 100 psig.
 - e. Chilled Water Supply and Return: 100 psig.
 - f. Steam and condensate (high pressure): 250 psig.
 - g. Steam and condensate (low pressure): 125 psig.
- J. Sanitary Waste and Soil System:
 - 1. After all soil and waste pipes and vent stacks have been installed, the outlets shall be plugged, and the piping system filled with water in vertical sections to the highest point of the system and allowed to remain filled for twenty-four (24) hours and shall prove to be leaktight under such conditions. A one-inch drop will be allowed in water level in standpipe. This test may be conducted in segments as required by the sequence of construction. Contractor shall certify in writing that all tests were satisfactorily completed before piping was concealed and shall submit the certification to the Architect/Engineer for his records and for transmittal to the owner.
- K. Test Report
 - 1. A detailed report of pressure tests on piping and equipment shall be forwarded in duplicate to the Architect/Engineer. This report shall show date of test, lines tested, test medium,

length of time test pressure was held, pressure drop or rise, and extent of venting or repressurizing.

1.27 COOPERATION WITH OTHER TRADES

- A. The Contractor shall refer to other sections of these specifications covering the work of other trades which must be carried out in conjunction with the mechanical work so that the construction operations can proceed without harm to the Owner from interference, delay, or absence of coordination.

1.28 FIELD MEASUREMENTS

- A. The Contractor shall verify the dimensions covering the mechanical work at the building. No extra compensation shall be claimed or allowed on account of difference between actual dimensions and those indicated on the drawings. He shall examine the adjoining work on which Mechanical work is dependent for maximum efficiency and shall report any work which must be corrected. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting Mechanical work.

1.29 SAFETY GUARDS

- A. The Mechanical Contractor shall furnish and install safety guards required in order to obtain certificates of inspection from all authorities having jurisdiction. All belt driven equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded. Provide coupling guards on all rotating shafts.

1.30 PROTECTION

- A. All work, equipment, and materials shall be protected at all times to prevent obstruction, damage, or breakage. All pipe openings shall be closed with caps or plugs during installation. All equipment shall be covered and protected against dirt, water, chemical, or mechanical injury. At the completion of the work, all equipment shall be thoroughly cleaned, and the entire system shall be delivered in a perfect, unblemished condition.

1.31 PAINTING AND IDENTIFICATION

- A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be marred in transit or during installation, it shall be finished to present a neat, workmanlike appearance.
- B. Except as elsewhere hereinafter specifically required, any painting of equipment, piping, ductwork, grilles, insulation, etc., furnished and installed under this Section of the Specifications will be done by the Painting Contractor. However, the Mechanical Contractor shall leave his equipment clean and free from any grease, dirt, rust, etc., and in suitable condition for painting.
- C. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.
- D. The piping shall be painted the basic color as indicated in other sections of these specifications and shall be marked every 10 feet on centers with Brady pipe markers. Arrows, approximately 6 inches in length and spaced about 10 feet on centers shall indicate the direction of the flow pipe. Locate additional labels as required in Mechanical Rooms. Staple in place, brush with clear lacquer. Markers shall state pipe usage, pipe size, and flow direction (such as "cold water 1-1/4" →" etc.).

1.32 RECORD DRAWINGS

- A. During the execution of the work, the Contractor shall maintain a complete set of drawings upon which all dimensional locations of equipment piping and all deviations and/or changes in the work shall be recorded. Water, storm, and drainage mains shall be delivered to the Architect/Engineer in good condition upon the completion and acceptance of the work and before final payment is made.

1.33 SUPPLIER RESPONSIBILITY

- A. Each supplier, whether furnishing equipment as specified or as a substitution, shall be responsible for certifying that the equipment is properly installed and that the warranty is valid. Submit written reports on the installation and the equipment performance when requested to do so by the Architect/Engineer or his representative. Each supplier shall be responsible for furnishing qualified personnel at the job site at anytime requested by the Architect/Engineer or his representative during the construction or warranty periods.

END OF SECTION

22 0500

SECTION 22 0523**VALVES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. All valves except lubricated plug valves and butterfly valves shall be manufactured by Nibco, Hammond, Lunkenheimer, Kennedy, Stockham, Walworth, Powell, or Milwaukee.
- B. Lubricated plug valves shall be as manufactured by Rockwell, Milwaukee, or Walworth.
- C. Butterfly valves shall be as manufactured by W.C. Norris, Centerline, Nibco, Demco, Grinnell, Milwaukee, or Keystone.

1.3 RELATED WORK IN OTHER SECTIONS

220000	PLUMBING INDEX
220500	GENERAL PLUMBING REQUIREMENTS
220700	PIPING INSULATION
221113	DOMESTIC WATER SYSTEMS
221313	SOIL AND WASTE PIPING SYSTEMS

1.4 IDENTIFICATION OF VALVES

- A. Each valve shall be provided with a stamped metal tag secured to the valve with metal chain. Tag shall indicate both the service and function of each valve. The Contractor shall furnish two prints of drawings showing floor plan for each floor with all valves accurately located and labeled. These drawings shall be neat and easily read.

PART 2 - PRODUCTS**2.1 VALVES**

- A. Heating water, chilled water, condenser water, domestic water and low pressure steam (<15 psi):
1. Gate Valves 2" and Under: Nibco No. T134, rising stem, ductile iron hand wheel, union bonnet, solid wedge disc, bronze body, Class 150 psi working pressure.
 2. Gate Valves 2-1/2" and Larger: Nibco No. F617-0, bronze trimmed, solid wedge disc, iron body, O.S. & Y., 125 psi working pressure.
 3. Swing Check 2" and Under: Nibco No. T433, swing type, Y-pattern, all bronze, renewable seat & disc, regrounding, 200 psi working pressure.
 4. Swing Check, 2-1/2" and Larger: Nibco No. F938-31, iron body, bolted bonnet, Class 150, bronze trimmed, check valves installed at discharge of pumps shall be non-slam type.
 5. Globe Valves 2" and under: Nibco No. T235, union bonnet, integral seat, Class 150 bronze body with renewable disc.
 6. Globe Valves, 2-1/2" and Larger: Nibco No. 718-B, bolted bonnet, cast iron body, 125 psi working pressure O.S. & Y., pattern bronze trimmed.

7. Gate Valves 3" and Under for Copper Pipe: Nibco No. S134, union bonnet, Class 150 bronze rising stem wedge disc.
8. Globe Valves 2" Under for Copper Pipe: Nibco S-235, Class 150, bronze union bonnet, integral seat, renewable seat and disc.
9. Angle Valves 2" and Under Copper Pipe: Nibco T335, Class 150, Union Bonnet, integral seat, renewable seat & disc.
10. Angle Valves 2 1/2" and Larger: Nibco F8180-B, Class 125, bolted bonnet cast iron, renewable seat & disc., bronze trim.
11. Check Valve for 3" and under for Copper Pipe: Nibco S-433, Y-pattern, swing type, all bronze, renewable seat & disc.
12. Manual Balancing Valves:
 - a. 2" and Under: Nibco T-585-70 ball valve or Milwaukee Butterball butterfly valve with calibrated flow set handle.
 - b. 2-1/2" and Larger: W.C. Norris butterfly valves with lever with infinite throttling position as specified below.
13. Circuit Balancing Valves: Balance Valves shall be "Circuit Setter" balance valves as manufactured by Bell & Gossett.
14. Automatic Balancing Valves: Shall be spring loaded, variable orifice type capable of maintaining present flow within 5% over an operating pressure differential of at least 14 times the minimum valve pressure requirement. Maximum controlled pressure differential shall be at least 75% of the system pump head. Valve shall be Griswold Automatic Flow Control Valve or approved equal. At Contractor's option, automatic flow control valves may be used in 2" size and above in lieu of manual balancing valves.
15. Butterfly Valves: Lug type butterfly valves, ductile iron or cast iron body, bronze blade, stainless steel shaft and with EPT liner for tight shutoff up to 150 psi, bonded seat. Valves to be suitable for mounting between flanges, with lugs drilled and tapped so that pipe line can be disconnected with the valve still holding pressure. Valves 3" and smaller to have lever operators with infinite throttling positions. Valves 4" and larger to have worm gear and hand wheel manual operators. Butterfly valves may be used in lieu of gate valves for water service 2" and larger. Liner shall be suitable for -30 F to + 275 F.
16. Ball Valves: 1/2" to 2": Nibco No. T-585-70, two piece body, bronze, screwed ends, Teflon seats, straight through flow design.
17. Lubricated Plug Valves: Rockwell Mfg. Co. "Permaturn" lubricated plug valves Fig. No. 143. Provide valve handle for each valve. Valves shall have tapered plugs with thermally bonded lubricated film.
18. Water Pressure Relief Valves for makeup to heating and cooling systems, and relief for heating and cooling system, Bell & Gossett No. 1170 unless otherwise noted.
19. Relief Valves for hot water generators and heating converters. ASME labled temperature and pressure relief valves shall be installed on the hot water generator. Pressure relief valve shall be installed on the converter set for 30 psi. Valves shall be sized for the full heating capacity. Discharge from valves shall be piped to the nearest floor drain.
20. Drain Valves: Nibco No. T134, 3" and smaller.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All valves shall be installed in locations which will allow easy operation and facilitate maintenance.
- B. Gate and globe valves shall be installed with stems up.

- C. System balancing valves shall be installed where shown or required to balance waterflows to all system components. In general balancing valves shall be provided at the following locations:
1. Each pump discharge, lubricated plug valve.
 2. Each main branch circuit, circuit balancing valve.
 3. At each water coil, circuit balance valve.

END OF SECTION

22 0523

SECTION 22 0700**PIPING INSULATION****PART 1 - GENERAL****1.1 SUMMARY**

- A. Furnish and Install:
 - 1. Piping insulation
 - 2. Jackets and accessories

1.2 RELATED DOCUMENTS:

- A. The General Provisions of the Contract, including General and Special Conditions and the General Requirements apply to the work specified in this section.
- B. Insulation furnished under this specification shall comply with all requirements of the State Energy Code and the recommendations of the latest edition of ASHRAE 90.1 and these specifications. The more stringent of these shall be the standard for the work provided under these specifications.
- C. The work included under this specification consists of furnishing all labor, accessories, equipment, and materials necessary for installation of all piping, and mechanical equipment insulation systems. This includes but is not limited to:
 - 1. Thermal Insulation
 - a. Domestic hot water piping
 - b. Heating water piping
 - c. Chilled water piping
 - d. Refrigerant piping
 - e. Steam and steam condensate piping
 - f. Heat exchangers
 - g. Boilers
 - h. Chiller coolers
 - 2. Condensation Prevention Insulation
 - a. Domestic cold water piping
 - b. Roof drain and overflow piping and roof drains
 - c. Cooling coil condensate piping
 - d. Chiller condensers

1.3 RELATED WORK IN OTHER SECTIONS

220000	PLUMBING INDEX
220500	GENERAL PLUMBING REQUIREMENTS
230500	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS

1.4 REFERENCES

- A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

- B. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of Guarded Hot Plate Apparatus.
- C. ASTM C195 - Mineral Fiber Thermal Insulation Cement.
- D. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.
- E. ASTM C518 - Test Methods for Steady-State Heat Flux, Heat Flow Meter Apparatus.
- F. ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- G. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- H. All preformed Fiberglass pipe insulation with factory applied jackets shall meet the following standards:
 - ASTM E84 - Surface Burning Characteristics of Building Materials
 - ASTM E96 – Jacket Permeance
 - ASTM C335-Steady-State Heat Transfer Properties of Horizontal Pipe Insulation
 - ASTM C411 - Standard Test Method for Hot-Surface Performance of High- Temperature Thermal Insulation
 - ASTM C547 - Mineral Fiber Preformed Pipe Insulation
 - ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
 - ASTM C795 – Thermal Insulation for use in Contact with Austenitic Stainless Steel
 - ASTM C1136 – Flexible Low Permeance Vapor Retarders for Thermal Insulation: Types I-IV.
 - NRC 1.36 – Nuclear Regulatory Commission Guide 1.36 Non Metallic Thermal Insulation
 - NFPA 90A
 - NFPA 255
 - UL 723 – Composite Surface Burning Characteristic
 - CAN ULC S102-M
 - MIL – I – 22344D – Insulation, Pipe, Thermal, Fibrous Glass
 - MIL – I – 24244C (Ships)
 - USCG 164.109 – Non Combustible Materials
 - New York City MEA
 - GreenGuard Certified for Indoor Air Quality
 - GreenGuard Certified for Children and Schools

1.5 DEFINITIONS

- A. Exposed Location: Exposed in mechanical rooms, rooms with finished walls or ceilings, and pipe chase between toilet rooms and equipment rooms.
- B. Concealed Location: Located in furred spaces, attics, crawl spaces, above suspended ceilings in finished or unfinished rooms, or all other locations not exposed to view.
- C. Cold Piping: Shall include domestic water and other piping with surface temperatures less than 70°F.

- D. Hot Piping: Domestic hot water, supply and return and other piping with surface temperatures greater than 105°F.
- E. Exterior Locations: All locations exposed, unexposed above grade, or below grade beyond the building floor, wall, or roof line of the structure or building
- F. Location and Insulation Requirements:
 - 1. Cold Water, including Non-potable Water (NPW): Insulate as follows:
 - a. All piping above ceilings and in walls.
 - b. Entire system except for stubouts to fixtures.
 - 2. Domestic Hot: Insulate as follows:
 - a. Entire system except for stubouts to fixtures.
 - 3. Chilled Water Supply and Return and Heating Water Supply and Return:
 - a. All piping above ceilings, drops in wall and in mechanical rooms.
 - 4. K Factors: All K Factors shown in this Specification are expressed in BTU-in/hr.-ft²-F.
 - 5. Steam and Condensate Piping
 - a. Entire System

1.6 SUBMITTALS

- A. Comply with Section 220500.
- B. Product Data: Provide product description, list of materials, and thickness for each service and location.
- C. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.7 QUALITY ASSURANCE

- A. Qualifications of Applicator: Company specializing in piping insulation application with five (5) years minimum experience.
- B. Regulatory Requirements Fire Hazard Classification: Insulation shall have a composite (insulation, jacket or facing, and adhesive to secure jacket or facing) fire hazard rating as tested by ASTM E-84, NFPA 255, and UL 723 not to exceed 25 flame spread, 50 fuel contribution, and 50 smoke developed. Materials shall be labeled accordingly.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Compliance: Comply with Section 230500. Deliver materials to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness and store in a warm, dry location.

1.9 PROJECT/SITE CONDITIONS

- A. Storage Environment: Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation while in storage.
- B. Environmental Requirements: Perform work at ambient and equipment temperatures as recommended by the insulation manufacturer.
- C. Protection: Protect insulation against dirt, water, and chemical or mechanical damage before, during and after installation. Repair or replace any such insulation or covering damaged prior to final acceptance of work.

- D. Application Surfaces: Surface shall be dry, free of dust, oil, construction residues, or other foreign materials before insulation is applied. Piping joints shall be dry, leak free and tested before application of insulation occurs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
1. Owens-Corning
 2. Knauf
 3. Johns Manville
 4. Industrial Insulation Group

2.2 MATERIALS

- A. Glass Fiber:
1. Insulation: ASTM C547; rigid molded, noncombustible.
 - a. 'K' value: ASTM C335, 0.24 at 75°F
 - i) K values shall conform to the following at 75°F
 - (a) Heating water to 250°F: .28
 - (b) Heater water and Steam to 350°F or above: .32
 - (c) Chilled water 40°F to 55°F: .24
 - (d) Domestic water 105°F or greater: .24
 - b. Minimum Service Temperature: -20°F
 - c. Maximum Service Temperature: +450°F
 - d. Maximum Moisture Absorption: 0.2 percent by volume
 2. Vapor Barrier Jacket:
 - a. All Service Vapor Retarder Jacket
 - b. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
 - c. Secure with self sealing longitudinal laps and butt strips.
 - d. Alternate: Paper Free All Service Vapor Retarder Jacket

2.3 JACKETS

- A. A.PVC Plastic
1. Jacket: ASTM C921, one-piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: -40°F
 - b. Maximum Service Temperature: +150°F
 - c. Moisture Vapor Transmission: ASTM E96; 0.002 percent by volume
 - d. Maximum Flame Spread: ASTM E84: 25.
 - e. Maximum Smoke Developed: ASTM E84; 50
 - f. Thickness: 20 mil.
 - g. Connections: Brush on welding adhesive
 2. Covering Adhesive Mastic: Compatible with insulation
 3. Acceptable Manufacturers
 - a. Proto
 - b. Zeston

- c. Speedline
- B. Canvas Jacket; UL listed.
 - 1. Fabric: ASTM C921, 6 oz/sq yd, plain weave cotton treated with dilute fire-retardant lagging adhesive.
 - 2. Lagging Adhesive: Compatible with insulation.
 - 3. Aluminum Jacket: ASTM B209.
 - a. Thickness: 20 mil inch sheet.
 - b. Finish: Smooth.
 - c. Joining: Longitudinal slip joints with 2-inch laps.
 - d. Fittings: 0.016-inch-thick die shaped covers with factory attached protective liners.
 - e. Metal Jacket Bands: 3/8 inch wide; 0.015-inch-thick aluminum.
- C. Aluminum Jacket: ASTM B209
 - 1. Thickness: 0.016-inch sheet.
 - 2. Finish: Smooth
 - 3. Joining: Longitudinal slip joints and 2-inch laps.
 - 4. Fittings: 0.016-inch-thick die shaped fitting covers with factory attached protective liner.
 - 5. Metal Jacket Bands: 3/8 inch wide; 0.015-inch-thick aluminum.
- D. Stainless Steel Jacket: Type 304 stainless steel.
 - 1. Thickness: 0.016 inch
 - 2. Finish: Smooth
 - 3. Metal Jacket Bands: 3/8 inch wide; 0.016-inch-thick stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect work in conformance with Section 220500.

3.2 PREPARATION

- A. Pipe Testing: Testing of piping shall be completed, and leaks repaired prior to application of insulation. Surfaces shall be clean and dry before proceeding.
- B. Installation: Install materials after piping has been tested and approved. See Section 220500.
- C. Surface Cleaning: Clean surfaces for adhesives.

3.3 INSTALLATION

- A. Pipe Insulation:
 - 1. Manufacturer's Instructions: Install materials according to manufacturer's instructions.
 - 2. Finished Surface Temperature: Insulation thickness shall conform to those recommended ASHRAE 90.1, latest edition, unless otherwise specified. Thickness of insulation shall be sufficient to keep surface temperatures below 115°F.
 - 3. Continuity: Apply insulation tightly over clean, dry surfaces with sections or edges firmly butted together. Make insulation continuous through sleeves or openings in walls and floors.

4. Make insulation continuous at pipe hangers, trapezes, and other types of supports. Do not notch insulation to fit over hangers, trapezes, and other supports. Install shields at all supports.
5. Name Plates: Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.
6. Supports: Finish insulation neatly at hangers, supports and other protrusions. Locate insulation or cover seams in least visible locations.
7. Inserts: On piping 2 inches in diameter or larger, provide an insert not less than 6 inches long, of same thickness and contour as adjoining insulation, and between support shield and piping but under the finish jacket to prevent insulation from compressing at support points. Inserts shall be cork, hardwood, or other heavy density insulating material suitable for the planned temperature range. Factory fabricated inserts may be used with field fabricated insulation value equal to insulation approved by the Project Engineer. Do not use calcium silicate inserts or other material that can absorb moisture on any piping system below ambient temperature.
8. Enclosures: Do not insulate hot water heating pipe within radiation enclosures.
9. Flanges: On insulated piping without vapor barrier and piping conveying fluids 140°F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation at such locations.
10. Equipment Fittings and Valve Coverings: Insulate all equipment, fittings, and valves. Terminate insulation neatly with insulating and finishing cement troweled on bevel.
11. Preformed Fittings Locations: All fittings and valves shall be insulated with preformed fiberglass for fittings, mitered sections of pipe insulation, or fiberglass blanket insulation of equal thickness to the adjacent pipe insulation. Cover the fittings, valves, and insulation with preformed PVC jacket. Close jacket with stainless steel tacks and compatible adhesive.
12. Radiation Barrier: When insulating hot pipe fittings, a layer of kitchen-type aluminum foil shall be applied over the first fiber glass insert applied, making sure the aluminum foil is extended over the adjacent pipe insulation. A second fiber glass insert shall then be applied over the foil with a vapor seal at all the aluminum foil edges. Insulation thickness shall be such that the surface temperature shall not exceed 115°F.
13. Expansion Devices: On insulated piping with vapor barrier; insulate all equipment, fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
14. Fasteners: Avoid the use of staples on vapor barrier jackets. Seal vapor barrier penetrations with white vapor barrier finish and adhesive.
15. Adhesive Limitations: Apply adhesives to not exceed the coverage recommended by the manufacturer.
16. Wall, Floor, and Ceiling Penetrations: Continue insulation with vapor barrier through penetrations including walls, floors, and ceilings.
17. Enclosure: All insulation ends shall be firmly butted and secured with minimum 3-inch-wide butt strips. Exposed end of pipe insulation shall be sealed with vapor barrier mastic.
18. Repairs: Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.
19. Service Access: When equipment with insulation requires periodical opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.

20. Unless pre-insulated pipe is used, all insulation below grade shall be polyurethane spray foam covering suitable for use in wet environments without degradation. Piping shall be supported by a rigid Styrofoam board 4 inches thick which exceeds the width of the pipes laid in the trench parallel to the pipe. All pipes shall be wrapped with two wraps of 1 1/2-inch-thick fiberglass blanket before spraying. Spray foam shall be applied to assure a 2-inch MINIMUM coverage. Insulation shall be coated with Deer-O Foam Cap W-256 applied at the rate of one gallon per 100 square ft. or vapor barrier protection with a perm rating of 0.0019.
 21. A complete moisture and vapor seal shall be provided on cold surfaces where vapor barrier jackets or coatings are required. Anchors, hangers, and other projections shall be insulated and vapor-sealed to prevent condensation. For heat traced piping, insulated fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size vapor seal large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
 22. Insulation shall be installed in a workmanlike manner by workmen regularly engaged in this type of work. Insulation shall not be applied until all surfaces are clean and dry and until inspection and release for insulation application.
 - a. Do not notch insulation to fit around trapezes or wall-mounts fabricated from slotted metal framing (Unistrut or equal), angle iron, or other materials. Insulation shall be continuous across the support and an insulation shield shall be installed to prevent crushing the insulation. Pipe clamps shall be sized to fit around insulation and shield.
 - b. Insulation may be notched or trimmed around riser clamps. Seal exposed insulation.
- B. Jackets:
1. Indoor, Concealed Applications: Insulated pipes conveying fluids above ambient temperature shall have standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish fittings, joints, and valves with pre-molded PVC jackets secured with stainless steel tacks. The pre-cut insulation shall be held in place by copper wire or hemp twine and be removable without damage to the insulation or jacket. Leave surfaces clean and ready for painting.
 2. Indoor, Concealed Applications: Insulated dual-temperature pipes or pipes conveying fluids below ambient temperature shall have vapor barrier jackets, factory-applied or field-applied. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe, and finish with pre-molded PVC jackets.
 3. Indoor, Exposed Applications: Mechanical Equipment Rooms, all insulated piping to be finished with aluminum jacket secured with metal jacket bands.
 4. Indoor, Exposed Applications: Same as Indoor, Concealed Applications except that in addition the insulation shall be covered with an aluminum jacket secured with metal jacket bands.
 5. Exterior Applications: Same as Indoor, Exposed Applications plus connect with a modified S lock equal to Premetco "Loc-Jack" Z-Crimp, Factory or Field installed. All seams shall be sealed with silicone caulking and have seams oriented so that the jacketing will shed water & not tend to trap and enter rainwater.

3.4 APPLICATION

A. Fittings and Valves Insulation:

1. Pre-molded Fittings: All insulated pipe fittings shall be insulated with 20-mil PVC Zeston one piece pre-molded insulated fittings wherever possible. If Zeston fittings are not

available for the use required, comply with the following paragraph #2. Insulate fittings with fiberglass tightly wrapped with copper wire or heavy hemp twine to within 1/4 inch of thickness of adjoining copper wire or insulation, finished with 1/4 inch of insulating cement troweled flush with pipe insulation. A tack coat of mastic vapor barrier Foster 60-25 or 26-to-1/16-inch thickness or equal shall be applied to fittings and valves. Apply 6 oz. fiberglass canvas jacket to build-up (not PVC) fitting band valve insulation. Cement laps thoroughly with Foster 81-42 or 30-36 adhesive.

B. Perm Rating Vapor Barrier Mastic Coatings:

1. Perm rating not more than 0.25 when tested in accordance with ASTM E-96, Procedure A Fire Retardant.

C. Adhesives, Sealers, Facings, and Vapor Barrier Coatings:

1. Compatible with materials to which applied, and shall not corrode, soften, or otherwise attach the pipe or insulation materials in either the wet or dry state. Use only adhesives, sealers, facings, and vapor barrier coatings recommended by the approved manufacturers of insulation materials.

3.5 SCHEDULE

<u>Service</u>	<u>Pipe Size</u>	<u>Thickness</u>
CW, HW, HWC	All sizes CW, 1/2 inch to 2-inch HW, HWC	1 inch
	2-1/2 inch and Larger HW, HWC	1-1/2 inch
NPW & Cooling Condensate	All sizes	1 inch
HWS, HWR CHWS, & CHWR	All sizes	2 inches
RD & OF	All sizes	1 inch
Steam & Condensate	All sizes	2-inch

END OF SECTION

22 0700

SECTION 22 1000**PIPE AND PIPE FITTINGS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 SCOPE

- A. This section of the specifications encompasses the basic materials and methods of the various piping systems covered in Division 25.
- B. Standards: The latest edition of each standard referenced shall be used to determine compliance.

1.3 RELATED WORK IN OTHER SECTIONS

220000	PLUMBING INDEX
220500	GENERAL PLUMBING REQUIREMENTS
220523	VALVES
220700	PIPING INSULATION
221113	DOMESTIC WATER SYSTEMS
221313	SOIL AND WASTE PIPING SYSTEMS

1.4 IDENTIFICATION OF PIPING

- A. All accessible piping shall be labeled at not more than 10 ft. intervals with labels indicating the service and direction of flow. Pipe labels shall be self-adhesive labels, all-temperature Perma-Code pipe markers No. B-500, manufactured by the W.H. Brady Company. The background color code for all markers shall conform to the American National Standard A13.1 - 1975 "Scheme for the Identification of Piping Systems."
- B. The color red shall be for the exclusive use on fire protection service piping and sprinkler piping per OSHA regulations (CFR 1910.144).

PART 2 - PRODUCTS**2.1 PIPING SYSTEMS**

- A. Domestic water system
 - 1. Above grade:
 - a. Copper: Shall be Type K soft drawn, or Type L hard drawn, seamless copper tubing conforming to ASTM B88, with wrought copper and bronze solder joint pressure fittings conforming to ANSI B16.22.
 - b. Galvanized steel: Shall be schedule 40, galvanized steel pipe conforming to ASTM A-53, with 150-pound galvanized malleable iron screwed fittings conforming with ANSI B16.3.
 - 2. Underground:
 - a. Copper: Type K hard, seamless copper tubing conforming to ASTM B-88 with silver brazed joints (ASTM B-260 Class BAg-1) with wrought copper fittings per ANSI B16.22.

- B. Soil and waste system
 - 1. Above ground:
 - a. Cast Iron: Shall be cast iron hub and spigot soil pipe or hubless cast iron pipe and fittings, (No-Hub Couplings shall conform to CISPI Standard 310 & ASTM A-1277 or latest edition) conforming to ASTM A74 (latest edition) and/or Cast Iron Soil Pipe Institute (CISPI) CS-888 and shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. The hub and spigot pipe shall use compression gasket joints per ASTM C-564 & ASTM 1563.
 - 2. Underground inside building:
 - a. Cast Iron: Shall be cast iron hub and spigot soil pipe or hubless cast iron pipe and fittings, (No-Hub Couplings shall conform to CISPI Standard 310 & ASTM A-1277 or latest edition) conforming to ASTM A74 (latest edition) and/or Cast Iron Soil Pipe Institute (CISPI) CS-888 and shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. The hub and spigot pipe shall use compression gasket joints per ASTM C-564 & ASTM 1563.
- C. Sanitary vent system
 - 1. Vent piping 2" and smaller in diameter may be schedule 40 galvanized steel pipe conforming to ASTM A-53 with 150 pound galvanized malleable iron screwed fittings conforming with ANSI B16.3. Vent piping larger than 2" shall be cast iron as specified for interior soil and waste.
- D. Heating water and chilled water and condenser water systems
 - 1. Copper: Shall be Type K soft drawn, or Type L hard drawn, seamless copper tubing conforming to ASTM B88, with wrought copper and bronze solder joint pressure fittings conforming to ANSI B16.22.
 - 2. Galvanized steel: Shall be schedule 40, galvanized steel pipe conforming to ASTM A-53 with 150 pound galvanized malleable iron screwed fittings conforming with ANSI B16.3.
 - 3. Black steel: Shall be Schedule 40, black steel pipe conforming to ASTM A-53. Fittings 2" and smaller shall be 250 pound malleable iron screwed fittings conforming with ANSI A-197. Fittings 2 1/2" and larger shall be scheduled 40 weld fittings per ASTM A-234. Flanges shall be 150 pound slip-on or wild neck types, flat faced, per ASTM A181, Grade 1.
- E. Preinsulated piping systems
 - 1. Heating water: The pre-insulated piping system shall consist of a FRP -Fiberglass Reinforced Plastic pressure carrier pipe, a sealed PVC - plastic jacket with polyurethane-foam insulation completely filling the annular space between the pipe and the jacket. Joints shall be made using a special two - component adhesive supplied in kits and suitable for domestic water service. Jacket end shall be sealed with factory installed water-tight end seals. Piping shall be equal to Dual-Gard 250 as manufactured by Ric-Wil. All joints shall be insulated and sealed with factory supplied units.
 - 2. Chilled water: The pre-insulated piping system shall consist of a Schedule-40 polyvinyl-chloride-plastic pipe that meets the requirements of National Sanitation Foundation Standard No. 14, a sealed PVC-plastic jacket with polyurethane-foam insulation completely filling the annular space between the pipe and the jacket. Joints shall be made using bell-and-spigot type joints utilizing a gasket ring. Jackets ends shall be sealed with factory installed water tight end seals. Piping shall be equal to Chill-Guard as manufactured by Ric-Wil. All joints shall be insulated and sealed with factory supplied units.

2.2 JOINTS

- A. Copper:
 - 1. Silver brazed joints shall use brazing material containing approximately 45% silver, 15% zinc, 25% cadmium and 15% copper. Joints shall conform to ASTM B-260 Class BA9-1.

Approved materials include Mueller #122, Lucas Milhaupt "Easy Flo45" and United Wire and Supply "Sil-Bond 45".

- B. Cast Iron:
 - 1. Neoprene Rubber gaskets for hub and spigot piping per ASTM C564.
 - 2. No hub joints shall consist of couplings that conform to CISPI 301.
- C. Ductile Iron: Joints shall be of the stuffing box type per ANSI 21.11 as modified by ANSI 21.51 or push-on type per ANSI 21.51. Rubber gaskets and lubricant shall be per ANSI 21.11.
- D. Black Steel:
 - 1. Screwed joints shall be made with no more than three threads showing using teflon tape or teflon joint sealing compound.
 - 2. Welded joints shall be fusion welded to full metal depth with width at least 2 1/2 times the depth of the metal being joined.
- E. Galvanized Steel:
 - 1. Screwed joints shall be made with no more than three threads showing using teflon tape or teflon joint sealing compound.
- F. Fiberglass Reinforced Plastic (FRP)
 - 1. Filament Wound Reinforced Thermosetting Resin Plastic (RTRP-I): Joints shall be bell and spigot with elastomeric gasket, threaded and bonded coupling or tapered bell and spigot with compatible adhesive. All materials shall be the products of a single manufacturer.
 - 2. Centrifugally Cast Reinforced Thermosetting Resin (RTRP-II): Joints shall be bell and spigot type with elastomeric gasket, bell and spigot with adhesive, butt jointed with adhesive bonded reinforced overlay, mechanical, flanged, threaded or commercially available proprietary joints capable of conveying water at the pressure and temperature of the piping system.
- G. Reinforced Concrete Pipe: Joints shall be rubber gasket type using a bell and spigot design of steel. Gaskets shall conform to AWWA C300, C301 or C303.
- H. Bell and spigot joints shall conform to AWWA C200 with rubber gaskets.
- I. Bonded joints shall have metallic bond including joints made with flexible couplings, caulking or rubber gaskets. Metallic bond shall be of ferrous material to effect continuous conductivity. Bond wire shall be type RHW-USE, size 1/0 neoprene gasketed copper conductor. Bond shall be thermal weld type.
- J. Insulating joints shall be installed between nonthreaded ferrous and nonferrous metallic pipe. Insulating joints shall consist of a sandwich type flange insulating gasket of the dielectric type, insulating washers, and insulating sleeves for flange bolts. Gaskets shall be full faced. Bolt insulating sleeves shall be full length. Units shall be of a construction to prevent metal to metal contact of dissimilar piping materials.

2.3 FLOOR, WALL, AND CEILING PLATES

- A. Where exposed pipes pass through finished floors, walls, or ceilings, fit with chromium plated spun brass flanges or flanges to match the type of pipe or pipe finish used. Plates shall be large enough to completely close the hole around the pipe and shall be not less than 1-1/2" or more than 2-1/2" larger than the diameter of the pipes. All plates shall be securely held in place.

2.4 UNIONS

- A. Piping 2-1/2" and larger to have bolted flange unions with gaskets of material suitable for the specified service. Ground joint unions with brass to iron seats shall be used in piping 2" and smaller. Unions shall be installed at all valves and equipment connections.
- B. Insulating Unions: See Specification Section 230519.

2.5 HANGERS AND ANCHORS

- A. To prevent galvanic action between copper pipe and a dissimilar metal, copper pipe shall be isolated to prevent the pipe from contacting the dissimilar metal. This may be accomplished by mounting the pipe in an isolation fitting, or by wrapping the pipe with a 20-mil thickness of UPC-rated isolation tape. The 20-mil thickness can be accomplished by using a single wrap of 20-mil tape or by using 10-mil tape with a 50% overlap.
- B. Copper pipe does not need to be isolated from copper plated pipe hangers that are suspended from hanger rods.
- C. Copper pipe mounted on slotted metal framing (Unistrut or equal), angle iron, or other dissimilar metal support shall be isolated as described above, even if pipe clamps used are copper plated. Painted, epoxy, and powder-coated finishes on the metal support are not an acceptable means of isolation.
- D. All piping shall be rigidly supported from the building structure by means of adjustable ring type hangers. Where pipes run side by side, support on rod and angle trapeze hangers. Hangers shall be spaced not greater than 5 feet on centers for cast iron piping, 6 feet on centers for copper piping and 10 feet on centers for steel piping. Plastic pipe shall be supported on not more than 3 feet centers. Round rods supporting the pipe hangers shall be of the following dimensions:
- | | |
|------------------------------|--------------|
| 1. 1/2-inch to 2-inch pipe | 3/8-inch rod |
| 2. 2-1/2-inch to 3-inch pipe | 1/2-inch rod |
| 3. 4-inch to 5-inch pipe | 5/8-inch rod |
| 4. 6-inch pipe | 3/4-inch rod |
| 5. 8-inch pipe | 7/8-inch rod |
- E. Rods for trapeze hangers shall be a minimum of 3/4 inch and shall have the equivalent cross section listed above per pipe supported. The use of pipe hoods, chains, or perforated iron for pipe supports will not be permitted. Insulated piping shall have hangers outside of insulation with 18 ga. protection sleeves 12" long. Anchors and guides shall be as detailed on the drawings. The Contractor shall provide inserts in the building construction at the time the concrete is poured, and the hangers shall be attached to these inserts. Where inserts cannot be used expansion shields may be used provided the hanger is not attached rigidly to the bolt but is supported from an angle held in place by the expansion bolt. The use of expansion shields must be approved by the Architect/Engineer. See drawings and details for support of tunnel piping.
- F. Hanger rods for all equipment, pipes, ducts, trapezes, vibration isolators, etc., shall be installed straight, true, and plumb. Do not bend or flex hanger rods to accommodate sloping structures, avoid obstacles, or for any other purpose. Where necessary, utilize swivel beam clamps; beveled or swivel hardware; angled, swivel, or hinged brackets spanning members; or other appropriate means of connection.

2.6 THRUST BLOCKS

- A. All underground water line tees, crosses, bends and valves shall be provided with concrete blocking. Concrete blocking shall be used for cast-iron or vitrified clay tile fittings where a change of flow direction occurs. All fittings at bends in the pipeline shall be firmly wedged against the vertical face of the trench by means of concrete thrust blocks bearing on undisturbed earth, to prevent the fittings from being blown off the line when under pressure. Fittings at vertical bends downward shall be anchored with concrete anchors as required. Thrusts blocks shall be determined using an allowable soil bearing pressure of 1,500 PSF at 200 psi test pressure in water line. No blocking will be covered or backfilled until inspected and approved by the Architect/Engineer.

2.7 VALVE BOXES

- A. Valve boxes shall be of cast iron extension type with flared base and shall be M & H Valve and Fittings Company, two-piece, 5-1/4" shaft, screw type to fit depth of bury. The minimum thickness of metal shall be 3/16" and the nominal diameter of the box shall be at least four inches. The cover shall have the name of the utility service cast in the metal. Boxes shall be installed over each outside gate valve unless otherwise shown on the drawings. The boxes shall be of such length as will provide without extension a cover of not less than three feet over all water pipes. Valve boxes shall have concrete collars.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide and erect in a workmanlike manner according to the best practices of the trade all piping shown on drawings and required for the complete installation of the systems. The piping shown on the drawings shall be considered as diagrammatic for clarity in indicating the general run and connections, and may or may not in all parts be shown in its true position. The piping may have to be offset, lowered, or raised as required or as directed at the site. This does not relieve the Contractor from responsibility for the proper erection of systems or piping in every respect suitable for the work intended as described in the specifications and approved by the Architect/Engineer.
- B. In the erection of all piping, it shall be properly supported and proper provisions shall be made for expansion, contraction and anchoring of piping. All piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing or forcing, properly clearing equipment and all windows, door, and other openings. Cutting or other weakening of the building structure to facilitate installation will not be permitted. All pipes shall have burrs and/or cutting slag removed by reaming or other cleaning methods. All changes in direction shall be made with fittings.
- C. Preinsulated Piping Systems
 - 1. All piping adjoining this system shall be anchored at or near the point of connection to avoid imposing any external forces on the carrier pipe. The Contractor shall pour concrete anchor blocks at every change of direction after testing the pipe. The anchor blocks are to be sized in accordance with forces resulting from thermal stress, existing soil conditions, and shall be in accordance with the manufacturer's recommendations.
 - 2. Immediately after the system is installed in the ditch, a partial backfill of selected earth shall be made in the middle of each unit, leaving the joints exposed for inspection of the hydrostatic test. A hydrostatic test of 200-psig shall be required for a period of four hours. No leakage shall be allowed.
 - 3. After hydrostatic testing, final backfill of selected earth shall be hand placed and hand tamped to 12" minimum over the top of the jacket. Remainder of the backfill shall be free of large boulders, rocks over 6" in diameter, frozen earth, or foreign matter. The backfill operation shall now be completed by any convenient means. Do not use wheeled or tracked vehicles for tamping.
 - 4. The services of a factory-trained Field Service Instructor shall be required, and materials shall be stored, handled, and installed in accordance with Manufacturer's recommendations. The Field Service Instructor shall be present during critical stages of the installation and testing.
- D. All open ends of pipes and equipment shall be properly capped or plugged with plugs manufactured for this purpose to keep dirt and other foreign materials out of the system. Plugs of rags, wool, cotton waste or similar materials may not be used in plugging.
- E. All piping shall be arranged avoiding interference with removal and maintenance of equipment, filters, or devices; and not blocking access to manholes, access openings, etc. Flanges or

unions as applicable for the type of piping specified shall be provided at the piping connections to all items of equipment.

- F. Valves and specialties shall be placed to permit easy operation and access, and valves shall be regulated, packed, and adjusted at the completion of the work before final acceptance.
- G. All piping shall be erected to ensure proper draining. Steam mains shall be pitched down in the direction of flow, a minimum of one inch per 40 feet or appropriately trapped. Where steam and condensate flow in opposite directions within the same pipe, the pipe shall be 2 sizes larger than shown unless specifically shown on the drawings that counterflow of condensate was intended by the design. Condensate return mains shall be pitched down, one inch per 20 feet in the direction of flow. Domestic water piping may be run level but shall be free from traps.
- H. Soil and waste piping and other gravity drains shall be sloped down in direction of flow minimum one inch in 20 feet.

3.2 ACCESS DOORS

- A. Furnish all access doors required for access to valves, controls, or other items for which access is required for either operation or servicing. All costs incurred through failure to perform this function as the proper sequence of the work dictates shall be borne by this Mechanical Contractor.
- B. The type of access door shall be as required by the room finish schedule. Acoustical tile access doors shall be equal to Krueger Style B, Style A for acoustical plaster, or Style C-CF for sidewall drywall or plaster construction.

3.3 JOINTS

- A. Resilient molded gaskets shall be used on hub and spigot piping. For cast iron soil pipe not located under buildings, the Contractor may also use the No-hub sanitary system for pipe 6" and below with neoprene sealing gaskets, stainless steel retaining sleeves and two draw bands. An adequate torque wrench shall be used for system installation in accordance with manufacturer's recommendations.
- B. Screwed Joints: Screwed joints shall be American Standard taper pipe threads. Ream pipe ends and remove burrs after threading. Make up joints using an approved compound or teflon tape, applied to the male threads only.
- C. Brazed and Soldered Joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool before sweating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections.
- D. Welded Joints: On black steel piping 2 inches and above in size, the joints shall be welded. Welding shall be done using either gas or electric welding equipment. Certified welders shall be used. All pipe surfaces shall be thoroughly cleaned before welding. Each joint shall be beveled before being welded. Piping shall be securely aligned and spaced, and the width of circumferential welds shall form a gradual increase in thickness from the outside surface to the center of the weld. The Contractor shall use appropriate materials to protect the structure and provide adequate fire protection at all locations where welding is done. All elbows shall be long radius unless otherwise specified. Wherever tee connections are made to piping systems on the main run, welding sockets may be installed for the branch connections up to one half the size of the main run. On connections larger than one half the size of the main run, welding tees shall be used. The use of fittings formed from welded pipe sections will not be permitted.
- E. Flanged Joints:
 - 1. Cast iron flanges shall conform to the American Standard for cast iron pipe flanged fittings, Class 125 (B.16.1). Gaskets shall be suitable for the service on which used.
 - 2. Steel flanges shall be 150 lb. raised face type.

F. Solvent Welded Joints:

1. Pipe shall be cut square with pipe cutters designed specifically for plastic pipe. Pipe shall be protected from serrated holding devices and abrasion. Remove burrs from inside and outside of pipe. Clean the joining surfaces using an approved ABS Cleaning compound. Following the instructions on the can, apply the ABS cement and assemble the joint as quickly as possible before the cement dries.

3.4 PUMP AND EQUIPMENT CONNECTIONS

- A. All piping connecting to pumps or other equipment shall be installed with isolation valves and flexible connections to prevent strain at the connection to equipment. The Contractor shall be required as directed to disconnect piping to demonstrate that piping has been so connected. Provide a suction diffuser at each end suction pump where the inlet piping has a straight run of less than 15 pipe diameters in length. Suction diffusers shall consist of angle type body with inlet vanes and combination diffuser-strainer-orifice cylinder with 3/16-inch diameter openings for pump protection. Strainer free area shall be five times the section area of the pump connection. Provide an adjustable support foot for diffusers installed on end suction pumps.

3.5 PIPE SLEEVES

- A. Pipe sleeves shall be furnished and set by the Contractor, and the Contractor shall be responsible for their proper and permanent location. Piping will not be permitted to pass through footings, beams or ribs unless so noted on the drawings or with the consent of the Architect/Engineer. Pipe sleeves shall be installed and properly secured in place at all points where pipes pass through concrete or masonry construction and through all exterior walls, regardless of construction. Pipe sleeves, except sleeves in footings and beams shall be of sufficient diameter to provide approximately 1/4-inch clearance around the pipe, and in cases of insulated pipes, approximately 1/4-inch around the insulation. Pipe sleeves in footings and beams and exterior walls shall be of steel pipe. Sleeves in footings shall be not less than one inch or more than two inches larger in diameter than the pipe to be installed. Pipe sleeves in floors shall be cut flush with finished floor. Openings between piping and sleeves shall be made watertight with plastic cement to a minimum depth of two inches. Openings between piping and sleeves in all masonry or concrete interior walls and partitions shall be similarly caulked for acoustical reasons.

3.6 EXPANSION AND CONTRACTION

- A. The Contractor shall make all necessary provisions for expansion and contraction of piping with offsets or loops and anchors to prevent undue strain.

3.7 PROTECTIVE COATINGS

- A. All underground pipe except exterior cast iron water distribution pipe shall be wrapped with "Scotchwrap" No. 50 tape to give not less than two complete layers on the entire underground piping system, or piping shall have X-TRU Coat factory applied plastic protective covering.
- B. All buried exterior cast iron water distribution piping shall be tar coated.

3.8 TESTING

- A. Before any insulation is installed or before piping is covered or enclosed all piping systems shall be tested and proved tight at not less than 1.5 times the maximum service pressure which the piping systems will be required to handle, unless otherwise specified.
- B. All tests shall be conducted in the presence of the Architect/Engineer and the building Owner or his representative. Any systems failing to meet the specified test requirements shall be corrected and retested until the test requirements are met.

3.9 FLUSHING, DRAINING, AND CLEANING PIPE SYSTEMS

- A. The Contractor shall flush water piping systems with water before placing them in operation. After systems are in operation and during the test period all strainer screens shall be removed and thoroughly cleaned. The Contractor shall notify the Architect/Engineer in writing when this requirement is to be accomplished.
- B. All domestic water lines shall be sterilized as described in Section 221113 -DOMESTIC WATER SYSTEM of these specifications.

END OF SECTION

22 1000

SECTION 22 1113**DOMESTIC WATER SYSTEMS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. The Contractor shall furnish and install the Domestic Water System as shown on the drawings including specialties shown or called out in the fixture and/or equipment list and as necessary for satisfactory operation of the system.

1.3 RELATED WORK IN OTHER SECTIONS

220000	PLUMBING INDEX
220500	GENERAL PLUMBING REQUIREMENTS
220523	VALVES
220700	PIPING INSULATION
221000	PIPE AND PIPE FITTINGS

1.4 STERILIZATION

- A. All domestic water piping shall be sterilized as described in Part 3 of this section.

PART 2 - PRODUCTS**2.1 PIPE AND PIPE FITTINGS**

- A. Pipe and pipe fittings shall be as described in Section 221000 - PIPE AND PIPE FITTINGS.
- B. All piping in any utilities tunnel shall have welded or silver brazed joints.

2.2 SHOCK ABSORBERS

- A. Shock absorbers and/or air cushions shall be installed where shown on the drawings. Shock absorbers shall be equal to Zurn Z-1700, Diatrol Series 500 or approved equal sized for the system being protected.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. The installation shall conform to the requirements of Section 220500 - GENERAL PLUMBING REQUIREMENTS, and Section 221000 - PIPE AND PIPE FITTINGS.
- B. Insulating couplings shall be furnished and installed at all connections between copper and steel pipe to prevent electrolysis.
- C. Each water service main, branch main, riser, and branch to a group of fixtures shall be valved. Stop valves shall be provided at each fixture.

3.2 STERILIZATION

- A. Domestic Water lines shall be sterilized as follows: Chlorine shall be applied to provide a solution of not less than 250 PPM. The chlorinating material shall be introduced into the waterline in a manner approved by the Architect/Engineer. The solution shall be circulated if provided with pumps and all valves in the line shall be operated several times during the contact period. After a contact period of no less than eight (8) hours the system shall be flushed with clean water until the residual chlorine content is not greater than 0.2 PPM.
- B. The sterilization procedure shall be witnessed by the Architect/Engineer and Owner.

3.3 TESTS

- A. General: All tests shall be conducted in the presence of the Architect/Engineer or his representative. Any systems failing to meet the specified test requirements shall be corrected and retested until the test requirements are met.
- B. Water Systems: The complete water systems shall be hydrostatically tested at a pressure of 150 psi and shall show no loss in pressure for a period of one hour.

END OF SECTION**22 1113**

SECTION 22 1313**SOIL AND WASTE PIPING SYSTEMS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. The Contractor shall furnish and install the soil and waste piping system as shown on the drawings including specialties shown or called out in the equipment list and as necessary for satisfactory operation of the system.

1.3 RELATED WORK IN OTHER SECTIONS

220000	PLUMBING INDEX
220500	GENERAL PLUMBING REQUIREMENTS
221000	PIPE AND PIPE FITTINGS

1.4 REQUIREMENTS

- A. See Sections 220500 - GENERAL PLUMBING REQUIREMENTS and 221000 - PIPE AND PIPE FITTINGS for general requirements.
- B. Furnish and install all concrete, grout, and other required materials to fill all block outs and/or sleeves left open for this Subcontractor's convenience or for the installation of this work.

PART 2 - PRODUCTS**2.1 PIPE AND PIPE FITTINGS**

- A. The pipe and pipe fittings shall be as described in Section 221000 - PIPE AND PIPE FITTINGS.

2.2 FLOOR DRAINS

- A. Drains shall be Zurn, Wade or J.R. Smith and shall be equal to those specified on the drawings.

2.3 FLOOR SINKS

- A. Drains shall be Zurn, Wade or J.R. Smith and shall be equal to those specified on the drawings.

2.4 CLEANOUTS

- A. Cleanouts shall be as manufactured by Zurn, Wade or J.R. Smith and shall be of the same size as the pipe except that cleanout plugs larger than four inches will not be required. Cleanouts installed in connection with cast iron soil pipe shall consist of a long sweep, quarter bend, or one or two eighth bends extended to an easily accessible place, or as indicated on the drawings.
- B. Cleanouts in finish floors shall be of the type made to match the floor and/or covering. All exposed metal shall be polished or chrome plated brass.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Installation shall conform to Section 220500 - GENERAL PLUMBING REQUIREMENTS, and Section 221000 - PIPE AND PIPE FITTINGS.
- B. Flashings: Vent pipes shall be flashed and made watertight at the roof with sheet lead flashing. Flashing shall weigh at least four pounds per square foot, shall be 24 inches square and shall be turned up around the pipe and into the top of the pipe. Vent pipes shall extend at least 12 inches above roof.
- C. Traps: Each fixture and piece of equipment connecting to the drainage system shall be equipped with a trap, whether integral or external to the fixture. Each trap shall be placed as near to the fixture as possible and no fixture shall be double trapped.
- D. Floor Drains: All floor drains shall be installed with grates square with the building lines.

3.2 TESTS

- A. The entire sanitary system shall be tested in accordance with the requirements of the State Plumbing Code, all local codes and ordinances, and the Uniform Plumbing Code.

END OF SECTION

22 1313

SECTION 22 4200**PLUMBING FIXTURES****PART 1 - GENERAL****1.1 SCOPE**

- A. Plumbing fixtures shall be supplied, set, and connected as shown on plans. Fixtures shall be protected from damage during construction and shall be thoroughly cleaned of all tape, paint, and adhesive prior to final acceptance.

PART 2 - PRODUCTS**2.1 PLUMBING FIXTURES**

- A. Plumbing fixtures shall be as manufactured by Kohler, American Standard, or Sloan and shall be as scheduled on the drawings.
- B. Flush valves shall be as manufactured by Zurn, Delany, or Sloan.

2.2 FITTINGS AND PIPES

- A. Fittings and piping shall be brass and whenever exposed, shall be polished chrome plated. Provide tight fitting wall and/or floor escutcheons of chrome-plated brass whenever pipes pass through floors, wall, or ceilings.
- B. All porcelain or vitreous china shall be clean, smooth, and bright. All shall be warranted not to craze, discolor, or scale.
- C. This contractor shall furnish and install all required water, waste, soil, and vent connections to all plumbing fixtures together with all fittings, supports, fastening devices, cocks, valves, traps, etc., leaving all in complete working order.
- D. All automatic or self-closing valves for faucets shall be adjusted in accordance with manufacturer's instructions and supervised as necessary by equipment supplier's representative at the request of the Architect or Engineer.
- E. Owner furnished equipment shall be connected with drains, traps, hot water, cold water and other services required for optimum operation. This contractor shall obtain information from the Owner or his approved representative for services required or field verify specific requirements.

END OF SECTION**22 4200**

Division Twenty Three

HVAC

SECTION 23 0000**HEATING, VENTILATING, AND AIR CONDITIONING INDEX****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Heating, Ventilating, and Air Conditioning Work, as indicated on the Drawings and specified herein. Heating, Ventilating, and Air Conditioning work indicated on the Drawings and/or specifications covering other trades shall conform to Division 23 of these Specifications.
- B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Heating, Ventilating, and Air Conditioning systems, shall be accomplished without additional cost to the Owner.
- C. Furnish all labor and materials required for Heating, Ventilating, and Air Conditioning service connections to all the various items of equipment requiring connection throughout the project shown on the Contract Drawings (even if not shown on Heating, Ventilating, and Air Conditioning Drawings). Coordinate with other trades for the installation of required connections and service.

1.3 HEATING, VENTILATING AND AIR CONDITIONING DIVISION INDEX

230500	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
230593	BALANCING OF MECHANICAL SYSTEMS
230713	DUCT INSULATION
232500	WATER TREATMENT SYSTEMS
233000	AIR DISTRIBUTION
233113	DUCTWORK CLEANING

PART 2 - PRODUCTS - NOT USED**PART 3 - EXECUTION - NOT USED****END OF SECTION****23 0000**

SECTION 23 0500**GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes: General Mechanical Requirements specifically applicable to Division 23 sections in addition to Division 1- General Requirements.
- B. Scope:
 - 1. The work covered by this division consists of performing all operations in connection with the installation of heating, cooling, and ventilating work as indicated under this section. This entire section applies to all mechanical work and all mechanical sections of these specifications. This Contractor shall read and comply with all sections of these specifications including all General and Special Conditions.

1.2 REFERENCES

- A. Standard Requirements:
 - 1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. All work shall be executed in accordance with the local and state codes, ordinances, and regulations governing the particular class of work involved. This Contractor shall be responsible for the final execution of the work under this heading to suit these requirements. In the event of a conflict between the various codes and standards, the more stringent shall govern. Where these specifications and accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect/Engineer. The Architect/Engineer shall prepare any supplementary drawings required, illustrating how the work may be installed so as to comply. On approval of the change by the Architect/Engineer, the Contractor shall install the work in a satisfactory manner without additional cost to the Owner. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved, and on completion of the work, this Contractor shall obtain and deliver to the Owner final certificates of acceptance. This Contractor shall furnish copies of each certificate to the Architect/Engineer.
- C. The Contractor shall secure all permits and licenses for his work and shall pay all fees in connection with such permits and licenses.
- D. The contractor shall hold and save the Owner free and harmless from liability of any nature or kind arising from his failure to comply with codes and ordinances.
- E. Any and all meter deposits and all utility extension costs shall be paid by the Contractor whose work is done in connection with the service that the meter is connected to.
- F. Schedule of Referenced Organizations: The following is a list of the acronyms of organizations referenced in these Specifications:
 - 1. AABC Associated Air Balance Council
 - 2. ADC Air Diffusion Council
435 North Michigan Ave.
Chicago, IL 60611
 - 3. AGA American Gas Association
1515 Wilson Boulevard

	Arlington, VA 22209
4. AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004
5. ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
6. ASHRAE	American Society of Heating Refrigerating and Air Conditioning Engineers 345 East 47th Street New York, NY 10017
7. ASME	American Society of Mechanical Engineers 345 East 45th Street New York, NY 10017
8. ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
9. AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
10. AWS	American Welding Society 2501 NW 7th Street Miami, FL 33125
11. FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
12. FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Building 197 Washington, DC 20407
13. NBFU	National Board of Fire Underwriters 5530 Wisconsin Avenue, Suite 750 Chevy Chase, Maryland 20815
14. NEC	National Electric Code (of NFPA)
15. NEBB	National Environmental Balancing Bureau 8224 Old Courthouse Road Vienna, VA 22180
16. NEMA	National Electrical Manufacturer's Association 2101 L Street, NW Washington, DC 20037
17. NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
18. NSF	National Sanitation Foundation Box 1468 Ann Arbor, MI 48106
19. OSHA	Occupational Safety and Health Administration U.S. Department of Labor
20. SMACNA	Sheet Metal and Air Conditioning Contractor's

- National Association
8224 Old Courthouse Road
Vienna, VA 22180
21. TIMA Thermal Insulation Manufacturers Association
 Technical Services
 1420 King Street
 Alexandria, VA 22314
22. UL Underwriters Laboratories, Inc.
 333 Pfingston Road
 Northbrook, IL 60062

- G. Underwriters Laboratories Inc. (UL): All materials, appliances, equipment, devices, or appurtenances shall conform to the applicable standards of Underwriters Laboratories Inc., where such standards have been established.

1.3 DRAWINGS

- A. Drawings and specifications shall be considered as cooperative, and work or materials called for by one and not mentioned in the other, or vice versa, shall be done and furnished as though treated by both.
- B. In the cases of discrepancies in figures, drawings, or specifications, the Architect/Engineer shall be notified immediately and his decision shall determine the necessary adjustment. Without such decision, said discrepancies shall not be adjusted by the Contractor save only at his expense, and, in case of any settlement or any complication arising from such adjustment to the Contractor, he shall bear all extra expense involved.
- C. Should it appear that the work intended to be done, or any of the matters relative thereto, are not sufficiently detailed or explained on the drawings or specifications, the Contractor shall apply to the Architect/Engineer for such further drawings or explanations as may be necessary, allowing a reasonable time for the Architect/Engineer to supply same, and the Contractor shall conform to same as part of the Contract.
- D. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, reference shall be made to the Architect/Engineer whose decision shall be final and conclusive. No alleged oral admission, condonation, or inadvertent neglect on the part of the Architect/Engineer will be accepted as an excuse for inferior work.
- E. The mechanical plans do not give exact details as to elevations of ductwork and piping, exact locations, etc., and do not show all offsets, control lines, pilot lines, and other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated, satisfactory operational installation.
- F. Should the particular equipment which any Bidder proposes to install, require other space conditions than those indicated on the drawings, the Bidder shall arrange for such space with the Architect/Engineer before submitting his bid. Should changes become necessary on account of failure to comply with these details, the Contractor shall make such necessary changes at his (the Contractor's) own expense.
- G. The Contractor shall submit working scale drawings of all his apparatus and equipment that varies in any way from these Specifications and plans which shall be checked by the Architect/Engineer and approved before the work is started. Interference with structural conditions shall be corrected by the Contractor.
- H. All equipment shall be installed in accordance with the manufacturer's recommendations. Provide all accessories and components for optimum operation as recommended by the manufacturer.

- I. Site visit: The Contractor shall visit the site prior to bidding and satisfy himself as the conditions under which the mechanical systems are to be installed. No subsequent allowance shall be made in his behalf for failure to make such a visit. Contractor shall examine all work noted under the demolition drawings and all new work and shall satisfy himself as to the extent of work required to be completed.

1.4 PRIOR APPROVALS

- A. Each equipment item for which the Contractor desires to install equipment other than the specific item identified in the equipment schedule or equivalent equipment by manufacturers specifically named in the schedule, the Contractor shall bear full responsibility to prove to the Engineer that the furnished equipment is equivalent to or better than the specified item. Failure to provide such proof will result in rejection of the shop drawing submittal by the Engineer. Prior written or verbal approval by the Engineer of equipment by other manufacturers will not relieve the Contractor of responsibility to provide equivalence. Prior approval is not required, however, any prior approval given is intended only to provide preliminary agreement that the alternate manufacturer may make equipment that complies with the specification requirements and not that all equipment manufactured by him is acceptable.

1.5 SHOP DRAWINGS

- A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this Contract. This shall include piping, ductwork, mechanical equipment, plumbing equipment, control items, etc. The Contractor shall submit to the Architect/Engineer a sufficient number of copies of all such shop drawings or catalog data to provide him with as many review copies as he may need, plus three (3) copies for retention by the Architect/Engineer. No materials or equipment shall be installed until officially approved by the Architect/Engineer.
- B. Before submitting Shop Drawings to the Architect/Engineer for review, the Contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of Shop Drawings is not intended to take the place in any way of the official review of the Architect/Engineer, and the Shop Drawings which have not been reviewed by the Architect/Engineer shall not be used in fabrication or installing any work.
- C. The review of Shop Drawings or catalog data by the Architect/Engineer shall not relieve the Contractor from responsibility for deviations from the plans and Specifications unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Architect/Engineer thereon, nor shall it relieve him from the responsibility for error of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Architect/Engineer, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra costs are involved for making the change.
- D. After receiving approval on the make and type of materials, the Contractor shall order such materials in sufficient time so that no delay or changes will be caused. This is done to facilitate progress on the job and failure on the part of the Contractor shall render him liable to stand the expense of any and all delays occasioned by failure on this part to provide necessary details. All shop drawings shall be delivered to the Architect/Engineer's office within thirty (30) days from the date of the contract.
- E. Shop drawings will be returned rejected unless the following information is included: name of the project, reference to all pertinent data in the Specifications or on the Drawings, size and characteristics of the equipment, and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings.

1.6 SUBMITTALS

- A. Submittal data shall be organized in commercial quality, three ring binders with durable and cleanable covers. Product information for each piece of equipment shall be separated by an indexing leaf with clear tabs. The product name and symbol (e.g., AHU-1/Air Handling Unit) shall be presented for each item within the submittal. Complete data must be furnished showing performance, quality, and dimensions. A signed review by the Architect/Engineer must be obtained before purchasing any equipment.
- B. The following items shall be submitted for review by the Architect/Engineer but are not limited to:
 - 1. Diffusers, Registers and Grilles
 - 2. Duct Insulation
 - 3. Temperature Controls
 - 4. Hydronic Air Control Devices
 - 5. Flexible Pipe Connections
 - 6. Ductwork Shop Drawings
 - 7. Vibration Isolation Equipment and Calculations

1.7 QUALITY ASSURANCE

- A. General: Comply with Division 1.
- B. Welder Qualifications: Welders shall be certified by the American Society of Mechanical Engineers (ASME) National Certified Pipe for the type of work being performed. Current operators' certificates in accordance with ASME standards shall be on file at the site and shall be available to the Architect/Engineer for examination. Coupons shall be available for review by the Architect and Engineer.
- C. Locations of all pipes, ducts, outlets, appliance, etc., as shown on the drawings, are approximate only and are understood to be subject to such revisions as may prove necessary or desirable at the time the work is installed. Each Contractor will be required to install his work with relation to existing building conditions and shall be entirely responsible for the correctness of his work with reference to finished elevations, etc. Piping shown on the drawings is diagrammatic only and their exact locations, depths, and invert elevations shall be as required for proper flow and coordination with other trades.
- D. The contract drawing depicts graphically the arrangement of piping and ductwork. Should local conditions necessitate a rearrangement, or if any of the piping or ductwork can be installed to better advantage in a different manner, the Contractor shall, before proceeding with the work, prepare and submit three (3) copies of Drawings of the proposed arrangement for the Architect/Engineer's review.
- E. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such change shall be accompanied by Shop Drawings of the space in question.
- F. Each Contractor is responsible for the proper location and size of all slots, holes, or openings in the building structure pertaining to his work, and for the correct location of pipe sleeves.
- G. Each Contractor shall coordinate his work with that of all other trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. Drainage lines shall take precedence over water lines in determination of elevations. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

- H. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Lubricate all equipment properly in accordance with manufacturer's instructions. Furnish zerk grease fittings on all greaseable bearings.
- I. Equipment and Materials: The materials and equipment shall be new and shall be the standard products of the manufacturers regularly engaged in the production of Heating, Cooling, and Ventilation Equipment, and shall be the manufacturer's latest standard design. Where two or more units of the same class of equipment are required, these units shall be the products of the same manufacturer. However, the component parts of the systems need not be the products of the same manufacturer. Specific equipment specified hereinafter is to be considered a standard of quality and operation. In general, all capacities of equipment, and motor and starter characteristics are shown in schedules on the drawings. Reference shall be made to the schedules for specific information. The capacities shown are minimum capacities. Variations in the characteristics will be permitted only on written approval of the Architect/Engineer. All equipment shall be shipped to the job with not less than a prime coat of paint or as specified hereinafter. Insofar as is possible all items of the same type (i.e., pumps, fans, etc.) shall be by the same manufacturer. Where installation instructions are not included in these specifications or on the plans, the manufacturer's instructions shall be followed. All equipment affected by altitude shall be rated to operate at the altitude where it is to be installed.
- J. Excavation and Backfilling: This Contractor shall do all necessary excavation and backfill for the installation of the Mechanical systems as may be required. Curb cuts, asphalt and concrete patching, cutting and patching existing floor, etc., shall be part of this Contractor's responsibility. No extra payment will be made for rock excavation. Trenches for all underground piping shall be excavated to the required depths. The bottoms of trenches shall be tamped hard and graded to secure maximum fall. Bell holes shall be excavated to assure the pipe resting for its entire length on solid ground. Should rock be encountered, it shall be excavated to a depth of 6 inches below the bottom of the pipe, and before laying the pipe, the space between the bottom of the pipe and the rock surface shall be filled with gravel, thoroughly tamped. Pipe laid in trenches dug in fill shall be supported down in the trenches and shall be filled. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. The backfill material shall be identical to the surrounding fill material and shall be placed in 6-inch layer, wetted, and compacted to the density of the adjacent soil. See Division 2 for additional information for site utilities. All surplus materials shall be hauled from the project by the Contractor at his expense.
- K. Cutting and Repairing:
1. Responsibility lies with the Contractor whose work is involved. Coordinate with other trades to prevent unnecessary cutting and repairing.
 2. Lay out and locate equipment, openings, and chases. Install sleeves, inserts, and supports. Arrange with those whose work is involved to do cutting and replacing caused by negligence or error with costs reimbursed by the Contractor at fault. Cutting and replacing of existing work shall be the responsibility of the Contractor whose work is being installed.
 3. Removal or terminating connections of existing work which is abandoned or replaced shall also be done hereunder to provide correct and finished work.
- L. Foundations: All equipment shall be provided with suitable foundations and supports. It shall be the responsibility of the Contractor to provide for the proper locations of these foundations and supports. This applies to all rooftop equipment also.
1. All concrete foundations required by equipment furnished by the Mechanical Contractor shall be constructed by them (except where otherwise noted) the conformity with the recommendations of the manufacturer of the respective equipment, and with the approval of the Architect/Engineer. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow 1 inch below the equipment base for alignment, leveling and grouting with nonshrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has

- hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed.
2. Unless otherwise noted, foundations shall be a minimum of 6-inch high. All concrete work performed by these Contractors shall conform entirely to the requirements of the Concrete Specifications which describe this class of work.
- M. Code Requirements: Comply with state and local code requirements and ordinances. Call for inspections required by responsible building inspection authority.
- N. Applicable Building Codes and Ordinances: Including the latest edition of each code, but not limited to the following:
1. International Building Code.
 2. Uniform Mechanical Code.
 3. Uniform Plumbing Code.
 4. Governing Fire Department Requirements
 5. Utility Company Requirements
 6. National Fire Protection Association Standards
 7. NFPA 70 - National Electrical Code
 8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
 9. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
 10. NFPA 13 - Sprinkler Systems
 11. NFPA 101 - Life Safety
 12. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment
 13. International Energy Conservation Code 2018
- O. Access Panels
1. Similar to Milcor, or as noted on the drawings, size as required for concealed expansion joints, valving, gauges, balancing dampers, valves, traps, pitot stations, equipment and similar items requiring accessibility. Notify the General Contractor of each access panel location and the required size. Panels shall be proper type for ceiling or wall in which they are installed. The panels shall be furnished under this section of the Specifications, unless otherwise directed, but shall be coordinated to be compatible with walls and ceilings furnished under other sections.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with Division 1
- B. Large Items: Arrange with other trades on the job for introduction into the building of equipment too large to pass through finished openings.
- C. Acceptance: Check and sign for materials to be furnished by others for installation under all Mechanical Divisions upon delivery. Contractor shall be responsible for the storage and safekeeping of such materials from time of delivery until final acceptance.
- D. Protection: Close ends of pipe and ductwork at the close of each working day during construction to prevent entry of foreign material. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Protect fixtures and equipment against damage during mechanical work with heavy paper or plastic until final clean-up.
- E. Storage: Store equipment in covered enclosure or wrap with weather tight 6 mil Visqueen.
- F. Shipping Protection: Protective casings, crating, and coverings to remain in place until start-up of equipment.

1.9 PROJECT CONDITIONS

- A. Performance: All systems are to be rated at [5,500 ft.] elevation.

1.10 SEQUENCING AND SCHEDULING

- A. General: Comply with Division 1.
- B. Schedule: Coordinate and order the progress of mechanical work to conform to the progress of the work of the other trades. Complete the entire installation as soon as the condition of the building will permit.
- C. Utility Interruptions: Schedule mechanical utility interruptions with the Architect/Engineer/Owner minimum of seven (7) days prior to the requested outage. Plan work so that the duration of the interruptions is as short as reasonably possible.

1.11 PROTECTION AGAINST HAZARDOUS CONDITIONS

- A. The Contractor shall take precautions against hazardous construction conditions at all times during construction. The final condition of the facilities shall be safe and, where safety to operating personnel is jeopardized, suitable signage shall be posted.
- B. Protruding metal (bolts, steel angles, etc.) potentially hazardous to maintenance and operating personnel, shall be cut back and/or protected to reduce the risk of injury. All openings between floors shall be protected with barriers around the openings, gratings across the openings, or steel bars through the openings to avoid and protect against injury.

1.12 HAZARDOUS SIGNS

- A. Any equipment room that contains moving or rotating parts, floor openings, or other potentially hazardous environments and shall include a sign on the door entering it that shall read similar to the following: **Hazardous Area - Authorized Personnel Only.**

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. The Mechanical Contractor shall furnish to the Owner a bound (three (3) ring binder) manual in triplicate, containing complete repair parts lists, and operating, service, and maintenance instructions on all mechanical equipment, fixtures, and systems, as noted below:
 - 1. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Engineer, Sub-consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
 - 2. For Each Product System: List names, addresses and telephone numbers of Sub-contractors and suppliers, including local source of supplies and replacement parts.
 - 3. Product Data: Mark each sheet to clearly identify specific product and component parts, and data applicable to installation. Delete inapplicable information.
 - 4. Warranties and Bonds: Bind in copy of each.
 - 5. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
 - 6. Include color-coded wiring diagrams as installed for control system.
 - 7. Operating Procedures: Include start-up, break-in and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and any special operating instructions.
 - 8. Maintenance Requirements: Include routine procedures and guide for troubleshooting, disassembly, repair, reassembly, alignment, adjustment, balancing, and verification instructions.
 - 9. Provide servicing and lubrication schedule and list of lubricants required.

10. Include manufacturer's printed operation and maintenance instructions.
11. Include sequence of operation by controls manufacturer.
12. Provide original manufacturer's part list, illustrations, assembly drawings and diagrams required for maintenance.
13. Provide control diagrams by controls manufacturer as installed.
14. Provide charts of valve tag numbers, with locations and functions of each valve, keyed to flow and control diagrams.
15. Provide list of original manufacturer's spare parts and recommended quantities and to be maintained in storage.
16. Include Test and Balance (T&B) Reports as specified in Section 230593.

1.14 WARRANTY AND SERVICE PROGRAM

- A. Due to the critical performance requirements and to clearly establish warranty responsibility for this project, the Contractor shall provide a full service maintenance and warranty program to the Owner for one full year after beneficial occupancy (substantial completion).
- B. This service program shall be included as part of the base bid and shall include service, maintenance, repair, replacement, lubrication, temperature control calibration and repairs, and documenting proof for all service and maintenance work on all equipment and system furnished by the Contractor.
- C. A single representative in the employment of the Contractor shall be responsible for coordination and follow through of this program. This representative's name and phone number shall be submitted to the Owner as part of the maintenance manuals and supportive data. The Contractor shall respond to a request for service with 24 hours if so requested.
- D. During this first year of operation, the following sequence of maintenance service shall be performed as a minimum:
 1. Clean strainers in piping.
 2. Lubricate and oil fans and/or pumps once every four (4) months.
 3. Calibrate controls throughout the facility at the end of six (6) months (following substantial completion). Any leaks in the piping systems shall be repaired.
 4. Follow all equipment manufacturer's service recommendations during this period.

1.15 FLUSHING AND DRAINING

- A. It shall be the responsibility of this Contractor to properly drain and flush all ducts and pipes before use or acceptance to ensure that all debris is completely removed. Damage caused by such debris remaining in the ducts or pipes shall be repaired by this Contractor at his expense. This Contractor shall demonstrate to the Architect/Engineer's representative that all piping is clean.

1.16 CLEANING

- A. This Contractor shall remove from the building construction site all rubbish and dirt as it accumulates under the contract. At completion, all areas shall be broom cleaned, and all obstructions, surplus materials, etc., shall be removed.

1.17 GUARANTEE

- A. The Contractor shall guarantee all materials, equipment, and workmanship furnished and installed by him under this Contract, to be free from any defects of workmanship and materials, and shall agree to replace, at his expense, any and all defective equipment, parts, etc., that may be found at any time within one year after installation is accepted by the Architect/Engineer. This excludes normal maintenance and daily servicing of equipment which is the Owner's responsibility.

1.18 FLOOR, WALL, AND CEILING PLATES

- A. Where exposed pipes pass through floors, finished walls, or finished ceiling, they shall be fitted with chromium-plated escutcheons of an approved pattern. Escutcheons and plates in Mechanical Rooms do not require chrome finish.
- B. This Contractor shall be responsible for providing and installing all counter flashing. All openings in the roof shall be flashed and counter-flashed. Use four pound lead flashing materials for all vent lines and welded flashing in steel lines passing through roof. The Mechanical Contractor shall notify the General Contractor where each roof penetration is and the size of the opening.

1.19 PIPE SLEEVES

- A. Schedule 40 steel pipe sleeves or pipe sleeves made of 20-gauge galvanized steel shall be provide for all pipes passing through concrete floors, roofs, and masonry walls. Properly secure in place with approximately 1/4" space between each sleeve and the surface of the pipe or insulation passing through it. All pipe sleeves shall be fixed in place as the walls and floors are built up. The Contractor shall furnish and locate all sleeves and pipes passing through concrete floors, exterior masonry walls, and roofs. These penetrations shall be made watertight with approved non-hardening plastic material. Sleeves through pipe chase or equipment room floors shall project a minimum of 2 inches above the floor and shall be of black steel pipe with waterproof flange at center of floor thickness. Each sleeve through a fireproof wall shall be packed with approved fireproof rope in the annular space.

1.20 PIPE HANGERS

- A. Pipe hangers shall be Fee and Mason of a type suitable for each use. Perforated straps shall not be used in any work. For ferrous pipes up to and including 4 inch in size, use Fee and Mason Figure 199 malleable iron, adjustable, split ring, swivel hanger. For plumbing piping larger than 4 inch, use Fee and Mason Figure 239 steel clevis hanger. Where several pipes are parallel at the same elevation, trapeze hangers may be used. Where trapeze hangers are used, the pipes shall be supported on rollers where indicated on the Drawings. For copper pipes up to and including 3 inch in size, use Fee and Mason Figure 360 malleable iron, copper plated hangers. For copper pipes larger than 3 inch, use Fee and Mason Figure 364 copper plated clevis hanger.
- B. Hanger rod sizes shall conform to the following schedule:

1. Pipe up to and including 2"	3/8" rods
2. Pipe 2-1/2", 3" and 3-1/2"	1/2" rods
3. Pipe 4" and 5"	5/8" rods
4. Pipe 6"	3/4" rods
5. Pipe 8", 10", and 12"	7/8" rods
- C. Unless shown otherwise on the Plans, all horizontal runs of ferrous piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following spacing:

1. Pipe up to and including 1-1/4"	8'
2. Pipe 1-1/2" and 2"	10'
3. Pipe 2-1/2" and 3"	12'
4. Pipe 3 1/2" and 4"	14'
5. Pipe 5" and 6"	16'
6. Pipe 8" and 10"	20'

- D. Unless shown otherwise on the Plans, all horizontal runs of copper piping shall be suspended from the floor or roof construction as the case may be, by means of hangers with the following maximum spacing:
- | | |
|----------------------------|-----|
| 1. Pipe up to 3/4" in size | 5' |
| 2. Pipe 1" and 1-1/4" | 6' |
| 3. Pipe 1-1/2" and larger | 10' |
- E. There shall be a hanger within 2 inch of each elbow or tee. Additional supports shall be provided for valves, strainers, etc. Cast iron pipe shall have not less than one hanger per length of pipe. Vertical risers shall be supported by approved riser clamps at each floor. Vertical pipes within a space shall have not less than two supports.
- F. Supports and hangers shall be installed to permit free expansion and contraction in the piping systems. Hangers shall permit vertical adjustment to maintain proper pitch. Where necessary to control expansion and contraction, the piping shall be guided and firmly anchored. No piping shall be self-supporting, nor shall it be supported from equipment connection.
- G. Hanger rods for all equipment, pipes, ducts, trapezes, vibration isolators, etc., shall be installed straight, true and plumb. Do not bend or flex hanger rods to accommodate sloping structures, avoid obstacles, or for any other purpose. Where necessary, utilize swivel beam clamps, beveled or swivel hardware, angled, swivel or hinged brackets spanning members or other appropriate means of connection.
- H. Expansion bolts shall be Ackerman-Johnson or Hilti.
- I. Beam clamps suitable for use with this type of steel construction involved shall be Grinnell.

1.21 ISOLATION

- A. Excessive vibration or objectionable noise created in any part of the building by the operation of any equipment furnished and/or installed under the Mechanical Contract will be extremely objectionable and the Contractor shall take all precautions against the same by isolating the various items of equipment from the building structure and by such other means as may be necessary to eliminate all excessive vibration and objectionable noise produced by any equipment installed by them. Consequently, they shall design all foundations, supports, etc., for their equipment, and all piping with this end in view. In addition, these Contractors shall supervise the construction of all foundations and supports, whether they build them or not, in order that they may be constructed in such a manner as to prevent the transmission of objectionable noise and/or excessive vibration. Submit calculations on all vibration isolation equipment.
- B. All equipment having moving parts shall be isolated from the building structure by means of Korfund isolation materials, unless specifically noted otherwise. All isolators shall be the same brand and shall be supplied from the same source. Equipment manufacturer's recommendations shall be followed in the isolation of equipment.
- C. Vibration isolators shall have sufficient resilience to meet the following minimum efficiencies:
- | | |
|-----------------|-----------------------|
| <u>Motor HP</u> | <u>Equipment Room</u> |
| Up to 5 | 90% |
| 7-1/2 to 15 | 93% |
| 20 to 40 | 95% |
| 50 to 100 | 97.5% |
- D. Spring isolators shall be of the housed type with ribbed pads bonded to the underside of the baseplate or may be unhoused stable springs. Isolators shall be furnished with snubbers and limit stops where so recommended by the equipment manufacturer.

- E. The Supplier of the isolating equipment shall, upon completion of the job, check all isolating materials, verify that they are installed properly, and submit a report in writing to the Architect/Engineer.

1.22 TESTING

- A. Before completion of this project, the Mechanical Contractor shall test all materials and equipment which normally require testing. All piping, etc., shall be tested to meet code requirements or the Specification requirements, whichever is more stringent.
- B. All equipment shall be operated sufficiently long enough to prove to the Architect/Engineer that the equipment performs satisfactorily and meets the requirements set forth on the Plans or in these Specifications.

1.23 CERTIFICATIONS

- A. Before receiving final payment, the contractor shall verify that all equipment furnished and all work done complies with all applicable codes mentioned in these Specifications. Submit certifications and acceptable certificates to the Architect/Engineer.

1.24 GENERAL PIPING INSTALLATION REQUIREMENTS

- A. Provisions for Drainage: All piping systems shall be installed so that they may be easily drained. Drain caps, plugs, or hose bibbs shall be installed at low points. Grade piping toward drain locations.
- B. Alignment: All installed pipelines shall be straight and shall remain straight against strains. Proper allowance shall be made for expansion and contraction.
- C. Clean as Installed: All piping shall be kept free from scale or loose dirt when installed and must be kept clean during the completion of the installation. All openings in the piping system shall be capped or plugged while awaiting further connections. All detergents, solvents and other cleaning agents shall be compatible with the materials of fabrication of the system in which they are used. They shall not adversely affect the materials of mechanisms in the systems and they shall be acceptable to equipment manufacturers. All detergents, solvents, and other cleaning agents shall also be compatible with the process streams to be handled by the systems in which they are used.
- D. Insulated Fittings: Install between any dissimilar metals such as steel and copper.
- E. Expansion and Contraction: The Contractor shall make all necessary provisions for expansion and contraction with proper fittings, anchors, dresser couplings, loops, etc. Install flexible connectors on each pipe at each building expansion joint.
- F. Welding: Refer to Paragraph 1.25 of this section of these specifications.
- G. Bending: No bending of pipe will be permitted.
- H. General: The installation shall be coordinated with respect to space available with heating, cooling, ventilating, and electrical installation. In every instance where there is a conflict in the routing of the piping and the ducting, the routing of the ducting shall govern. Installed piping shall not interfere with the operation or accessibility of doors or windows, shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping, installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping above ground shall be run parallel with the lines of the building unless otherwise noted on the drawings. Unless otherwise shown on the drawings, horizontal piping shall pitch down in the direction of flow with grade of not less than 1 inch in 40 feet. Piping connections to equipment shall be in accordance with details shown on the drawings or as recommended by the equipment manufacturer.

Service pipe valves and fittings shall be kept a sufficient distance from other work to permit finished covering not less than 1/2 inch from such other work, and not less than 1/2 inch between finished covering on the different services.

- I. Installation of Valves: Valves shall be installed at the locations shown on the drawings and where specified and where directed at site. Gate valves shall be used unless otherwise shown, specified, or directed. All valves shall be installed with their stems horizontal or above. Where tight shutoff is required, a composition seat globe valve or resilient seat ball valve shall be used.
- J. All valves which must be used during operation, all control valve assemblies, instrument control cases, liquid level controls, gage glasses, orifices, relief valves, and other equipment which must be observed, adjusted, or serviced during operation shall be located conveniently accessible from an operating platform or grade.
- K. In general, relief valves within processing unit limits shall be located conveniently accessible from an operating platform or grade.
 - 1. Those in non-hazardous service, such as water, shall discharge directly to outside.
 - 2. Relief valves should have no piping between the vessel or line and the valve inlet, except as shown on the drawings.
 - 3. Relief valves shall be installed in a vertical position. Vent piping shall be braced and supported in a manner that will not produce excessive stresses in the relief valve and will permit removal of the relief valve without necessary temporary supports for the vent lines.
- L. Equipment Connections: All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment. The contractor shall be required as directed to remove the bolts in flanged connections or disconnect piping to demonstrate that the piping has been so connected. Pipe connections to equipment shall be made with unions or flanged fittings. Provide removable headers for large equipment for service access.
- M. Joints
 - 1. Flanged Joints: All flanged joints shall be face matched. Raised face flanges shall not be mated to flat-faced cast-iron flanges on valves or equipment. The raised face must be turned off. All flanged bolt holes shall straddle the horizontal and vertical center line unless otherwise noted.
 - 2. Screwed Joints: Screwed pipe joints shall have American Standard Taper Pipe Threads ANSI-B2.1 Latest Edition. Burrs formed when cutting pipe shall be removed by reaming. Care shall be taken that the inside of pipe is thoroughly clean and free of cutting oil and foreign matter before installation. Joints shall be made perfectly tight by the use of Teflon tape or approved Teflon thread sealing and lubricating compound.
 - 3. Solder-Joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool or wire brush before seating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for serrated fittings on water, compressed air below 60 psig, and vacuum lines shall be made with a 95 percent tin and 5 percent antimony. Cored solder or solder containing lead will not be permitted.
- N. Reducers: Reduction in pipe size shall be made with one piece reducing fittings. Bushings reducing at least two pipe sizes will be acceptable only when there is no room for reducing couplings or swaged nipples.
- O. Unions: All piping unions shall be of the ground joint type constructed from materials equivalent in alloy composition and strength to other fittings specified with which they are used. Union Pressure classes and end connections shall be the same as the fittings used in the lines with the unions. Steel unions shall have hardened stainless steel seating surfaces on both faces.

P. Hanger Supports:

1. All hanger rods used to support piping, conduit, mechanical units, equipment, trapezes and other items shall be straight and installed plumb, regardless of length. Do not bend rods to adapt to sloped or rotated structural members, secondary support members or to sloped mounting holes on supported equipment. Contractor shall utilize available swivel, hinged, or rigid mounting techniques designed to accommodate a slope or rotation, or shall design a custom solution. Selected techniques for each application shall be submitted for approval prior to use.
2. Do not bend rods to circumvent an obstruction.
3. Loads on hanger rods shall be applied in direct tension. Do not apply compression, lateral or moment loads to hanger rods. Install bracing or additional supports to prevent hanger rod from incurring non-tension loading.
4. Do not create offsets in rods; use only in-line couplers, and only when length of coupled rod exceeds standard available length (typically 12 feet), or when full lengths cannot be placed in position. Provide additional horizontal bracing to prevent swaying of supported piping or equipment.
5. Do not straighten bent rods for subsequent use. If a rod becomes bent, cut off and discard the bent portion. Remaining straight portion of rod may be used.

1.25 WELDING

- A. All welding of piping covered by this specification, regardless of condition of service shall be accompanied as follows:
1. The welding shall be in accordance with the recommendations of the American Welding Society. Mitering of pipe to form elbows, notching to form these, or any similar construction will not be permitted. Welding fittings shall be installed on all welded lines. Joints to be welded shall be properly aligned and spaced, using special welding clamps where necessary. All welders to be employed shall have passed qualification tests prescribed by the National Certified Pipe Welding bureau (or by another reputable testing laboratory or agency) using procedures approved by the American Society of Mechanical Engineers or the American Welding Society. The welders will be required to pass qualification tests when the work of the welder creates a reasonable doubt as to his proficiency. Tests shall be conducted at no additional expense to the Owner.
 2. Each welder shall, in addition to having passed the prescribed qualification tests (as noted in Paragraph 1.30.A.1), prepare sample coupons at the job site on a portion of pipe that is cut such that the cross section of the weld is open to view. The sample weld should be prepared using a 6-inch diameter pipe. The sample shall reflect a continuous weld with perpendicular cut out to show the weld in cross sectional view. This sample, when accepted and approved by a certified welding inspector, shall be used as a standard of quality to compare to other welds that this welder will be performing on the job. This same sample weld will also be a basis for accepting or rejecting the welder for working on this project. The sample weld shall be identified with a date and the welder's name and shall be kept at the site throughout the project.
 3. All welding on pressure piping shall conform to all of the requirements of the American Society of Mechanical Engineers Code for Pressure Piping - B31.1 (An American National Standards Institute publication), as defined in the latest edition of the ANSI Power Piping B31.1 Manual. All welding shall also conform to all of the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. All chapters, current addenda and supplements of these manuals shall apply. This code shall be used to establish standards of performance and quality of welds. However, the Owner reserves the right to perform radiographic testing of all welds, to compare any of the welds to the approved "standard" sample welds of each welder, and to compare the welds to the welding diagrams and sketches of those recommended in the ANSI B31.1 Power Piping Manual. The intent is to obtain the highest quality welding job possible. The cost of any

initial radiographic testing, for random inspection, shall be paid for by the Owner. If radiographic random testing reveals that a weld is defective, the Contractor shall bear the cost of all repairs and re-testing necessary to be made to subject weld until conformance with radiographic tests is reached. The potential for random radiographic testing and welding quality control applies to all pressure piping systems in this project, including systems below 100 psig. If a question should arise regarding the possibility of faulty welding or if there are obvious visual defects in the welding, the Contractor shall be required to correct such deficiencies to a quality level consistent with the recommendations, welding diagrams and sketches in the ANSI B31.1 Manual. The quality level shall also reflect that of the approved sample welds accomplished by each welder for this particular project.

1.26 TESTING FOR PIPING SYSTEMS

- A. General: Before insulation is applied, all piping, equipment, and accessories installed under this contract shall be inspected and tested by the Contractor. All labor, material, and equipment required for testing shall be furnished by the Contractor. The Contractor shall be responsible for all repairs and retesting as required. All instruments and other equipment whose safe pressure range is below that of the test pressure shall be removed from the line or blanked off before applying tests. Prior to performing tests, all lines shall be "blown" free of all loose dirt and foreign particles. The lines shall then be thoroughly flushed with water (liquid lines only) at a sufficient flow rate and period of time to ensure complete cleaning of the lines of all dirt, scale, and foreign matter. Satisfactory flushing of the lines shall be subject to approval. After testing and flushing lines, all filters and strainers shall be cleaned.
- B. Safety: Since the risk of failure is appreciably greater with further testing with the attendant possibility of injury, all safety measures required by codes or ordinance or reasonable applicable to the situation shall be taken.
- C. Concealment: Equipment or piping to be pressure tested shall not be insulated, covered, or concealed prior to that test. Compression joint underground piping may be backfilled prior to pressure test except that joints shall remain exposed until after the test, but tie rods, clamps, etc., shall be in place and fastened.
- D. Pressure Ratings: These tests shall not be used to establish pressure ratings.
- E. System Protection: Protect all piping and equipment against overpressure, collapse from vacuum, and hydraulic shock during the filling, testing and draining procedures. Seats of iron valves shall not be subjected to a pressure in excess of the maximum cold working pressure of the valve. Pressure tests against other closed valves shall not exceed twice the normal rating. Note that where significant differences in elevation exists, there is a risk of overpressure in the lower portions of the system in order to attain test pressure in the upper portion of the system
- F. Test Temperature: Apply test pressure only after the system and test medium are at approximately the same temperature, preferably not less than 60°F. Note that some applicable codes require testing above a specified minimum temperature.
- G. Sectionalizing: Systems may be separated into sub-systems for testing if such action will expedite or simplify the testing.
- H. Temporary Supports: During hydrostatic testing of lines provide temporary supports to prevent overstressing supports or hangers. When tests are completed, remove all temporary supports, locks, stops, etc., and adjust supports for their cold load and alignment.
- I. Testing: Domestic hot and cold water piping and heating water piping shall be tested hydrostatically at the test pressures specified and shall show no drop in pressure in a 2 hour period. Leaks shall be located by soap testing
 - 1. Test Pressures:
 - a. Condenser or Tower Water Supply & Return: 100 psig.
 - b. Heating Water Supply and Return: 100 psig.

- c. Chilled Water Supply and Return: 100 psig.
- d. Steam and condensate (high pressure): 250 psig.
- e. Steam and condensate (low pressure): 125 psig.

J. Test Report

1. A detailed report of pressure tests on piping and equipment shall be forwarded in duplicate to the Architect/Engineer. This report shall show date of test, lines tested, test medium, length of time test pressure was held, pressure drop or rise, and extent of venting or repressurizing.

1.27 COOPERATION WITH OTHER TRADES

- A. The Contractor shall refer to other sections of these specifications covering the work of other trades which must be carried out in conjunction with the mechanical work so that the construction operations can proceed without harm to the Owner from interference, delay or absence of coordination.

1.28 FIELD MEASUREMENTS

- A. The Contractor shall verify the dimensions covering the mechanical work at the building. No extra compensation shall be claimed or allowed on account of difference between actual dimensions and those indicated on the drawings. He shall examine the adjoining work on which Mechanical work is dependent for maximum efficiency, and shall report any work which must be corrected. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting Mechanical work.

1.29 SAFETY GUARDS

- A. The Mechanical Contractor shall furnish and install safety guards required in order to obtain certificates of inspection from all authorities having jurisdiction. All belt driven equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded. Provide coupling guards on all rotating shafts.

1.30 PROTECTION

- A. All work, equipment, and materials shall be protected at all times to prevent obstruction, damage, or breakage. All pipe openings shall be closed with caps or plugs during installation. All equipment shall be covered and protected against dirt, water, chemical, or mechanical injury. At the completion of the work, all equipment shall be thoroughly cleaned and the entire system shall be delivered in a perfect, unblemished condition.

1.31 PAINTING AND IDENTIFICATION

- A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be marred in transit or during installation, it shall be finished to present a neat, workmanlike appearance.
- B. Except as elsewhere hereinafter specifically required, any painting of equipment, piping, ductwork, grilles, insulation, etc., furnished and installed under this Section of the Specifications will be done by the Painting Contractor. However, the Mechanical Contractor shall leave his equipment clean and free from any grease, dirt, rust, etc., and in suitable condition for painting.
- C. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.
- D. The piping shall be painted the basic color as indicated in other sections of these specifications and shall be marked every 10 feet on centers with Brady pipe markers. Arrows, approximately 6 inch in length and spaced about 10 feet on centers shall indicate the direction of the flow pipe. Locate additional labels as required in Mechanical Rooms. Staple in place, brush with clear lacquer. Markers shall state pipe size, flow direction, and pipe usage (such as "cold water," etc.).

1.32 RECORD DRAWINGS

- A. The Contractor shall, during the execution of the work, maintain a complete set of drawings upon which all dimensional locations of equipment piping and all deviations and/or changes in the work shall be recorded. Water, storm, and drainage mains shall be delivered to the Architect/Engineer in good condition upon the completion and acceptance of the work and before final payment is made.

1.33 SUPPLIER RESPONSIBILITY

- A. Each supplier, whether furnishing equipment as specified or as a substitution shall be responsible for certifying that the equipment is properly installed and that the warranty is valid. Submit written reports on the installation and the equipment performance when requested to do so by the Architect/Engineer (or his representative). Each supplier shall be responsible for furnishing qualified personnel at the job site at anytime requested by the Architect/Engineer (or his representative) during the construction or warranty periods.

END OF SECTION

23 0500

SECTION 23 0593**BALANCING OF MECHANICAL SYSTEMS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Furnish all labor, materials and equipment required to test and balance the mechanical systems identified on the contract drawings and these specifications, including but not limited to:
1. Testing, adjustment, and balancing of hydronic, steam, and refrigerating systems.
 2. Measurement of final operating condition of HVAC systems.
 3. Sound measurement of equipment operating conditions.
 4. Vibration measurement of equipment operating conditions.
 5. Adjustment of the mechanical systems shall include but not limited to impellers trimmed, new sheeves and belts to match cfm required, etc. as required to match equipment specified.
 6. Operating Test

1.3 RELATED SECTIONS

230000	HEATING, VENTILATING AND AIR CONDITIONING INDEX
230500	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
233000	AIR DISTRIBUTION

1.4 REFERENCES

- A. The publications listed below form a part of these specifications to the extent referenced. Each publication shall be the latest edition of each except as noted.
1. AABC - National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning System.
 2. ADC - Test Code for Grilles, Registers, and Diffusers.
 3. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
 4. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
 5. NFPA – NFPA 90A - Installation of Air Conditioning and Ventilating System.
 6. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.5 SUBMITTALS

- A. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- B. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.

- C. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
- D. Provide reports in letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- E. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.
- F. Test Reports: Indicate data on AABC National Standards for Total System Balance forms.
- G. When test and balancing has been completed, the balancing agency shall prepare a complete report including design and test conditions compared. The report shall be as outlined below.
- H. Seven copies of the complete and compiled test data shall be submitted to the Contractor for forwarding to the Architect/Engineer for evaluation and approval.
 - 1. The Report shall be on standard 8-1/2" x 11" good quality paper and bound together to form a complete report. All forms shall be typewritten. Field data may be handwritten on appropriate printed or typewritten forms. Copies of handwritten field notes shall be legible.
 - 2. Each sheet shall have the Building number, name of the Testing Firm, instruments used to perform the tests, name of personnel performing the test, and date test was performed. Date and firm performing the calibration on photometry equipment shall also be included.
 - 3. Outside weather conditions shall be noted during the times the tests were made; cloud cover, temperature, wind speed and direction, precipitation, etc.
- I. The Report shall have a T & B Summary section including:
 - 1. Identification of any system or equipment item the Contractor had difficulty balancing to specification or could not be balanced to specification.
 - 2. Identification of any piece of equipment or system whose balance should be rechecked and/or reset during weather conditions different from those present during system balancing.

1.6 PROJECT RECORD DOCUMENTS

- A. Record actual locations of flow measuring stations balancing valves and rough setting. Show locations on Test and Balance report reduced size plan drawings.

1.7 QUALITY ASSURANCE

- A. Perform total system balance in accordance with NEBB Procedural Standards for Testing, Balancing, and Adjusting of Environmental Systems.

1.8 QUALIFICATIONS

- A. The balancing shall be performed by Energy Balance, Inc., De La Pena LLC, or Kirk Air. Qualified personnel are limited to registered mechanical Engineers and agencies regularly engaged in testing and balancing work. The Contractor shall submit, prior to the start of the balancing work, the qualifications and experience record of the balancing personnel for approval by the Architect/Engineer.
- B. Perform Work under supervision of registered Professional Engineer experienced in performance of this Work and licensed in the state where the Project is located.
- C. The balancing agency shall not be associated with or the same contractor furnishing the controls or instrumentation.

1.9 PRE-BALANCING CONFERENCE

- A. Convene pre-balancing conference one week prior to commencing work of this section in coordination with Architect/Engineer/General Contractor and his Subcontractors.

1.10 SEQUENCING

- A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project. See section 3.1 for pre-balancing inspection.

PART 2 - PRODUCT**2.1 INSTRUMENTS**

- A. Instruments in general shall be direct reading. Pressures between 2" W.G. and 12" W.G. shall be measured with manometers. Duct velocities above 600 fpm shall be measured with a pitot tube. Averaging hoods with tight seal shall be used for airflow measurement at diffusers, registers, and grilles. RPM shall be measured with a revolution counter and stopwatch. Mercury thermometers are preferred; bi-metallic thermometers may be used if calibration is checked daily. Test report shall list all instruments used and include accuracy and date calibrated. The Contractor shall provide all instruments to make the tests herein specified and required for complete system balancing.

2.2 AIR HANDLERS

- A. After the air system is balanced and an optimum fan speed is selected, the adjustable sheaf or sheaves furnished shall be replaced by the Mechanical Contractor with new non-adjustable sheaves for permanent operation.

2.3 PUMPS

- A. After the water system is balanced and an optimum pump operating point is selected, the pump impeller shall be trimmed to supply the required capacity for pumps over 2 HP, without throttling the flow.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. The test and balance agency shall review the plans and specifications prior to installation of the system and submit a report to the Architect/Engineer of any deficiencies in the system which could preclude proper adjusting, balancing and testing of the system.
- B. The test and balance agency shall inspect the system prior to adjusting, balancing, and testing work to ensure that all specified components which will affect proper execution of such work are installed and are operating properly. A report shall be submitted to the Architect/Engineer indicating the results of the inspection within three days of the inspection. The following is a partial list of items to be inspected and report provided to the Architect/Engineer.
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems and control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.

6. Fans are rotating correctly.
 7. Fire/smoke and volume dampers are in place and open. The smoke detectors and power to them is installed and the dampers are operational. Air coil fins are cleaned and combed.
 8. Access doors are closed and duct end caps are in place.
 9. Air outlets are installed and connected.
 10. Duct system leakage is minimized.
 11. Hydronic systems are flushed, filled, and vented.
 12. Pumps are rotating correctly.
 13. Proper strainer baskets are clean and in place.
 14. Service and balance valves are open.
- C. Submit field reports in a timely manner within one week of pre-balancing conference. Report defects and deficiencies noted during performance of services which prevent system balance.
- D. Beginning of work means acceptance of existing conditions of the installed system and equipment on the project.

3.2 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
- M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.
- N. On fan powered VAV boxes, adjust airflow switches for proper operation.

3.6 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.7 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing
 - 1. Electric Water Coolers
 - 2. Air Coils
 - 3. Terminal Heat Transfer Units
 - 4. Induction Units
 - 5. Air Handling Units
 - 6. Fans
 - 7. Air Filters
 - 8. Air Terminal Units
 - 9. Air Inlets and Outlets
- B. Report Forms
 - 1. Title Page
 - a. Name of Testing, Adjusting, and Balancing Agency
 - b. Address of Testing, Adjusting, and Balancing Agency
 - c. Telephone number of Testing, Adjusting, and Balancing Agency
 - d. Project name
 - e. Project location
 - f. Project Architect
 - g. Project Engineer
 - h. Project Contractor
 - i. Project altitude
 - j. Report date
 - 2. Summary Comments
 - a. Design versus final performance
 - b. Notable characteristics of system
 - c. Description of systems operation sequence
 - d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
 - e. Nomenclature used throughout report
 - f. Test conditions, including weather conditions
 - 3. Instrument List:
 - a. Instrument
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Range
 - f. Calibration date
 - 4. Electric Motors:
 - a. Manufacturer
 - b. Model/Frame
 - c. HP/BHP
 - d. Phase, voltage, amperage; nameplate, actual, no load
 - e. RPM
 - f. Service factor
 - g. Starter size, rating, heater elements
 - h. Sheave Make/Size/Bore

5. V-Belt Drive:
 - a. Identification/location
 - b. Required driven RPM
 - c. Driven sheave, diameter and RPM
 - d. Belt, size and quantity
 - e. Motor sheave diameter and RPM
 - f. Center to center distance, maximum, minimum, and actual
6. Pump Data:
 - a. Identification/number
 - b. Manufacturer
 - c. Size/model
 - d. Impeller
 - e. Service
 - f. Design flow rate, pressure drop, BHP
 - g. Actual flow rate, pressure drop, BHP
 - h. Discharge pressure
 - i. Suction pressure
 - j. Total operating head pressure
 - k. Shut off, discharge and suction pressures
 - l. Shut off, total head pressure
7. Cooling Coil Data:
 - a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Air flow, design and actual
 - f. Entering air DB temperature, design and actual
 - g. Entering air WB temperature, design and actual
 - h. Leaving air DB temperature, design and actual
 - i. Leaving air WB temperature, design and actual
 - j. Water flow, design and actual
 - k. Water pressure drop, design and actual
 - l. Entering water temperature, design and actual
 - m. Leaving water temperature, design and actual
 - n. Saturated suction temperature, design and actual
 - o. Air pressure drop, design and actual
8. Heating Coil Data:
 - a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Air flow, design and actual
 - f. Water flow, design and actual
 - g. Water pressure drop, design and actual
 - h. Entering water temperature, design and actual
 - i. Leaving water temperature, design and actual
 - j. Entering air temperature, design and actual
 - k. Leaving air temperature, design and actual
 - l. Air pressure drop, design and actual

9. Air Moving Equipment
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Arrangement/Class/Discharge
 - f. Air flow, specified and actual
 - g. Return air flow, specified and actual
 - h. Outside air flow, specified and actual
 - i. Total static pressure (total external), specified and actual
 - j. Inlet pressure
 - k. Discharge pressure
 - l. Sheave Make/Size/Bore
 - m. Number of Belts/Make/Size
 - n. Fan RPM
10. Return Air/Outside Air Data:
 - a. Identification/location
 - b. Design air flow
 - c. Actual air flow
 - d. Design return air flow
 - e. Actual return air flow
 - f. Design outside air flow
 - g. Actual outside air flow
 - h. Return air temperature
 - i. Outside air temperature
 - j. Required mixed air temperature
 - k. Actual mixed air temperature
 - l. Design outside/return air ratio
 - m. Actual outside/return air ratio
11. Exhaust Fan Data:
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Air flow, specified and actual
 - f. Total static pressure (total external), specified and actual
 - g. Inlet pressure
 - h. Discharge pressure
 - i. Sheave Make/Size/Bore
 - j. Number of Belts/Make/Size
 - k. Fan RPM
12. Duct Traverse:
 - a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air temperature

- j. Air correction factor
- 13. Duct Leak Test:
 - a. Description of ductwork under test
 - b. Duct design operating pressure
 - c. Duct design test static pressure
 - d. Duct capacity, air flow
 - e. Maximum allowable leakage duct capacity times leak factor
 - f. Test apparatus
 - i) Blower
 - ii) Orifice, tube size
 - iii) Orifice size
 - iv) Calibrated
 - g. Test static pressure
 - h. Test orifice differential pressure
 - i. Leakage
- 14. Air Distribution Test Sheet:
 - a. Air terminal number
 - b. Room number/location
 - c. Terminal type
 - d. Terminal size
 - e. Area factor
 - f. Design velocity
 - g. Design air flow
 - h. Test (final) velocity
 - i. Test (final) air flow
 - j. Percent of design air flow
- 15. Sound Level Report:
 - a. Location
 - b. Octave bands - equipment off
 - c. Octave bands - equipment on
- 16. Vibration Test:
 - a. Location of points:
 - i) Fan bearing, drive end
 - ii) Fan bearing, opposite end
 - iii) Motor bearing, center (if applicable)
 - iv) Motor bearing, drive end
 - v) Motor bearing, opposite end
 - vi) Casing (bottom or top)
 - vii) Duct after flexible connection (discharge)
 - viii) Duct after flexible connection (suction)
 - b. Test readings:
 - i) Horizontal, velocity and displacement
 - ii) Vertical, velocity and displacement
 - iii) Axial, velocity, and displacement
 - c. Normally acceptable readings, velocity, and acceleration
 - d. Unusual conditions at time of test
 - e. Vibration source (if non-complying)

3.8 CALCULATIONS

- A. The following calculations shall be made and become part of the reported data.
1. The CFM at each heating, cooling, and fan coil, the heating and/or cooling capacity of each and the air temperature change of each.
 2. The water flow at each heating, cooling, and fan coil, the heating and/or cooling capacity of each and the water temperature change of each.
 3. The fuel flow to each gas fired unit and the BTUH input.
 4. The capacity of each refrigeration unit in BTUH or tons at full capacity and at each unloaded step.
 5. The saturation efficiency of each dry cooler and air washer.

3.9 OPERATING TEST

- A. The test and balance agency shall coordinate and set up an operating test when Test & Balance is completed to ensure complete operation of the system in all modes. The controls contractor, sheet metal trade and the general contractor shall certify in writing test completion and all units are operating as designed. Attach copy of operating test to Test & Balance report.

END OF SECTION

23 0593

SECTION 23 0713**DUCT INSULATION****PART 1 - GENERAL****1.1 SUMMARY**

- A. Furnish and Install
 - 1. Ductwork insulation.
 - 2. Duct liner.
 - 3. Insulation jackets.

1.2 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section

1.3 DESCRIPTION OF WORK

- A. Work Included: The work included by this specification consists of furnishing all labor, accessories, equipment, and materials necessary for the installation of all insulation for ductwork and mechanical equipment in accordance with the specification and applicable drawings. This includes but is not limited to:
 - 1. All supply ductwork
 - 2. Return ductwork not within the conditioned space
 - 3. All ductwork in the mechanical room
 - 4. Outside air inlet ductwork that is within the conditioned space.
 - 5. Mechanical equipment not factory insulated.
- B. Do not internally insulate ductwork from evaporative coolers unless specifically indicated on the drawings.
- C. Exterior duct wrap insulation with vapor barrier shall be used on all outdoor air ductwork within conditioned spaces.
- D. Supply and return air ductwork shall be insulated with duct liner except in air handling systems having air washers or humidifiers. Where air washers or humidifiers are used, exterior duct insulation shall be used. Where duct liner is used, dimensions shown on the drawings shall be clear inside duct liner.
- E. Testing:
 - 1. All ductwork and mechanical equipment shall be tested for leakage and approved by the Architect/Engineer before any insulation is applied. The insulation contractor shall have this verified in writing before beginning work.

1.4 RELATED WORK IN OTHER SECTIONS

099000	PAINING: PAINTING INSULATION JACKETS.
230000	HEATING, VENTILATING, AND AIR CONDITIONING INDEX

230500	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
233000	AIR DISTRIBUTION

1.5 REFERENCES

- A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- C. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
- D. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
- E. ASTM E84 - Surface Burning Characteristics of Building Materials.
- F. ASTM E96 - Water Vapor Transmission of Materials.
- G. NFPA 255 - Surface Burning Characteristics of Building Materials.
- H. SMACNA - HVAC Duct Construction Standards 1985 Ed. - Metal and Flexible.
- I. UL 723 - Surface Burning Characteristics of Building Materials

1.6 DEFINITIONS

- A. Exposed Location: Exposed in mechanical rooms or rooms with finished walls or ceilings.
- B. Concealed Location: Located in pipe chase, furred spaces, attics, crawl spaces, above suspended ceilings in finished and unfinished rooms, or all other locations not exposed to view.
- C. Duct Sizes: Inside clear dimensions. For lined ducts, maintain sizes inside lining.
- D. K Factors: All K Factors shown in the following specifications are expressed in BTU-in/hr-ft²-F.

1.7 SUBMITTALS

- A. General: Comply with Section 230500.
- B. Product Data: Provide product description, list of materials and thickness for each service, and locations.
- C. Manufacturer's Installation Instructions: Indicate procedures, which ensure acceptable workmanship and installation standards will be achieved.

1.8 QUALITY ASSURANCE

- A. Regulatory Requirements Fire Hazard Classification: Insulation shall have a composite (insulation, jacket or facing, and adhesive to secure jacket or facing) fire hazard rating as tested by ASTM E84, NFPA 255, or UL 723 not to exceed 25 flame spread, 50 fuel contribution, and 50 smoke development. Materials shall be labeled accordingly.
- B. Certifications of Insulation and Covering Materials: UL listed; flame spread/fuel contributed/smoke development rating of 25/50 in accordance with ASTM E84, NFPA 255, and UL 723.

1.9 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum five years of documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. General Requirements: Comply with Section 230500. Deliver materials to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness. Store in a warm, dry location and protect against dirt, water, chemical, and mechanical damage.

1.11 PROJECT CONDITIONS

- A. Manufacturer's Requirements: Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation while in storage.
- B. Environmental Requirements: Perform work at ambient and equipment temperatures as recommended by the insulation manufacturer.
- C. Protection: Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Repair or replace any such insulation or covering damaged prior to final acceptance of work.

1.12 WARRANTY

- A. General: Satisfy requirements of Section 230500.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Acceptable Manufacturers:
 - 1. Owens-Corning Fiberglass Corporation.
 - 2. Knauf.
 - 3. Certainteed.
 - 4. Manville.

2.2 INSULATION MATERIALS

- A. Glass Fiber, Flexible:
 - 1. Insulation: ASTM C-553; flexible, noncombustible blanket.
 - a. 'K' value: ASTM C518, of 0.29 at 75°F.
 - b. Maximum service temperature: 250°F.
 - c. Maximum moisture absorption: 0.20 percent by volume.
 - d. Density: 0.75 lb/cu ft.
 - 2. Vapor Barrier Tape:
 - a. Kraft paper reinforced with glass fiber yarn and bonded to aluminum film.
 - 3. Tie Wire: Annealed steel, 16-gage.
- B. Glass Fiber, Rigid:
 - 1. Insulation: ASTM C612; rigid, noncombustible blanket.
 - a. 'K' value: ASTM C518, of 0.29 at 75°F.
 - b. Maximum service temperature: 250°F.

- c. Maximum moisture absorption: 0.20 percent by volume.
 - d. Density: 0.75 lb/cu ft.
 - 2. Vapor Barrier Jacket:
 - a. Kraft paper reinforced with glass fiber yarn and bonded to aluminum film.
 - b. Moisture vapor Transmission: ASTM E96; 0.04 perm.
 - c. Secure with pressure sensitive tape.
 - 3. Vapor Barrier Tape:
 - a. Kraft paper reinforced with glass fiber yarn and bonded to aluminum film, with pressure sensitive rubber based adhesive.
- C. Glass Fiber Duct Liner, Flexible
 - 1. Insulation: ASTM C-553; flexible, noncombustible blanket.
 - a. 'K' value: ASTM C518, of 0.28 at 75°F.
 - b. Maximum service temperature: 250°F.
 - c. Density: 2.0 lb/cu ft.
 - d. Maximum Velocity on Coated Air Side: 4000 ft/min.
 - 2. Adhesive
 - a. Waterproof, fire-retardant type.
 - 3. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.
- D. Glass Fiber Duct Liner, Rigid:
 - 1. Insulation: ASTM C-612; flexible, noncombustible.
 - a. 'K' value: ASTM C518, of 0.23 at 75°F.
 - b. Maximum service temperature: 250°F.
 - c. Density: 2.0 lb/cu ft.
 - d. Maximum Velocity on Coated Air Side: 4000 ft/min.
 - 2. Adhesive:
 - a. Waterproof, fire-retardant, type.
 - 3. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

2.3 JACKETS

- A. Canvas Jackets: UL listed.
 - 1. Fabric: 6 oz/sq yd, plain weave cotton treated with dilute fire retardant lagging adhesive.
 - 2. Lagging Adhesive: Compatible with insulation.
- B. Aluminum Jacket: ASTM B209.
 - 1. Thickness: 0.025-inch sheet.
 - 2. Finish: Smooth or Corrugated.
 - 3. Joining: Longitudinal slip joints and 2-inch laps.
 - 4. Fittings: 0.016-inch-thick die shaped fittings covers with factory attached protective liner.
 - 5. Metal Jacket Bands: 3/8-inch wide, 0.016-inch-thick aluminum.
 - 6. Flexible glass fiber with fire resistant coating facing air stream; ASTM E-84/ASTM C518-70; 'k' value of 0.25 maximum at 75 F, 2 lb. density, one-inch thickness.
- C. Type C: Neoprene faced, rigid glass fiberboard, 2 lb. density, ASTM E- 84/ASTM C-518; 'k' value of 0.23 at 75 F; one-inch thickness.

D. Jackets:

1. Interior Applications
 - a. Vapor Barrier Jackets: Kraft reinforced foil vapor barrier with self-sealing adhesive joints.
2. Exterior Applications
 - a. Sheet metal enclosure of corrugated aluminum, 0.02 in. thick, with metal jacket bands: 3/8 inch wide, 0.016 thick aluminum; or stick clips with smooth finish.

2.4 ACCESSORIES

- A. Impale Anchors: Galvanized steel, 12-gage, self-adhesive pad and press on washer head.
- B. Joint Tape: Glass fiber cloth, open mesh.
- C. Lagging Adhesive: Fire resistive to ASTM E-84 or NFPA 255 or UL 723.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Verify that ductwork has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

- A. General
 1. Applications: Apply insulation tightly over clean, dry surfaces with sections or edges firmly butted together or lapped. Make insulation continuous through sleeves or openings in walls or floors.
 2. Vapor Barriers: Seal vapor barriers and run continuous throughout for heated and cooled supply air ductwork.
 3. Finishes: Finish insulation neatly at hangers, supports and other protrusions. Locate insulation or cover seams in least visible locations.
 4. Installation Repairs: Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.
 5. Exterior Locations: Re-cover with corrugated aluminum jacket attached with suitable aluminum rivets.
 6. Manufacturer's Instructions: Install materials in accordance with manufacturer's instructions.
 7. Thermal Units: Provide insulation with vapor barrier on ductwork downstream of fan coil terminal units.
 8. Factory Insulated Equipment: Do not insulate factory-insulated equipment.
 9. Attachment: Apply insulation as close as possible to equipment by grooving, scoring, and bevelling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
 10. Cement and Fillers: Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

11. Placards: Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such nameplate or any operable device.
12. Service Access: When equipment with insulation requires periodical opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.
13. Insulation shall be installed in a workmanlike manner by workmen regularly engaged in this type of work. Insulation shall not be applied until all surfaces are clean and dry and until inspection and release for insulation application.
14. A complete moisture and vapor seal shall be provided on cold surfaces where vapor barrier jackets or coatings are required. Anchors, hangers, and other projections shall be insulated and vapor sealed to prevent condensation.
15. Duct insulation shall be continuous through walls and floor openings except where walls or floors are required to be fire stopped or required to have a fire resistance rating.

B. Locations for Insulation:

1. External: Outside of ducts not internally lined, located interior of building, in mechanical room.
 - a. Rectangular: 1-1/2-inch-thick glass fiber insulation. Fasten to duct with weld pins or stock clips spaced 12 inches to 18 inches on center with minimum of two rows per side of duct. Secure with washers firmly embedded in insulation. Seal joints, breaks, and punctures in cold air ductwork with fire-retardant vapor adhesive reinforced with a three-inch wide strip similar to that of facing.
 - b. Round: Two-inches thick glass fiber blanket duct wrap. Adhere insulation to duct with fire retardant adhesive applied in bands around the duct. Butt tight with facing overlapping all joints at least two inches. Seal cold air ductwork with fire retardant vapor barrier adhesive. Seal breaks and punctures in the facing of cold air ductwork with vapor barrier tape sealed with fire retardant adhesive.
2. For exterior applications, provide insulation with vapor barrier jacket with 2" thick rigid insulation with a minimum R-value of 8. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
3. Insulation below grade shall be polyurethane spray foam, suitable for use in wet environments without degradation and having the following properties.
 - a. All duct shall be supported on 2" thick rigid polystyrene board exceeding the width of the duct. Spray foam shall be applied to assure a 2" minimum coverage. Insulation shall be coated with Deer-O Foam Cap W-256 applied at the rate of one gallon per 100 square ft. for vapor barrier protection with a perm rating of 0.00019.

C. Duct Liner

1. Duct liner shall be installed in accordance with Figures 6-1 through 607 of the SMACNA High Velocity Duct Manual and the Manufacturer's recommendations.

END OF SECTION

23 0713

SECTION 23 2500**WATER TREATMENT SYSTEMS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. The Contractor shall provide all labor, material, equipment, design detail and layout required to provide a cleaning solution to the existing chilled water and hot water system using a water treatment system(s) indicated in these specifications. The Contractor shall coordinate installation of the water treatment cleaning solution system(s) with the other trades involved in the project. The contractor shall furnish all piping, valves, equipment, meters, probes, tanks, pumps, controls, wiring, etc., for the cleaning of the existing system using chemical water treatment system. The water treatment contractor shall coordinate location of required taps, valves, etc. with the Owner, including piping instrument taps or wells with the piping contractor and obtain final approval from Architect/Engineer, etc. The Contractor shall not hold the Owner liable for any lack of coordination. The Contractor shall provide a comprehensive plan to the Owner within 30 days of contract award.

1.3 RELATED WORK IN OTHER SECTIONS

220700	PIPING INSULATION
221000	PIPE AND PIPE FITTINGS
230000	HEATING, VENTILATING, AND AIR CONDITIONING INDEX
230500	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS

1.4 GENERAL

- A. All systems, water treatment, and components shall be furnished and installed by one Contractor. The contractor shall have a minimum of five (5) years experience in design and installation of water treatment systems. The Architect/Engineer may reject any proposed installer who cannot show evidence of such qualifications.
- B. The system components and information herein is intended to establish standards of performance, quality and construction.

1.5 SUBMITTALS

- A. In addition to submittals required under GENERAL PROVISIONS the contractor shall furnish a 1/8" scale (minimum) room floor plan indicating location and connection points of all equipment to be installed.

PART 2 - PRODUCTS**2.1 WATER TREATMENT - SYSTEM(S)**

- A. Hot Water Boiler:
 - 1. The Contractor shall provide the Owner with a water analysis of existing water supply and analysis of existing hot water and chilled water systems.

2. Provide a boiler water treatment system for the hot water boiler(s) to inject controlled amounts of non-chromate chemicals into the boiler(s) as required to prevent scaling and corrosion of the closed loop system.
 3. The Contractor shall provide all necessary chemicals and service for one year. The Contractor shall provide the Owner with written reports, analysis, and recommendations on a monthly basis during the year with weekly reports when the boiler is in operation.
 4. The equipment shall consist of a feeder. The quantity of the chemical shall be determined by a qualified water treatment chemist for each type of installation.
 5. Provide a ball or gate valve and a check valve at each connection. Connecting tube shall be copper as preferred by the Contractor and approved by Code for the location where installed.
 6. The chemical shall be formulated by a water treatment chemist to prevent scale formation in piping systems. An oxygen scavenger shall be included.
- B. Chilled water systems shall be provided with the same water treatment system as boiler system as boiler system except treatment shall be for chilled water system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Review and as-build existing systems completely. After segregating valves are installed in piping system and system has been flushed, the treatment contractor shall provide the necessary treatment, for the fill of all piping and related equipment. The contractor shall be present at initial fill of the system(s).
- B. System shall be chemically treated and pressurized to clean out dirt and debris in hot water and chilled water systems. The Contractor shall provide recommendations on chemicals and pressure to be utilized to clean system.
- C. After operation of several hours, the treatment level in all systems shall be checked and adjusted to the proper level.
- D. After operation for several days, the treatment level of all systems shall be checked and adjusted. Repeat in 30 days.
- E. The installer shall be responsible for adjusting the proper amounts of chemicals on a monthly basis for the first year.
- F. Instruct the owner in proper methods of testing and adjusting the water treatment equipment and chemicals.

END OF SECTION

23 2500

SECTION 23 3000**AIR DISTRIBUTION****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Furnish and install fans, filters, sheet metal work, grilles, louvers, diffusers, registers, sound traps, special fan bases, fire dampers, combination fire and smoke dampers and sleeves, accessories, and natural gas fired appliance flue vents.
- B. All automatically controlled dampers furnished under Section 253000 - CONTROLS AND INSTRUMENTATION will be installed under this section. After dampers are set, they shall be balanced for free and easy operation.
- C. Where ductwork has an interior lining, dimensions shown on drawings shall be clear dimensions inside the liner.
- D. Prior to system test and balance, supply and install new, clean air filters throughout the air handling systems except for any high efficiency filters, which have pressure drop within normal operating limits.

1.3 REQUIREMENTS AND RELATED WORK

230000	HEATING, VENTILATING, AND AIR CONDITIONING INDEX
230500	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
230593	BALANCING OF MECHANICAL SYSTEMS
230713	DUCT INSULATION

1.4 REFERENCES

- A. ASTM A 36 - Structural Steel
- B. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
- C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- D. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality
- E. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
- F. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
- G. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality
- H. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled
- I. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality
- J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate

- K. AWS D9.1 - Welding of Sheet Metal
- L. NFPA 90A - Installation of Air Conditioning and Ventilating Systems - Latest Edition
- M. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems - Latest Edition.
- N. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying - Latest Edition
- O. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment - Latest Edition
- P. SMACNA - HVAC Air Duct Leakage Test Manual
- Q. SMACNA - HVAC Duct Construction Standards - Metal and Flexible - 1985
- R. UL STANDARD 181 - Factory-Made Air Ducts and Connectors
- S. UL STANDARD 555 – Standard for Safety Fire Dampers
- T. UL STANDARD 555S – Leakage Rated Dampers for use in Smoke Control Systems

PART 2 - PRODUCTS

2.1 EQUIPMENT SCHEDULES

- A. All major items of equipment are specified in the equipment schedule on the drawings and shall be furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory operating system.
- B. All registers, grilles and diffusers shall be as listed in the schedule on the drawings. Frame style shall be coordinated by the Contractor to match the ceiling type shown on the reflected ceiling plans of the Contract Documents.

2.2 DUCTWORK

- A. Sheet Metal
 - 1. Materials and Gauges: Construct all ducts, casings, plenums, etc., of galvanized steel sheets, of the gauges specified below, unless otherwise shown. Sheets shall be free from blisters, slivers, pits, and imperfectly galvanized spots.
 - 2. All ductwork shall be constructed in accordance with "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE". First Edition, 1985 as published by Sheet Metal and Air Conditioning Contractors National Association, Inc. Pressure class for all ductwork shall be 2" or more unless otherwise noted on plans.
 - 3. Construct low velocity ducts using Pittsburgh or "Snap-Lock" corner seams. All seams shall be made airtight. Using United Mc Grill "UNI-FLEX" duct sealer or approved equal.
 - 4. Connections of high pressure and/or velocity ducts, fittings and high pressure boxes shall be made airtight by tack welding on 8" centers and coating joints with United Mc Grill "United duct Sealer".
 - 5. Round ducts and fittings for high velocity systems shall be spiral lock seam conduit as manufactured by United Mc Grill Co., Inc., or approved equal. All 90 elbows shall be at least 5-piece construction. Standard manufactured ducts of other than spiral construction will be acceptable if constructed of the following gauges with welded seams. Sizes up to 12-inch diameter shall be 22-gauge, 13-inch through 36-inch diameter shall be 20-gauge, 37-inch and over shall be 18-gauge. Basic high velocity fittings are detailed on the drawings. Spun or tapered takeoffs shall be used from all vertical high velocity risers.
- B. Construct tees, bends, and elbows with radius of not less than 1-1/2 time's width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning

vaness. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

- C. Increase duct sizes gradually, not exceeding 15° divergence wherever possible, maximum 30° divergence upstream of equipment and 45° convergence downstream.
- D. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- E. Provide standard 45° lateral wye takeoffs unless otherwise indicated where 90° conical tee connections may be used.
- F. Flexible
 - 1. Flexible ducts for connections between rigid ductwork and variable volume boxes shall be Factory Insulated flexible conduit capable of holding 5 inches W.C. without development leaks and shall not exceed a flame spread of 25 or a smoke development of 50. Thermo flex Type N-KH or approved equal.
 - 2. Flexible connections between the diffusers and the run out ducts shall be factory insulated, sound absorbing low velocity flexible conduit conforming to the following duct fabrication shall not exceed a flame spread of 25 or a smoke development of 50.
 - a. Two ply vinyl film supported by helically wound spring steel wire: fiberglass insulation: polyethylene vapor barrier film.
 - b. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
 - c. Maximum Velocity: 4000 fpm (20.3 m/sec).
 - d. Temperature Range: -10°F to 160°F (-23°C to 71°C).

2.3 COMBINATION FIRE/SMOKE DAMPERS

- A. Furnish and install at locations shown on plans, or as required by code combination fire/smoke dampers meeting the following specifications. Frame shall be galvanized steel formed into a structural hat channel shape with tabbed corners for reinforcement.
- B. Each combination fire smoke damper shall be 1-1/2-hour fire rated under UL Standard 555 or greater where noted on architectural plans, and bear a UL label attesting to same. Damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. The leakage rating under UL555S shall be Leakage Class II (10 cfm/ft. at 1" w.g.)
- C. In addition to the leakage ratings already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 250° F, 350°F, or 450°F depending upon the actuator. Appropriate electric "Firestat" operator shall be installed by the damper manufacturer at time of damper fabrication. Damper and actuator shall be supplied as a single entity which meets all applicable UL555 and UL555S qualifications for both dampers and actuators. Manufacturer shall provide factory assembled sleeve of 16" minimum length (contractor to verify requirement). Factory supplied caulked sleeve shall be 16-gauge for dampers up to 36" wide by 24" tall and 14-gauge above 36" wide X 24" tall.
 - 1. Combination Fire/Smoke dampers shall be Ruskin FSD6O rectangular dampers and Ruskin FSDR25 for round dampers or approved equal with correct mounting frames and sleeves for actual installation.
 - 2. Combination Fire/Smoke dampers for corridors ceiling shall be Ruskin FSD36 with internally mounted actuator.
- D. Each combination fire and smoke damper shall include an integral factory furnished and installed duct smoke detector compatible with the building fire alarm system. Assembly by Ruskin DSDN or approved equal.

- E. Size of access doors in ductwork shall be 2 inches less than the width of the duct by 12 inches, up to a maximum size of 24 inches by 24 inches.

2.4 FIRE DAMPERS

- A. Furnish and install at locations shown on the drawings or as required by code fire dampers meeting the following requirements. Provide access doors at all fire damper locations of sufficient size to allow easy resetting of fire damper linkage. Fire damper links shall be of the test strength recommended to prevent nuisance closing. All fire dampers shall conform to the requirements of NFPA Pamphlet 90A and shall meet the required UL Standard 555.
- B. High Velocity Round or Oval Fire Dampers: High velocity fire dampers shall be of the folding blade type designed for minimum static pressure drop. Fusible links shall be accessible from either side of the damper. Each damper shall be furnished complete with a galvanized welded steel sleeve (round or oval) and closure compartment to house the folded blades. Fire dampers shall be Ruskin FD35 with 165°F fusible link or approved equal.
- C. Rectangular Fire Dampers: Fire dampers for rectangular ductwork shall be of the folding blade type with the hinged blades completely out of the air stream of the single hinged blade type. Fusible links shall be accessible from either side of the damper. Each damper shall have a galvanized welded steel sleeve (rectangular or square) and closure compartment to house the folded blades. Rectangular fire dampers mounted in the horizontal plane are to be spring loaded. Fire dampers shall be Ruskin DIBD with 165°F fusible link or approved equal.
- D. Provide access doors at all fire damper locations of sufficient size to allow easy resetting of fire damper linkage. Size of access doors in ductwork shall be 2 inches less than the width of the duct by 12 inches, up to a maximum size of 24 inches by 24 inches.
- E. Each fire damper shall be provided with spare fusible link(s) secured to the damper.

2.5 ACCESS DOORS

- A. Wall and Ceiling Access Doors: Furnish as required in Section 230500, paragraph 1.7.O.
- B. Duct Access Doors: Duct access doors at fire dampers and other locations which require access to mechanical devices inside of ductwork shall be Controlair 16-gauge access door with continuous hinge, neoprene gasket, thumb screw locks and baked enamel finish. Doors shall be sized for easy access to mechanical device.
- C. Walk Through Plenum Access Doors: Doors shall be provided with a flat iron or angle iron stiffening frame and so constructed that they can be operated without twisting or distortion. Doors on insulated ductwork shall be of double panel construction provided with an approved type insulated filler, not less than one inch thick. The duct opening at each door shall be provided with a continuous reinforcing galvanized bar or angle against which the door will close, this being provided with a sponge rubber gasket to make the door airtight.
- D. Doorframes on insulated ductwork shall be placed on an extended metal collar flush with the face of the finished insulation.
- E. Latches shall be operable from either side of door and shall be "Ventlok" No. 310.

2.6 BURIED UNDERGROUND DUCTS

- A. Buried ducts may be concrete encased sheet metal PVC jacketed sheet metal as indicated.
- B. Fabricate metal ductwork in accordance with SMACNA Low Pressure Duct Construction Standards, except as indicated. Fabricate using two gauges heavier material than indicated for 2-inch WG pressure class.

2.7 FILTERS

- A. Filters shall be as listed in the schedule on the drawings.

- B. Filter gauge for each bank of filters in the mechanical rooms and roof top equipment will be supplied and installed by the Controls Contractor as specified in Section 253000 - CONTROLS AND INSTRUMENTATION.

2.8 COILS

- A. In no case shall specified air or water pressure drops be exceeded more than 10%. Piping connections shall be as shown on the drawings. Coils shall be as specified in the equipment schedule on the drawings. In no case shall rows or fin spacing be less than the minimum surface scheduled.

2.9 TURNING VANES

- A. Turning vanes shall be installed in all square elbows. Turning Vanes shall be air foil blade type, shop or factory fabricated.

2.10 FAN PLENUMS

- A. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and construct for operating pressures indicated.
- B. Mount floor mounted casings on 4-inch 100 high concrete curbs. At floor, rivet panels on 8-inch centers to angles. Where floors are acoustically insulated, provide liner of 18-gauge galvanized expanded metal mesh supported at 12-inch centers, turned up 12 inches at sides with sheet metal shields.
- C. Reinforce doorframes with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. [Provide clear wire glass observation ports, minimum 6 X 6-inch size.]
- D. Fabricate acoustic casings with reinforcing turned inward. Provide 16-gauge back facing and 22-gauge perforated front facing with 3/32-inch diameter holes on 5/32-inch centers. Construct panels 3 inches thick packed with 4.5 lb/cu ft minimum glass fiber media, on inverted channels of 16-gauge.
- E. Plenum Access Doors: As indicated on the drawings, provide, and install sheet metal access doors of the size as noted or as required for proper access to the equipment. These doors shall be constructed as integral parts of the plenum walls. Fasteners: Walk-through type doors at plenum chambers shall be provided with two fastening devices equal to Ventlok #301 that can be operated on either side of the door. These devices are to be readily operated and moving parts to have bronze pins.

PART 3 - EXECUTION

3.1 INSTALLATION OF SHEET METAL WORK

- A. All necessary allowance and provisions shall be made in the installation of sheet metal ducts for the structural conditions of the building, and ducts shall be transformed or divided as may be required. Whenever this is necessary the required area shall be maintained. All of these changes, however, must be approved and installed as directed at the project. During the installation, the open ends of ducts shall be protected to prevent debris and dirt from entering. Whenever exposed ducts pass through walls, floors or ceilings, a flanged sheet metal collar fitting close around ducts shall be slipped along duct until flange is tight against finished surface covering edges of openings and presenting a neat appearance. Collar shall be locked to duct.
- B. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- C. Use double nuts and lock washers on threaded rod supports.

- D. Connect diffusers or light troffer boots to low-pressure ducts with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.
- E. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.
- F. Encase buried metal ductwork in 3-inch minimum of concrete. Provide adequate tie-down points to prevent ducts from floating during concrete placement. Introduce no heat into ducts for 20 days following placement of concrete.
- G. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- H. All ducts, coils, housings, registers, grilles, fans, etc., shall be clean when installed and shall be kept clean until the system is completed. As the various parts of the system are installed they shall be wiped or blown clean and openings taped dust-tight with heavy paper or cardboard until the system is completed and ready for testing. At that time all covers and protective wrappings shall be removed. Where one has been torn or previously removed, the duct, coil, register, etc., shall be carefully cleaned of any dirt or dust that has entered the opening.

3.2 DUCTS AT MASONRY

- A. Where ducts are shown connecting to masonry openings and along edges of all plenums at floors and walls, provide a continuous 2" x 2" x 1/8" galvanized angle iron which shall be bolted to the construction and made airtight to the same by applying caulking compound. Sheet metal in these locations shall be bolted to the angle iron.

3.3 HAND AND SPLITTER DAMPERS

- A. Install hand operated volume and splitter dampers at all locations of branches of main ducts, from equipment, supply ducts, return ducts and at all locations where air flow splits or is balanced, whether shown or not. Volume dampers shall be controlled by heavy duty locking quadrants mounted on the outside of the duct. Where ducts are insulated the damper rod shall be extended and the operator shall be mounted on the outside of the insulation. Where volume dampers are installed in ducts over 12" deep, the dampers shall be made in two sections and each independently operated. Splitter dampers shall be at least 1 1/2 times as long as the narrowest adjacent split. All damper fittings must be heavy commercial items and must be approved by the Architect/Engineer before installation.

3.4 FLEXIBLE CONNECTIONS

- A. Provide glass fabric, neoprene coated flexible connections, not less than 6" wide at the inlet and outlet connection of each fan unit, securely fastened to the unit and to the ductwork. Material shall comply with Underwriter's Laboratories Standard 214.
- B. Indoor applications shall have Metaledge Ventglas with heavy glass fabric, double coated with Dupont's Neoprene.
- C. Outdoor applications shall have Metaledge Ventlon with heavy glass fabric, double coated with Dupont's Hypalon.

3.5 CROSS BREAKING

- A. Rectangular sheet metal ducts shall be cross-broken on the four sides of each 4-foot panel. All vertical and horizontal sheet metal barriers, duct offsets, elbows, as well as 4-foot panels of straight sections of ducts shall be cross-broken. Cross breaking shall be applied to the sheet metal between the standing seams or reinforcing angles. The center of the cross break shall be of the required height to assure surfaces being rigid. High velocity plenum panels and ductwork shall not be cross-broken.

3.6 TEST HOLES IN DUCTWORK

- A. Furnish test holes in ducts at locations required by the testing and balancing team for testing of air quantities in ducts. Ventlok No. 699, closures shall be provided and installed for each test hole, with sufficient neck length to penetrate the insulation.

3.7 HANGERS AND SUPPORTS

- A. Hangers for ducts up to 18 inches in width or diameter shall be placed not more than ten-foot centers. Ducts 19 inches and over in width or diameter shall be supported on not more than five-foot centers. Hangers shall be placed plumb and present for a neat appearance. Construct hangers for high velocity boxes and for ductwork from galvanized iron 1" x 1" x 1/16" for ducts up to 36 inches in width or diameter. For ducts over 36 inches in width or diameter, support ducts every 4'-0" with 1 1/4" x 1 1/2" x 1/8" angles. The use of perforated band iron for duct support is prohibited. Hangers shall extend down the sides of the ducts using not less than three rivets or parker screws of appropriate sizes. It is essential that all ducts be rigidly supported. Where vertical ducts pass through floors or roofs heavy supporting angles shall be attached to ducts and to the structure. Angles shall be of sufficient size to support ductwork rigidly. Place supporting angles on at least two sides of the duct.

3.8 FABRICATION

- A. All ductwork shall be fabricated with the mill markings on the outside.

3.9 TESTS

- A. Testing and balancing of the air tempering systems will be as specified in Section 230593 - BALANCING OF MECHANICAL SYSTEMS.
- B. If specified conditions cannot be obtained due to deficiencies in equipment performance or improper installation or workmanship, the Mechanical Contractor shall make any changes necessary to provide the specified conditions.
- C. Cleaning ducts and testing for tightness: Before the ceiling is installed and final connections are made to air outlet devices, operate the fans at full capacity to blow out dirt and debris from the ducts. If it is not practical to use the main supply blower for cleaning, the ducts may be blown out in sections by a portable fan. After the ducts have been cleaned, an air tightness test shall be made on all ductwork. A minimum pressure equal to fan static pressure at less than 10% of design flow or 2 1/2 times design external static pressure, whichever is less shall be maintained during the test. A soap test shall be applied to all sheet metal connections and joints to locate air leaks. Air leaks which are in excess of that required to bubble the soap suds (that is, actually blow the suds away), shall be sealed by additional taping and caulking to reduce the leakage to a rate not to exceed slow bubbles forming. In lieu of the above tightness tests, the Contractor may test the ducts by attaching a fan with a capacity of not over 300 cfm at 2 1/2" static pressure to the ductwork and with outlets blocked air tight, build up the pressure in the ducts to 2" water gauge. If this pressure cannot be obtained the Contractor shall locate and repair the leaks as specified above. The Architect/Engineer and Owner's Representative shall witness the test and the Contractor shall notify the Insulation Contractor in writing when the test has been satisfactorily completed.

END OF SECTION

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SECTION 23 3113**DUCTWORK CLEANING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 RELATED WORK IN OTHER SECTIONS

230000	HEATING, VENTILATING, AND AIR CONDITIONING INDEX
230500	GENERAL HEATING, VENTILATING AND AIR CONDITIONING REQUIREMENTS

PART 2 - SPECIAL PROVISIONS**2.1 QUALIFICATION OF THE HVAC SYSTEM CLEANING CONTRACTOR**

- A. Membership: The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA) or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.
- B. Certification: The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full-time basis or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.
- C. Supervisor Qualifications: A person certified as an ASCS by NADCA or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.
- D. Experience: The HVAC system cleaning contractor shall submit records of experience in the field of HVAC system cleaning as requested by the owner. Bids shall only be considered from firms which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.
- E. Equipment, Materials and Labor: The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials, and labor to adequately perform the specified services.
 - 1. The contractor shall ensure that their employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification.
 - 2. The contractor shall maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification. Contractor shall submit to the owner all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.

- F. Licensing: The HVAC system cleaning contractor shall provide proof of maintaining any proper license(s) as required to do work in this state. Contractor shall comply with all Federal, state, and local rules, regulations, and licensing requirements.

2.2 STANDARDS

- A. NADCA Standards: The HVAC system cleaning contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA).
 - 1. All terms in this specification shall have their meaning defined as stated in the NADCA Standards.
 - 2. NADCA Standards must be followed with no modifications or deviations being allowed.

2.3 DOCUMENTS

- A. Mechanical Drawings: The owner shall provide the HVAC system cleaning contractor with one copy of the following documents:
 - 1. Project drawings and specifications.
 - 2. Approved construction revisions pertaining to the HVAC system.
 - 3. Any existing indoor air quality (IAQ) assessments or environmental reports prepared for the facility.

PART 3 - HVAC SYSTEM CLEANING SPECIFICATIONS AND REQUIREMENTS

3.1 SCOPE OF WORK

- A. Scope: This section defines the minimum requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.
 - 1. The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.
 - 2. The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating, air-conditioning, and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. Return air grilles, return air ducts to the air handling unit (AHU), the interior surfaces of the AHU, fans, fan housing, fan blades, heating coils (interior and exterior), cooling coils (interior and exterior), hydronic piping, hydronic conditioning water, coil compartment, mixing box, condensate drain pans, filters, filter housings, turning vanes, supply air ducts, supply diffusers, exhaust air ducts, exhaust grilles, intake hoods, and relief hoods are all considered part of the HVAC system.

3.2 HVAC SYSTEM COMPONENT INSPECTIONS AND SITE PREPARATIONS

- A. HVAC System Component Inspections: Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. The cleanliness inspection should include air handling units and representative areas of the HVAC system components and ductwork. In HVAC systems that include multiple air handling units, a representative sample of the units should be inspected.
 - 1. The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbes, or other debris. In cases where contamination is suspected environmental engineering control measures should be implemented

- a. Damaged system components found during the inspection shall be documented and brought to the attention of the owner.
- B. Site Evaluation and Preparations: Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.
- C. Inspector Qualifications: Qualified personnel should perform the HVAC cleanliness inspection to determine the need for cleaning. At minimum, such personnel should have an understanding of the HVAC system design, experience in utilizing accepted indoor environmental sampling practices, current industry HVAC cleaning procedures, and applicable industry standards.

3.3 GENERAL HVAC SYSTEM CLEANING REQUIREMENTS

- A. Containment: Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.
- B. Particulate Collection: Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes, other points of entry into the building, and walkways.
- C. Controlling Odors: Measures shall be employed to control odors and/or mist vapors during the cleaning process.
- D. Component Cleaning: Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.
- E. Air-Volume Control Devices: Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.
- F. Service Openings: The contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.
 - 1. Contractor shall utilize the existing service openings already installed in the HVAC system where possible.
 - 2. Other openings shall be created where needed. New openings shall be created so they can be sealed in accordance with industry codes and standards.
 - 3. Closures must not significantly hinder, restrict, or alter the airflow within the system.
 - 4. Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.
 - 5. Openings must not compromise the structural integrity of the system.
 - 6. Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.
 - 7. Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.

8. Rigid fiber glass duct systems shall be resealed in accordance with NAIMA recommended practices. Only closure techniques that comply with UL Standard 181 or UL Standard 181a are suitable for fiber glass duct system closures.
 9. All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the owner in project report documents.
- G. Ceiling sections (tile): The contractor may remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process. Any ceiling sections that are damaged during this work shall be replaced by this contractor unless replacement is already planned as part of the scope of work.
- H. Air distribution devices (registers, grilles & diffusers): The contractor shall clean all air distribution devices.
- I. Air handling units, blowers, and exhaust fans: The contractor shall ensure that supply, return, and exhaust fans and blowers are thoroughly cleaned. Areas to be cleaned include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades, vanes, shafts, baffles, dampers, and drive assemblies. All visible surface contamination deposits shall be removed in accordance with NADCA Standards. Contractor shall:
1. Clean all air handling units' (AHU) internal surfaces, components, and condensate collectors and drains.
 2. Ensure that a suitable operative drainage system is in place prior to beginning wash down procedures.
 3. Clean interior and exterior of all coils and related components, including evaporator fins.
- J. Duct Systems: Contractor shall:
1. Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas.
 2. Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Tests (see NADCA Standards).
- K. Heating Water and Chilled Water Systems: Contractor shall:
1. Isolate and drain the hydronic piping within the area of work to flush and clean the hydronic systems, including the interior of the heating and cooling coils.
 2. Flush the isolated area with a solution designed to clear fouling on the inside of the coils. The solution shall be such that it will not damage the material of the piping. Field verify existing conditions and material of hydronic piping.

3.4 HEALTH AND SAFETY

- A. Safety Standards: Cleaning contractors shall comply with applicable federal, state, and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.
- B. Occupant Safety: No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.
- C. Disposal of Debris: All Debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state, and local requirements.

3.5 MECHANICAL CLEANING METHODOLOGY

- A. Source Removal Cleaning Methods: The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the contractor's responsibility to select Source Removal methods that will render the HVAC system Visibly Clean and capable of passing cleaning verification methods (See applicable NADCA Standards) and other specified tests, in accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.
1. All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are ensured.
 2. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet vacuums.
 3. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes, or regulations.
 4. All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those which will not potentially damage the integrity of the ductwork nor damage porous surface materials such as liners inside the ductwork or system components.
- B. Methods of Cleaning Fibrous Glass Insulated Components
1. Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.
 2. Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (see NADCA Standards).
- C. Damaged Fibrous Glass Material
1. Evidence of damage: If there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.
 2. Replacement: When requested or specified, Contractor must be capable of remediating exposed damaged insulation in air handlers and/or ductwork requiring replacement.
 3. Replacement material: In the event fiber glass materials must be replaced, all materials shall conform to applicable industry codes and standards, including those of UL and SMACNA.
 - a. Replacement of damaged insulation is not covered by this specification.
- D. Cleaning of Coils (Exterior)

1. Any cleaning method may be used which will render the Coil Visibly Clean and capable of passing Coil Cleaning Verification (see applicable NADCA Standards). Coil drain pans shall be subject to Non-Porous Surfaces Cleaning Verification. The drain for the condensate drain pan shall be operational. Cleaning methods shall not cause any appreciable damage to, displacement of, inhibition of heat transfer of, or erosion of the coil surface or fins, and shall conform to coil manufacturer recommendations when available. Coils shall be thoroughly rinsed with clean water to remove any latent residues.

E. Cleaning of Coils (Interior)

1. Any cleaning method may be used which will render the interior of the hydronic coils as clean and smooth. Draining of the system shall be done in a manner compliant with all federal, state, and local codes and regulations based on any chemicals that have been added to the system water. A solution designed to corrode fouling and build-up shall be run through the system. This solution shall be such that it will not damage the system or any of its components. Dispose of this solution per all federal, state, and local codes and regulations.

F. Biocidal Agents and Coatings

1. Biocidal agents shall only be applied if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.
2. Application of any biocidal agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.
3. Only biocidal agents registered by the U.S. Environmental Protection Agency (EPA) specifically for use within HVAC system shall be used.
4. Biocidal agents shall be applied in strict accordance with manufacturer's instructions.
5. Biocidal coating products for both porous and non-porous surfaces shall be EPA registered, water soluble solutions with supporting efficacy data and MSDS records.
6. Biocidal coatings shall be applied according to manufacturer's instructions. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than "fogged" downstream onto surfaces. A continuous film must be achieved on the surface to be treated by the coating application. Application of any biocidal coatings shall be in strict accordance with manufacturer's minimum millage surface application rate standards for effectiveness.

3.6 CLEANLINESS VERIFICATION

- A. General: Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.
- B. Visual Inspection: The HVAC system shall be inspected visually to ensure that no visible contaminants are present.
 1. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the owner reserves the right to further verify system cleanliness through Surface Comparison Testing or the NADCA vacuum test specified in the NADCA standards.
 2. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
 3. NADCA vacuum test analysis should be performed by a qualified third party experienced in testing of this nature and as specified in part 2.1 of this Specification.
 4. Cleanliness verification shall be performed immediately after mechanical cleaning and before the HVAC system is restored to normal operation.

C. Verification of Coil Cleaning

1. Interior and exterior cleaning must restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see NADCA Standards).

3.7 PRE-EXISTING SYSTEM DAMAGE

- A. Contractor is not responsible for problems resulting from prior inappropriate or careless cleaning techniques of others or any other pre-existing damage to the HVAC systems.

3.8 POST-PROJECT REPORT

- A. At the conclusion of the project, the Contractor shall provide a report to the owner indicating the following:
1. Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
 2. Areas of the system found to be damaged and/or in need of repair.

3.9 APPLICABLE STANDARDS AND PUBLICATIONS: The following current standards and publications of the issues currently in effect form a part of this specification to the extent indicated by any reference thereto:

- A. National Air Duct Cleaners Association (NADCA): "ACR-2002, Assessment, Cleaning & Restoration of HVAC Systems," 2001.
- B. National Air Duct Cleaners Association (NADCA): "Understanding Microbial Contamination in HVAC Systems," 1996.
- C. National Air Duct Cleaners Association (NADCA): "Introduction to HVAC System Cleaning Services," 2002.
- D. National Air Duct Cleaners Association (NADCA): Standard 05 "Requirements for the Installation of Service Openings in HVAC Systems," 1997.
- E. Underwriters' Laboratories (UL): UL Standard 181.
- F. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62-89, "Ventilation for Acceptable Indoor Air Quality".
- G. Environmental Protection Agency (EPA): "Building Air Quality," December 1991.
- H. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): "HVAC Duct Construction Standards - Metal and Flexible," 1985.
- I. North American Insulation Manufacturers Association (NAIMA): "Cleaning Fibrous Glass Insulated Air Duct Systems," 1993.

END OF SECTION

23 3113

Division Twenty Six
ELECTRICAL

SECTION 26 0000**ELECTRICAL INDEX****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Electrical Work, as indicated on the Drawings and specified herein. Electrical work indicated on the Drawings and/or specifications covering other trades shall conform to Division 26 of these Specifications.
- B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Electrical systems, shall be accomplished without additional cost to the Owner.
- C. Furnish all labor and materials required for electrical service and control connections to all the various items of equipment requiring electric or wiring service throughout the project shown on the Contract Drawings (even if not shown on the Electrical Drawings). Coordinate with other trades for the installation of required connections and service.

1.3 ELECTRICAL DIVISION INDEX

260500	GENERAL ELECTRICAL PROVISIONS
260519	LOW VOLTAGE CONDUCTORS
260526	GROUNDING
260533	RACEWAYS, BOXES, AND FITTINGS
262416	PANELBOARDS
262726	WIRING DEVICES AND PLATES
265119	LED INTERIOR LIGHTING
266000	MECHANICAL AND ELECTRICAL COORDINATION SCHEDULE

PART 2 - PRODUCTS - NOT USED**PART 3 - EXECUTION - NOT USED****END OF SECTION****26 0000**

SECTION 26 0500**GENERAL ELECTRICAL PROVISIONS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

- A. Regulatory Agencies: Installation, materials, equipment, and workmanship shall conform to the applicable provisions of the National Electrical Code (NEC), the National Electrical Safety Code (NESC), Occupational Safety and Health Act (OSHA) all local, state, and national codes, ordinances and regulations governing the particular class of work involved and the terms and conditions of the electrical utility and other authorities having lawful jurisdiction pertaining to the work required. All modifications required by these codes, rules, regulations, and authorities shall be made by the Contractor without additional charge to the Owner. The Contractor shall secure all permits and licenses required for his work and shall pay all fees in connection with such permits and licenses.
- B. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved; and, on completion of the work, the Contractor shall obtain and deliver to the Owner, final certificates of acceptance. The Contractor shall furnish copies of each certificate to the Architect/Engineer.
- C. Underwriter's Laboratories (UL): All materials, appliances, equipment, or devices shall conform to the applicable standards of Underwriter's Laboratories, Inc. where such standards have been established.
- D. Standards: The current edition of the following specifications and standards shall form a part of these specifications:
 - 1. National Fire Protection Association Standards
 - 2. National Electrical Code, NFPA 70 (NEC)
 - 3. Life Safety Code, NFPA 101
 - 4. NFPA 72
 - 5. Occupational Safety and Health Act (OSHA)
 - 6. National Electrical Safety Code (NESC)
 - 7. Underwriter's Laboratories, Inc. (Standards)
 - 8. American National Standards Institute (ANSI)
 - 9. American Society of Testing and Materials (ASTM)
 - 10. Institute of Electrical and Electronic Engineers (IEEE)
 - 11. Insulated Cable Engineer's Association (ICEA)
 - 12. National Electrical Manufacturer's Association (NEMA)
 - 13. Americans with disabilities Act Accessibility Guidelines (ADA)

1.3 DRAWINGS

- A. The electrical drawings show the general arrangement of all conduit, outlets, equipment, etc. and shall be followed as closely as actual building construction and the work of other trades will permit. The architectural and structural drawings shall be considered as a part of the work insofar as these drawings furnish the Contractor with information relating to the design and construction of the building. Architectural drawings shall take precedence over electrical drawings. Because of the small scale of the electrical drawings, it is not possible to indicate all

offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, elbow, pullboxes, and accessories as may be required to meet such conditions.

- B. The Contractor shall verify the dimensions governing the electrical work at the building. No extra compensation shall be claimed or allowed because of differences between actual dimensions and those indicated on the drawings.
- C. Drawings and specifications shall be considered as complementary. Work or materials called for by one and not mentioned in other shall be provided as though treated by both.
- D. In the case of conflict between drawings and specifications, the greater or more restrictive requirement shall apply.
- E. Any question as to the intent of the drawings or specifications shall be referred to the Architect/Engineer, whose decision shall be final and conclusive.
- F. Should the Contractor observe any conflict or variation in the plans and specifications, he shall notify the Architect/Engineer in writing no later than seven (7) days prior to date of bid opening. Failure to clarify such variations will result in the Contractor bearing all costs arising from electrical work necessary to resolve the conflict or variation.

1.4 SERVICES

- A. General: Requirements of the serving power and telephone utilities and availability of services have been determined as accurately as possible. The Contractor shall verify availability of services and determine actual details pertaining to the exact locations and requirements of utilities before submitting bid. No consideration for extra cost will be given resulting from failure to comply with these requirements by the Contractor. Contractor shall immediately notify the serving utilities that he has the job, and also furnish information as to the total lighting and power loads for the job. He shall also furnish, at the same time, information as to the established completion date of the job.
- B. Telephone: Contractor shall immediately notify the serving NMSU ITC Department of the estimated date when service will be desired.

1.5 AS-BUILT DRAWINGS

- A. During progress of the work, the contractor shall maintain an accurate record of the installation of the system, locating each outlet, and note all circuiting deviations from the contract drawings. Upon completion of the installation, the contractor shall transfer all record data to a single neat and legible set of blue line prints of the original drawings.

1.6 OPERATING INSTRUCTIONS AND MANUALS

- A. Instructions: Without additional charge to the Owner, furnish competent instruction to the Owner in the care, adjustment, and operation of all parts of the electrical equipment and systems.
- B. Manuals: Upon completion of the work, prepare and deliver to the Owner two (2) sets of complete operating and maintenance manuals for the systems and major equipment installed, suitably bound in book form and must be originals. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating and maintenance data.
- C. Other: The above requirements are in addition to specific instructions and manuals specified for individual systems or equipment.

1.7 SITE VISIT

- A. The Contractor shall visit the site prior to bidding and satisfy himself as to the conditions under which the systems are to be installed. No subsequent allowance shall be made in his behalf for failure to make such a visit.

1.8 FIELD MEASUREMENTS

- A. The Contractor shall verify the dimensions covering the work. No extra compensation shall be claimed or allowed due to difference between actual dimensions and those indicated on the drawings. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting the work.

1.9 PERFORMANCE TESTS

- A. Thoroughly test all fixtures, batteries, services, and all circuits for proper operating condition, required durations and freedom from grounds and short circuits before acceptance is requested. All equipment, appliances and devices shall be operated under load conditions.
- B. After the interior wiring system installation is complete and at such time as the Architect/Engineer may direct, conduct operating tests for approval. When requested, test all the wire, cable, devices, and equipment after installation, to assure that all material continues to possess all the original characteristics as required by governing codes and standards listed in these specifications.
- C. After occupancy of the building has taken place and nominal building power loads established, make voltage readings at all panelboards. Based on these readings, make final adjustments of taps on all transformers in the building as directed.
- D. Perform such other tests as required by other sections of these specifications or as requested to prove acceptability.
- E. Furnish all instruments and labor for testing.

1.10 REMODELING WORK

- A. Where remodeling work is indicated, the Contractor shall be responsible for all electrical work associated with changes in, or removals of existing walls, ceilings, or floors. This work shall include rerouting of conduits, relocation of fixtures, devices, and conduits as well as provision for circuit continuity for circuits in remodeled areas. The cost of all of this work shall be included in the Contractor's price with no additional compensation allowed for failure to include this work.

1.11 MISCELLANEOUS ITEMS

- A. Miscellaneous items not covered in these specifications shall be as indicated on the drawings, installed, and connected in the proper manner and as recommended by the manufacturer.

1.12 GUARANTEE

- A. All equipment and workmanship to be furnished under this contract shall be guaranteed for a period of one year from the date of final acceptance thereof against defective materials, design and workmanship. Upon receipt of notice from the Owner of failure of any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be replaced promptly with new parts by and at the expense of the Contractor. The labor incident to the installation of these replacements shall be furnished by the Contractor.

1.13 STANDARDS OF MATERIAL AND WORKMANSHIP

- A. All material shall be new and shall bear the label of the Underwriter's Laboratories, Inc., or be listed under re-examination service. All material shall be of the best grade and latest pattern of manufacture as specified. All work shall be performed in a neat, workmanlike manner and shall present a neat mechanical appearance when completed.

PART 2 - PRODUCTS**2.1 EQUIPMENT REQUIREMENTS**

- A. The electrical requirements for equipment specified or indicated on the drawings are based on information available at the time of design. If equipment furnished for installation has electrical

requirements other than indicated on the electrical drawings, the Contractor shall make all adjustments to wire and conduit size, controls, overcurrent protection and installation as required to accommodate the equipment supplied, without additional charge to the Owner. The complete responsibility and costs for such adjustments shall be assigned to the respective section of this specification under which the equipment is furnished.

2.2 MATERIALS

- A. When the product of a specific manufacturer is indicated on the drawings or specified herein by catalog number or trade name, it has been done for convenience in fixing the standard for workmanship, finish, design, and the guaranteed performance. Any material, apparatus, or appliance which the Contractor desires to substitute for those mentioned herein shall also conform to these standards or exceed them and shall follow the procedure as outlined under substitutions and specified herein.
- B. All similar materials and equipment shall be the product of the same manufacturer.
- C. Where no specific material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be used, providing it conforms to the contract requirements and meets the approval of the Architect/Engineer.
- D. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design.
- E. Altitude: Equipment affected by altitude shall perform satisfactorily for the function intended at the altitude of the project site.

2.3 NAMEPLATES

- A. All items of mechanical and electrical equipment shall be identified by the attachment of engraved nameplates, constructed from laminated phenolic plastic, at least 1/16" thick, three-ply, black surface and white core. Plates shall be attached using stainless plate screws unless indicated otherwise. Nomenclature on the label shall include the name of the item and feeder circuit number. Equipment to be labeled shall include, but not be limited to, the following:
 - 1. Air Conditioning Control
 - 2. Contactors
 - 3. Panels and Switches
 - 4. Time Switches
 - 5. Relays
 - 6. Disconnect Switches
 - 7. Starters
 - 8. Transformers
 - 9. Miscellaneous
 - 10. Similar and/or related items

2.4 IDENTIFICATION AND SIGNS

- A. Label each individual motor controller, disconnect switch, transformer and remote control device to identify each item and its respective service.
- B. Provide nameplates with engraved lettering not less than 3/8 inch high where specified or noted. In general, use white core laminated plastic, attached with screws. Embossed plastic adhesive tape is not acceptable. Flush mounted devices may have identification engraved in the device plate.
- C. Provide warning signs on all equipment or devices operating at 300 volts or more, reading "DANGER - 480 VOLTS" (insert respective voltage) etc., with white letters on red background of standard code size. Signs may be decals, stencils, or nameplates.

- D. Identify panelboards and cabinets by nameplates with descriptions indicated on the drawings together with voltage and phase. Install on outside of hinged doors of panelboards and cabinets.

2.5 CHANGES

- A. No changes shall be made in the electrical work as shown and herein specified, unless such changes are authorized in writing by the Architect/Engineer and such authorization shall contain a statement covering the amount of the charges involved in the change.

2.6 SUBSTITUTIONS

- A. On all material, substitutions will be considered only if requested by letter from the Contractor to the Architect/Engineer. Letters must be in the engineer's office no later than 10 days prior to the bid date and shall be considered as authorized only upon written confirmation from the Architect/Engineer. Where materials are proposed to be substituted in lieu of the items specified, substitutions shall be equal in quality, workmanship, and design. The burden of proof of equality of materials shall be placed upon the Contractor. Samples of all materials proposed for substitution shall be submitted to the Architect/Engineer, when requested, for examination.

2.7 SHOP DRAWINGS

- A. Shop drawings shall be furnished for all equipment and materials. They shall be furnished by the Contractor as required in the Submittal Section. Where equipment will be furnished "as specified," a statement to that effect is sufficient. Where substitutions are proposed, complete data must be furnished showing performance, quality, and dimensions.
- B. The Contractor shall submit to the Architect/Engineer for checking a complete descriptive and technical data list for all items of material furnished under this contract. Complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of special nature or critical to the installation and pertinent data required for installation shall be shown. Fixture submittals shall include scale drawings showing metal gauges and finish together with complete photometric distribution curves and coefficient of utilization tables. Glare factor curves shall also be submitted for each fixture. Failure to submit this information can be the basis for disapproval.
- C. All descriptive and technical data and shop drawings shall bear signed certification that they have been carefully examined and found to be correct with respect to dimension, space available, non-interference with other trades and that the equipment complies with all the requirements of these specifications. Submittals that have not been checked for compliance will not be considered by the Engineer.
- D. Only complete submittals will be considered, partial submittals will not be reviewed.

2.8 SUBMITTALS

- A. Submittals shall be complete; bound booklets with an index of all items submitted including associated catalog/part numbers. The Contractor shall make submittals on all the following equipment (in addition to any special items indicated elsewhere in the plans or specifications):
 - 1. Lighting Fixtures
 - 2. Wiring devices
 - 3. Conduit
 - 4. Wire
 - 5. Panelboards
 - 6. Switchgear
 - 7. Fuses
 - 8. Metering equipment
 - 9. Transformers
 - 10. Starters

11. Contactors
 12. Disconnect switches
 13. Motor Control Centers
 14. Lamps
 15. Dimming systems
 16. Special Systems equipment (Fire Alarm, Intrusion Alarm, Sound, TV, Lightning Protection, etc.).
- B. Electrical System Controls: Refer to Section 253000 for additional submittal requirements.
- C. After receiving approval on the make and the type of materials, the Contractor shall order such materials in sufficient time to prevent any delay or changes on the job.

PART 3 - EXECUTION

3.1 GENERAL

- A. Fabrication, erection and installation of the complete electrical system shall be done in a first class workmanlike manner by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project. The Contractor shall check all areas and surfaces where electrical equipment material is to be installed, removed, or relocated and report any unsatisfactory conditions before starting work. Commencement of work signifies the Contractor's acceptance of existing conditions. In the acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of workmen.

3.2 EQUIPMENT

- A. Equipment and materials furnished by the Contractor shall fit the spaces allocated for them. Should the equipment which the Contractor proposes to install, require space conditions other than indicated on the drawings, it shall be the Contractor's responsibility to reconcile the available space with the equipment and make any changes required to accommodate the equipment. All required changes shall be made at the Contractor's expense.
- B. All equipment, both the Contractor and Owner furnished, shall be installed in accordance with the manufacturer's recommendations.

3.3 COORDINATION

- A. The Electrical Plans are diagrammatic, but shall be followed as closely as actual construction and the work of other trades will allow. Such minor changes as are necessary to make the electrical work conform to the work of other trades and to the building shall be made without cost to the Owner.

3.4 CIRCUITS AND FEEDERS

- A. Circuits and feeders shall be as shown and no deviations from the indicated outlet-circuit grouping will be permitted, except by permission of the Architect/Engineer. Branch circuit numbers are mandatory and shall be changed only on written permission from the Architect/Engineer. Any changes in layout or circuit numbering shall be accurately recorded on the "As-Built" drawings.

3.5 CONDUITS

- A. In all spaces, such as ceiling spaces and equipment rooms, all conduits shall be run to a continuous grade and square to the building.
- B. The plans do not give exact details as to the elevations of conduits, exact locations, etc., and do not show all off-sets, bends, junction boxes and other installation details. The Contractor shall carefully lay out his work at the site to conform to details of installation.

3.6 LOCATION OF EQUIPMENT AND OUTLETS

- A. The approximate locations of cabinets, panelboards, wiring gutters, switches, light outlets, power outlets, etc., are indicated on the drawings; however, they are not intended to give complete and exact information. Determine the exact location after thoroughly examining the general building plans and by actual measurements during construction, subject to the approval of the Architect/Engineer.
- B. Verify with Architect/Engineer, prior to installation, all locations of conduit, boxes, etc. stubbed or in the floor.

3.7 PROTECTION OF MATERIALS AND EQUIPMENT

- A. The Contractor shall be responsible for the protection of all materials and equipment under this section of the work whether incorporated into the building or not.
- B. The Contractor shall provide protection for all work where necessary and will be responsible for all damage done to property during the construction. The above protection shall be maintained while the work is in progress. In no case shall dirt, grit, etc., be ground into the floor finish or coverings.
- C. The Contractor shall provide space for storage of materials and equipment at ground level.

3.8 CUTTING AND REPAIRING

- A. Cutting and repairing shall be the responsibility of the Contractor. Coordinate to prevent unnecessary cutting and repairing. Lay out and locate equipment, openings, and chases. Install sleeves, inserts, and supports.

3.9 EXCAVATION AND BACKFILLING

- A. The Contractor shall do all necessary excavation and backfill for the installation of the systems as may be required. Curb cuts, asphalt, and concrete patching, etc., shall be part of the Contractor's responsibility. Any required trenching will be done by hand and all existing utilities avoided. Damage done to existing utilities will be repaired by the Contractor with no additional payment for the work. In addition to the above, trenches shall be backfilled with dirt, free from debris, rocks, and other foreign matter. Backfill shall be replaced in the trenches in 6" layers and each 6" layer shall be wetted down adequately and properly tamped. Remove surplus dirt and leave premises clean. Perform excavation, backfilling and repaving required for work under this Division in accordance with DIVISION 2, SITE CONSTRUCTION. In general, backfill and tamp with compaction at least equal to that of the surrounding area.

3.10 WARRANTY

- A. Deliver originals of all guarantees and warranties on this portion of the work to Owner. Warrant all equipment, materials, and workmanship for one year in accordance with the terms of this Contract.

3.11 PRODUCT HANDLING

- A. Use all means necessary to protect electrical materials and equipment before, during and after installation and to protect the installed work of other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no extra cost to him.

END OF SECTION

26 0500

SECTION 26 0519**LOW VOLTAGE CONDUCTORS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Furnish and install all conductors as required for the complete installation and operation of all electrically serviced and/or operated equipment, devices, and systems throughout the project.

1.3 RELATED WORK IN OTHER SECTIONS

- A. Conduit, feeders, wiring devices and plates, equipment connections, panelboards, transformers, lighting equipment and lamps.

PART 2 - PRODUCTS**2.1 WIRES AND CABLES (600 VOLTS)**

- A. Type: Conform to the applicable UL and ICEA Standards for the use intended. Copper conductors with 600-volt insulation unless otherwise specified or noted on the drawings. Stranded conductors for No. 6 and larger except where elsewhere specified or noted on the drawings.
- B. Use of aluminum conductors will not be permitted.
- C. Insulation: Type THWN, 75 degrees C. insulation unless otherwise specified or noted on the drawings. 90 degrees C. minimum insulation within fixture wireways of fluorescent fixtures. Where 90 degrees C. insulation is specified, the termination points for this conductor shall be rated for 90 degrees C.
- D. Size: No. 12 minimum unless otherwise specified or noted on the drawings. In the case of "homeruns", no conductor smaller than #10 shall be used for runs over 100 feet in length on 120-volt circuits. Not less than NEC requirements for the system to be installed. If the equipment to be installed requires larger conductor and conduit sizes than indicated on the drawings, the required changes shall be made without additional charge. Remote control wires, other than Class 2 remote control and signal circuits, shall be no smaller than #14.
- E. Color Coding: Phase, neutral and equipment ground conductors color-coded. Connect all conductors of the same color to the same phase conductor. Color coding shall be A-black, B-red, C-blue, N-white, for 250 volts or less. A-yellow, B-orange, C-brown, N-off white or grey, for 251-600 volts, with green for all equipment ground conductors. Conductors No. 12 and 10 shall be solid color compounded for the entire length. Conductor sizes larger than No. 10 may be color coded at each termination and in each box or enclosure with six inches of half-lapped 3/4-inch pressure sensitive, plastic tape of respective colors in lieu of solid color compound. The equipment grounding conductor shall be bonded to the outlet box grounding screw with taps to receptacles and equipment. Isolated ground conductors shall be green in color with a yellow trace.

2.2 CONTROL CONDUCTORS

- A. Copper, minimum size No. 14 with 19/35 stranding, color coded filled cross linked polyethylene 75 degrees C. 600-volt insulation and neoprene or equal outer jacket. Multi conductor control cables shall be provided where more than three control conductors are installed in the same conduit between common terminations. Provide two spare conductors minimum in each control cable.

2.3 DATA/COMMUNICATION AND ELECTRONIC CABLE

- A. As required or specified in the section of these specifications specifying the equipment. Splices shall be twisted and soldered or shall use an approved connector.
- B. All Cat. 6 cabling shall be tested in accordance with EIA/TIA performance standards. Refer to DIVISION 27 for more detailed information.

2.4 VERTICAL CABLE SUPPORTS

- A. Split wedge type supports which clamp each individual conductor and tightens due to weight of the cable shall be used for cables without metallic sheath. Basket weave type supports shall be used for cables with metallic sheath.

2.5 CONNECTORS AND LUGS

- A. For Copper Conductors No. 6 and Smaller: 3M Scotch-Lok or T & B Sta-Kon compression or indent type connectors with integral or separate insulating caps.
- B. For Copper Conductors Larger Than No. 6: Solderless, indent, hex screw, or bolt type pressure connectors, properly taped or insulated.

2.6 TAPE

- A. Plastic tape, 8.5 mils minimum thickness, 1,000,000 megohms minimum insulation resistance, oil resistant vinyl backing, oil resistant acrylic adhesive, incapable of supporting combustion per ASTM D-568 Test Method B.

PART 3 - EXECUTION**3.1 CONDUIT SYSTEMS**

- A. A complete system of conductors shall be installed in the raceway systems. Control wires shall be run in separate conduits from conductors of other systems. All conductors of all systems shall be installed in raceway or conduit.
- B. Lighting fixtures shall not be used as raceways for circuits other than parallel wiring of fixtures. Wiring in fixtures shall be rated for that purpose.
- C. When leaving a metal raceway or conduit in a cabinet, box, switch, enclosure, control enclosure or any other like member, conductors shall be protected by means of insulated bushings or end fittings. These protectors shall be "O.Z." type or similar.
- D. Conductors may be run in multiple sizes #1/0 to 600 kcmil inclusive provided all multiple conductors are the same size, length, and type of insulation. Multiple runs are to be in separate conduits. Each conduit to include one set of phase conductors, neutral and grounding conductors. All to conform to NEC 300-20.
- E. No splices or taps shall be made in any conductors except in outlet boxes, pull boxes, junction boxes, panelboard boxes, manholes or splice boxes. All taps and splices shall be made with solderless connectors and insulated in such a manner that provides an effective insulation equal to that of the adjoining wire. Any splice or tap shall be made only on conductors which are a component part of a single circuit properly protected by approved methods.

- F. Before any wire is pulled into any conduit, the conduit shall be thoroughly swabbed in such a manner as to remove all foreign material and to permit the wire itself to be pulled in a clean, dry conduit. The Contractor shall use only approved wire pulling lubricants for pulling any wire. All conductors shall be pulled into their respective conduits by hand, except where written permission of the Engineer is secured to the contrary.

3.2 WIRE AND CABLE TESTS (600 Volts)

- A. Measure the insulating resistance of service entrance conductors, feeder circuit conductors and service ground. Measurements shall be taken between conductors and between conductors and ground. Resistance shall be 1,000,000 ohms or more when tested at 500 volts by megger without branch circuit loads. Tests and procedures shall meet the approval of the Architect/Engineer and shall be in accordance with the applicable IPCEA standards for the wires and cables to be installed. Furnish all instruments, equipment and personnel required for testing and conduct tests in the presence of the Architect/Engineer. Submit written reports of the tests and results when requested.

3.3 PULL WIRES

- A. In each empty conduit, except underground conduits, install a No.14 galvanized steel pull wire or a plastic line having a tensile strength of not less than 200 pounds. In each empty underground conduit, install a No. 10 AWG bare, hard drawn copper or copper clad pull wire or a plastic line having a tensile strength of no less than 200 pounds.

3.4 IN RACEWAYS

- A. Install conductors in rigid conduit, EMT or flexible metallic conduit, unless otherwise specified or noted on the drawings.

3.5 CABLE BENDS

- A. Radius of bends not less than 10 times the outer diameter of the cable.

3.6 BUNDLING

- A. In cabinets conductors No. 10 and smaller shall be neatly and securely bundled and conductors larger than No. 10 shall be neatly and securely cabled in individual circuits, utilizing marlin twine, two ply lacing or nylon straps.

3.7 CONDUCTOR PULL

- A. Conductors shall not be pulled into conduits until after all plastering or concrete work is completed and all conduits in which moisture has collected have been swabbed out.

3.8 FEEDER IDENTIFICATION

- A. Tag feeder circuits in each enclosure with wrap around circuit designation labels where more than one feeder passes through or terminates in the enclosure.

3.9 CONNECTORS AND LUGS

- A. Install with manufacturer's recommended tools and with the type and quantity of deformations recommended by manufacturer.
- B. Contractor shall review one-line and other Drawings to assure that proper lugs are provided in termination equipment such as switches, panels, switchboards, mechanical equipment, etc. Due to voltage drop conductor sizes and/or numbers may not be accommodated by the equipment affected. If manufacturer cannot provide the proper number and size of lugs within their equipment the Contractor shall provide enclosures and properly sized terminals to convert the oversized cable, number and size that is compatible to the equipment affected.

END OF SECTION

26 0519

SECTION 26 0526**GROUNDING****PART 1 - GENERAL****1.1 RELATED WORK IN OTHER SECTIONS**

260500	GENERAL PROVISIONS
260519	LOW VOLTAGE CONDUCTORS
260533	RACEWAYS, BOXES, AND FITTINGS
262416	PANELBOARDS
262726	WIRING DEVICES AND PLATES
DIVISION 27	TELECOMMUNICATIONS SYSTEMS

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Materials, equipment, and devices related to the grounding system are specified under other sections of these specifications.

PART 3 - EXECUTION**3.1 GENERAL**

- A. Install two separate grounding systems, a service grounding system, and an equipment grounding system. The service equipment, conduit systems, supports, cabinets, equipment, and neutral conductor shall be grounded in accordance with the minimum code requirements and as further indicated on the drawings or specified. Connect the two grounding systems together only at the main service equipment and at the secondary terminals of transformers creating separately derived distribution systems such as dry-type transformers.

3.2 SERVICE GROUNDING SYSTEM

- A. General: The service grounding system is provided for the AC service neutral ground. Current return conductors, such as neutrals of the service entrance, feeder circuits and branch circuits, shall not be used for equipment grounding. Care must be exercised to ensure that neutral bars are not bonded to the enclosures of panelboards, etc., which are not part of the main service equipment. Except for separately derived systems, the neutral conductors shall be grounded only in the main service equipment.
- B. Common Ground Point: Establish one common ground point in the main service equipment by interconnecting the insulated neutral bus (or bar), the uninsulated equipment ground bus (or bar), and service grounding electrode conductor.
- C. Neutral Disconnecting Means: Install a neutral disconnecting means in the main service equipment for disconnecting and isolating the neutral bus from the common ground. The disconnecting means may be disconnecting links in the interconnection between the insulated neutral and uninsulated equipment ground.
- D. Neutral Bars: Provide an insulated neutral bar, separate from the uninsulated equipment ground bar, in all panelboards, transformers, starters, disconnect switches, cabinets, etc. which have neutral connections.

3.3 EQUIPMENT GROUNDING SYSTEM

- A. General: Provide a complete equipment grounding system in accordance with the minimum code requirements and as further indicated on the drawings or specified. The equipment ground (green conductor) consists of metallic connections to ground of non-current carrying metal parts of the wiring system or apparatus connected to the system. The primary purpose of equipment grounding is to provide greater safety by limiting the electrical potential between non-current carrying parts of the system and to provide a low impedance path to ground for possible ground fault currents.
- B. Common Ground Point: Establish one common ground point as specified elsewhere in this section of the specifications for interconnection of the equipment grounding system and the service grounding electrode conductor.
- C. Service Equipment Enclosure: Bond the enclosure of the main service equipment to the uninsulated equipment ground bus (or bar) with a conductor or bar sized for 25% of the largest service overcurrent device.
- D. Ground Bar: Provide an uninsulated equipment ground bar, separate from any insulated neutral bar, in all switchboards, panelboards, transformers, motor control centers, starters, disconnect switches, cabinets, etc. for grounding the enclosure and for connecting other equipment ground conductors. The ground bar shall be an integrally mounted and braced bus bar in switchboards or a separately mounted bar adequately braced or bolted to the enclosure of other types of equipment. The ground bar shall be adequately braced or bolted to the enclosure after thoroughly cleaning both surfaces to assure good contact. Provide solderless pressure connectors for all conductor terminations. Number and size of pressure connectors on equipment grounding bars as required for the termination of equipment grounding conductors. In addition to the active circuits, provide pressure connectors for all three-phase spares and spaces.
- E. Conduits: Where metallic conduits terminate without mechanical connection to a metallic housing of electrical equipment by means of lock nut and bushings, provide ground bushing connected with a bare copper conductor to the ground bar in the electrical equipment. Metallic conduits containing ground wiring only shall be bonded to the ground wire at both conduit entrance and exit. Install grounding conductor in each nonmetallic conduit or duct except those used for telephone, sound, or low-voltage signals and in all flexible conduit that does not have a built-in ground conductor. Bond the conductor at both ends to the equipment grounding system.
- F. Feeders and Branch Circuits: Provide a separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit with a three-phase protective device. Provide a separate green insulated equipment grounding conductor for single phase branch circuits unless otherwise indicated. Install the required grounding conductor in the common conduit or raceway with the related phase and/or neutral conductors and connect to the box or cabinet grounding terminal. Where there are parallel feeders installed in more than one raceway each raceway shall have a green insulated equipment ground conductor.
- G. Devices: Install a minimum No. 12 green insulated equipment bonding conductor from a grounding terminal in the respective outlet or junction box to the green ground terminal of all receptacles and through flexible conduit to all light fixture housings.
- H. Motors: Install a separate green insulated equipment grounding conductor from the equipment ground bar in the motor control center of separate starter through the conduit and flexible conduit to the ground terminal in the connection box mounted on the motor. Install the grounding conductor in the common conduit or raceway with the related motor circuit conductors.

3.4 SEPARATELY DERIVED SYSTEMS

- A. Transformers creating separately derived distribution systems, such as dry-type transformers, shall utilize the equipment ground bars in the transformer enclosure for both secondary

equipment ground and secondary neutral ground with separate grounding conductor extended to an approved ground electrode.

3.5 GROUNDING ELECTRODE SYSTEM

- A. A minimum of two service ground electrodes shall be utilized. One shall be the main cold water metallic water piping system and the other shall be a made electrode consisting of not less than twenty feet of bare copper conductor encased along the bottom of a concrete foundation footing which is in direct contact with the earth (NEC 250-81c). Make the connections to the cold water pipe inside the building at the point of entrance. Other grounding electrodes (building steel, ground counterpoise, etc.) shall be bonded to the grounding electrode system where utilized. The grounding electrode for separately derived systems shall be approved for the application.

3.6 GROUNDING CONDUCTORS

- A. The grounding electrode conductors for the service grounding electrode system shall be insulated or bare copper, sized in accordance with NEC 250-94 (a), including the conductor for the supplemental electrodes. The conductors shall be continuous without joint or splice and shall be installed in conduit with the conduit bonded to the conductor at each end. Install the conductor to permit the shortest and most direct path and terminate in the main service equipment on the common ground point. Equipment grounding conductors shall be green insulated conductors equivalent to the insulation on the associated phase conductor, but not less than Type TW. The equipment grounding conductor or straps shall be sized in accordance with NEC. Where one feeder serves a series of panelboards or transformers, the equipment grounding conductor shall be continuous without splices. Grounding conductors shall not be installed through metal-sheathed holes. All connections shall be available for inspection and maintenance.

3.7 GROUND CONNECTIONS

- A. Clean surfaces thoroughly before applying ground lugs or clamps. If surface is coated the coating must be removed down to the bare metal. After the coating has been removed apply a non-corrosive approved compound to cleaned surface and install lugs or clamps. Where galvanizing is removed from metal it shall be painted or touched up with "Galvanox", or equal.
- B. All grounding connections to bare stranded wire, ground rods, etc. shall be BURNDY HY-GROUND™ or approved equivalent or approved exothermic connection method. All connectors shall meet the requirements of IEEE STD 837 (Latest Revision), "IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding". All connectors must be listed by Underwriters Laboratories for direct burial in earth or embedment in concrete applications according to ANSI/UL-467 (latest revision), "Standard for Grounding and Bonding Equipment." Connectors must be suitable for lightning protection applications. Listing to UL-96 "Lightning Protection Components" preferred on applicable items.

3.8 TESTS

- A. Test the completed grounding system with a megger at the service ground bar and submit a written report to the Architect/Engineer for approval. The service shall not be energized if the test shows more than 5 ohms, unless approved by the Architect/Engineer.

END OF SECTION

26 0526

SECTION 26 0533**RACEWAYS, BOXES, AND FITTINGS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Furnish and install complete conduit systems for the various electrical systems required for this project. Systems shall be complete with supports, mounting devices, pull boxes, etc., as required for installation of wiring systems and terminal devices.

1.3 RELATED WORK IN OTHER SECTIONS

- A. Site work, wiring devices and plates, feeders, panelboards, lighting equipment and lamps, telephone system, transformers, and services.

PART 2 - PRODUCTS**2.1 CONDUITS**

- A. Steel Conduit: Rigid, threaded, thick wall, hot dipped galvanized.
- B. Electrical Metallic Tubing (EMT): Mild steel, zinc coated on the outside and either zinc coated or coated with an approved corrosion resistant coating on the inside. Maximum size 2-inch electrical trade size unless noted on the drawings or specifically approved.
- C. Intermediate Metal Conduit (IMC): Rigid, threaded, lightweight steel, zinc-coated on the outside and either zinc-coated or coated with an approved corrosion resistant coating on the inside.
- D. Flexible Conduit: Commercial "Greenfield," galvanized steel, with a separate grounding bond wire installed in the conduit in addition to other wires.
- E. Liquid Tight Flexible Conduit: Flexible galvanized steel tubing with extruded liquid tight PVC outer jacket and a continuous copper bonding conductor wound spirally between the convolutions. Where a separate grounding conductor is installed in the conduit, bonding conductor in the convolutions may be omitted.
- F. Plastic coated rigid steel conduit shall be hot dipped galvanized steel conduit with a coating of polyvinyl chloride, minimum 15 mills (0.015), on the exterior surfaces, shall have an approved corrosion resistant coat inside. To be Pittsburgh, J & L, Republic or approved equal.
- G. Rigid Non-Metallic Conduit: Schedule 40, high impact PVC with 7,000 psi tensile strength at 73.4 degrees F., 11,000 psi flexural strength, 8,600 psi compression strength, approved for 90 degrees C. conductors. Carlon, triangle, or approved equal. PVC conduits shall include a ground wire sized as noted or as required by NEC (whichever is larger). No bends shall be made in PVC. Rigid galvanized steel conduit shall be utilized for all elbows, risers, and bends.
- H. Aluminum Conduit: Shall not be used unless specifically indicated on the drawings for specialized purposes.
- I. Conduit Size: Minimum conduit size, 1/2 inch except where specifically approved for equipment connections. Sizes not noted on drawings shall be as required by the NEC. All homeruns to

panels shall be 3/4 inch minimum. Conduits for #12 THWN wire shall be sized the same as for #12 THW wire.

2.2 CONDUIT FITTINGS

- A. Connectors and Couplings: Compression type threadless fittings for rigid steel conduit or IMC not permitted. EMT couplings and connectors either steel or malleable iron only, "Concrete Tight" or "Raintight" and either the gland and ring compression type or the stainless steel multiple point locking type. Connectors to have insulated throats. EMT fittings using set screws or indentations as a means of attachment are not permitted.
- B. All conduits shall terminate in bushings or connectors which are insulated type, designed to prevent abrasion of wires without impairing the continuity of the conduit grounding system.
- C. Rigid Steel Conduit, IMC and EMT Fittings: Iron or steel only.
- D. Liquid Tight Flexible Conduit Fittings: With threaded grounding cone, a steel, nylon or equal plastic compression ring and a gland for tightening. Either steel or malleable iron only with insulated throats and male thread and locknut or male bushing with or without "O" ring seat. Each connector shall provide a low resistance ground connection between the flexible conduit and the outlet box, conduit, or other equipment to which it is connected.
- E. Rigid Aluminum Conduit Fittings: Malleable iron, steel, or aluminum alloy. Ferrous fittings zinc coated or cadmium plated. Aluminum alloy fittings shall conform with the characteristics defined by UL for aluminum rigid metallic conduit and shall not contain more than 0.04 percent copper.
- F. Flexible Conduit Fittings (Commercial Greenfield): Either steel or malleable iron only, with insulated throats and shall be one of the following types:
 - 1. Wedge and screw type with angular wedge fitting between the convolutions of the conduit.
 - 2. Squeeze or clamp type with bearing surface contoured to wrap around the conduit and clamped by one or more screws.
 - 3. Steel, multiple point type, for threading into internal wall of the conduit convolutions.
- G. Expansion Fittings: Each conduit that is buried in or rigidly secured to the building construction on opposite sides of a building expansion joint and each long run of exposed conduit that may be subject to excessive stresses shall be provided with an expansion fitting. Expansion fittings shall be hot dipped galvanized malleable iron with factory installed packing and a grounding ring.
- H. Sealing Fittings: Threaded, zinc or cadmium plated, cast or malleable iron type for steel conduits and threaded cast aluminum type for aluminum conduits. Fittings used to prevent passage of water vapor shall be of the continuous drain type.
- I. Fittings for PVC Coated Rigid Steel Conduit: Ells and couplings used with PVC coated rigid steel conduit shall have a factory applied coating of polyvinyl chloride, minimum 15 mills (0.015) on exterior surfaces and shall have a PVC sleeve extruded a minimum of 2" from one end of the fitting.

2.3 WIREWAYS

- A. Square-D Company Square-Duct "lay-in" type without knockouts with lengths and fittings hinged to provide an unobstructed wireway to "lay-in" conductors. Use standard lengths. Field cuts permitted where absolutely necessary. Rust inhibiting phosphatizing coating on sheet metal parts. Blue gray baked enamel finish. Hardware plated to prevent corrosion. Provide all accessories, including tee fittings, junction boxes, cross fittings, transposition section, gusset brackets, nipples, pull boxes, reducer fittings, wall flanges, panel or cabinet flanges, elbows, ceiling, and wall support brackets and supporting hardware, etc.

2.4 BUSSED GUTTER

- A. Bussed gutter shall be amperage, voltage, and phase configuration as noted on the drawings, with a 50% ground bus. Provide lugs on bus bars as indicated on the drawings. All bus bars shall be copper. Use of aluminum bus bars will not be permitted.

2.5 OUTLET BOXES

- A. Construction: Zinc coated or cadmium plated steel boxes of a class to satisfy the condition at each outlet except where unilet or conduit bodies are required. Knockout type with knockouts removed only where necessary to accommodate the conduit entering. Square cornered, straight sided gang boxes, 4-inch octagon concrete rings and 4-inch octagon hung ceiling boxes with bars may be folded type. One piece deep drawn type for all other boxes.
- B. Size: To accommodate the required number and sizes of conduits, wires, and splices in accordance with NEC requirements, but not smaller than size shown or specified. Standard concrete type boxes not to exceed 6 inches deep except where necessary to permit entrance of conduits into side of boxes without interference with reinforcing bars. Special purpose boxes shall be sized for the device or application indicated.
- C. Fixture Studs: 3/8-inch malleable iron fixture stud in outlet boxes for ceiling lighting fixtures and interior bracket lighting fixtures, other than lamp receptacles and drop cords.
- D. Exposed: Screw joint type, with gasketed weatherproof covers in locations exposed to the weather. Shall be of the continuous drain type. Where required to be "Raintite."
- E. Tile Boxes: Rectangular in shape with square corners and straight sides for receptacles and switches mounted in furniture cabinets or in glazed tile, concrete block, marble, brick, stone, or wood walls. Install without plaster rings.
- F. Wall Mounted Switch, Receptacle and Signal Boxes: Unless otherwise noted or specified, not less than 4 inches square by 1-1/2 inches deep for single devices, 4-11/16 inches by 1-1/2 inches deep for two devices and multi gang boxes for more than two devices. Boxes for switches and receptacles on unfinished walls may be screw joint type with covers to fit the devices. Provide plaster rings, as required, to provide proper opening for device.
- G. Wall Mounted Telephone Outlet Boxes: 4-11/16 inches square by 2-1/8 inches deep, unless otherwise noted on the drawings.
- H. Light Fixture Boxes: 4-inch diameter by 1.5-inch-deep minimum for ceiling and interior bracket fixtures with concealed conduits. Plaster covers for bracket fixtures to have 3-inch diameter openings. Screw joint boxes with canopy seat for ceiling and interior bracket fixtures with exposed conduits.
- I. Grounding Terminal: Provide a grounding terminal in each box with circuits serving motor driven equipment or receptacles for grounding to a green equipment ground conductor. Grounding terminal shall be green colored washer-in-head machine screw.

2.6 PULLBOXES

- A. Minimum NEC requirements unless larger box is noted. As specified for outlet boxes with blank cover for pullboxes with internal volume not more than 150 cubic inches. As specified for cabinets for pullboxes with internal volume over 150 cubic inches, except covers to have same thickness as box with corrosion resistant screw or bolt attachment.

2.7 FLOOR BOXES

- A. Heavy duty, cast, adjustable type, suitable for the device or application indicated, unless noted. Provide carpet flanges in carpet areas.

PART 3 - EXECUTION**3.1 CONDUIT INSTALLATION**

- A. Conduit Systems: Conduit shall be provided for all wiring circuits. Material shall be exposed or concealed as required by the Drawings. Rigid Steel conduit, IMC, EMT or Rigid Non-Metallic conduit unless noted. Install rigid steel conduits for underground runs, when specifically noted on the drawings, runs in concrete, feeder circuits and where required by the NEC for mechanical protection, etc. Use flexible conduit only for equipment connections and then only to the extent of minimum lengths required for connections (Typically 1'-0", maximum length 4'-0"). Install flexible conduit connections at all resilient mounted equipment. Provide liquid tight flexible conduit in exterior, wet or damp locations and for connections to all motors, dry type transformers and wet pipe mechanical systems. Aluminum conduit may be used only if specifically called for. Conduit and tubing shall be kept at least 6 inches from parallel runs of hot water or steam pipes. PVC conduit may be used only for runs below grade or in slab. Concrete encasement is required under all paved areas. Rigid steel, galvanized elbows shall be used for all bends and risers. No PVC shall be extended above grade or slab. Ground wires, sized in accordance with NEC, shall be installed in all conduit runs, except where used for telephone conductors.
- B. Conduit Installation: Install concealed conduit and EMT in as direct lines as possible. Install exposed conduits and EMT parallel to or at right angles to the lines of the building. Right angle bends in exposed conduit and EMT runs shall be made with standard elbows, screw jointed conduit fittings or conduit bent to radii no less than those of standard elbows. Exposed conduits below the five (5) foot level shall be galvanized rigid conduit.
- C. Concealed Conduits: Install conduit systems concealed where possible unless otherwise noted. Conduit systems may be exposed in unfinished utility areas, ceiling cavities and where specifically approved by the Engineer. No conduit shall be run on roof or exposed face of building unless specifically shown on plans or approved by Engineer.
- D. Conduit in Concrete: Conduits shall not be installed in floor slabs poured on grade. Conduits under slab shall be installed a minimum 6" below slab, covered with earth. PVC coated rigid steel conduit may be embedded in above grade concrete providing the outside diameter does not exceed 1/3 thickness of concrete slab, wall or beam, is located entirely within the center third of the member and lateral spacing of conduit is not less than 3 diameters.
- E. Conduit in Ground: PVC schedule 40 non-metallic conduit may be utilized for all underground runs unless noted otherwise on the drawings. Installation and use of PVC shall comply with Article 347 of NEC. All conduit sizes, shown on the plans, shall be increased to accommodate the installation of the equipment grounding conductor. All joints shall be made with solvent cement per manufacturer's recommendations and shall be watertight. Plastic conduit runs stubbing up to above grade junction boxes or conduit runs shall be converted to PVC plastoid coated rigid steel conduit by installing a female adapter, 90-degree PVC coated rigid steel elbow and a PVC coated rigid steel nipple of length as required to stub conduit up. No plastic conduit shall be installed above grade. Plastic conduit shall be used for straight runs only. PVC coated rigid steel conduit shall be used for all bends, ells and offsets. Where rigid galvanized steel conduit is in contact with dirt, soil, fill or earth, conduits shall be field wrapped with one layer of 3M Scotch 50 plastic tape with a 50% overlap, including all joints or couplings, or shall be coated with a bonded, 20 mil minimum thickness PVC, permanently fused at the factory, Pittsburgh Standard Co. "PlastiBond," or approved equal. All fittings, couplings, ells, etc., used with PVC coated conduit shall have same factory applied PVC coating. An equipment grounding conductor, in accordance with NEC, shall be installed in all conduits. Minimum burial depth of conduits or ducts shall be as follows:

Power: Primary (above 600v.), 42"

Secondary (below 600v.), 36"

Telephone: 24"

- F. Conduit Bends: In any conduit or EMT run, the number of quarter bends or equivalent between termination's at cabinets or boxes shall not exceed four bends. Conduit runs between cabinets or boxes shall not exceed 200 feet for straight runs nor 100 feet for runs with maximum number of bends. Bends in telephone and data conduits shall be long sweeping bends.
- G. Conduit Openings: Protect all vertical runs of conduits or EMT terminating in the bottoms of boxes or cabinets, etc., from the entrance of foreign material prior to installation of conductors.
- H. Roof Penetrations: All roof penetrations shall be sealed as called for in the architectural plans and specifications.
- I. Pull Cords: The Contractor shall furnish and install a full length, 3/32" nylon pull cord in every "empty" conduit installed hereunder to facilitate the future installation of wires. Identify each terminus of pull wire with linen tags with complete information as to service and location of the terminus of the cord.
- J. Sealing Fittings: Install where required by the NEC, where conduits pass from warm to cold locations and where otherwise indicated.
- K. Sleeves for Conduit: Install sleeves for conduit where shown or as required. Conduit sleeves not used shall be plugged with recessed type plugs. Sleeve all conduit passing through walls. Sleeves that are used shall be caulked tight with lead yarn.
- L. Identification: Identify all exposed raceways according to the system carried. Identify exposed conduits 3/4 inch or larger in diameter by means of painted-on stencils, and conduits less than 3/4 inch in diameter with enameled-on metal tags. Provide legible lettering in contrasting colors. Abbreviate only when approved. Identification shall be placed at maximum intervals of twenty feet on straight conduit runs, close to all terminations, adjacent to all change in directions and where conduits pass through walls or floors. In general, use yellow color. Painting shall be in accordance with DIVISION 9 - FINISHES.

3.2 CONDUIT SUPPORTS

- A. Supports: Provide supports for horizontal conduits and EMT not more than 8 feet apart with not less than two supports for each 10-foot straight length and one support near each elbow or bend including runs above suspended ceilings and within 3 feet of all junction boxes, switches, fittings, etc.
- B. Straps: Install one hole pipe straps on conduits 1.5 inch or smaller. Install individual pipe hangers for conduits larger than 1.5 inch. Spring steel fasteners with hanger rods may be used in dry locations in lieu of pipe straps.
- C. Trapezes: Install multiple (trapeze) pipe hangers where two or more horizontal conduits or EMT run parallel and at the same elevation. Secure each conduit or EMT to the horizontal hanger member by a U-bolt, one hole strap or other specially designed and approved fastener.
- D. Hanger Rods: Install 1/4-inch diameter or larger galvanized steel rods for trapezes, spring steel fasteners, clips, and clamps. Wire or perforated strapping shall not be used for the support of any conduit or EMT.
- E. Fastening: Fasten pipe straps and hanger rods to concrete by means of inserts or expansion bolts to brickwork by means of expansion bolts and to hollow masonry by means of toggle bolts. Wooden plugs and shield shall not be used. Power driven fasteners may be used to attach pipe straps and hanger rods to concrete only where approved by the Engineer.
- F. All conduits not embedded in concrete shall be firmly secured by means of pipe clamps, hangers, etc., equal to Caddy fasteners of ERICO Products, Inc. Wire wrapped around conduits and supporting members will not be accepted.
- G. On Roof: All conduits laid on roof shall be supported on 4" redwood blocks, mopped into roof and spaced at 5'-0" on center.

- H. Lay-in Ceiling: Conduits routed above acoustical "lay-in" ceilings shall be anchored to the building structure and not laid on the ceiling. Wire shall not be used to anchor boxes to structure. If ceiling support system is adequate, one 3/4" maximum conduit may be supported by a Caddy Clip to hanger wire. Multiple runs of conduit shall be racked on trapeze hanger. All support materials shall be rustproof. Perforated tape or soft iron wire shall not be used.

3.3 CONDUIT STUB-UPS

- A. Conduits run under floor shall be stubbed up to a coupling set flush with floor. This excludes conduits stubbed up in walls and feeder conduits. Install flush plug until after floor is finished, then complete connections to boxes or equipment.

3.4 OUTLET BOXES

- A. Outlet Boxes: Outlet boxes, covers and fittings, according to the particular use for which they are required, shall be provided in the locations marked on the drawings by symbols, and/or for use to facilitate the installation of the electrical systems. When necessary, outlets shall be relocated so that when fixtures of other fittings are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment required by the drawings and/or specifications.
- B. Installation: Unless otherwise specified or shown on the drawings, outlet boxes shall be flush mounted and the front edges of the boxes or plaster covers shall be flush with the finished wall or ceiling line or if installed in walls and ceilings of incombustible construction, not more than 1/4 inch back of same. Mount boxes with the long axes of devices vertical, unless otherwise specified. Boxes in plastered walls and ceilings shall be provided with plastic covers. A multiple of box extensions and/or covers will not be permitted. Install in a rigid and satisfactory manner with suitable metal bar hangers, box cleats, adjustable box hangers, etc. Use wood screws on wood, expansion shields on masonry and machine screws on steel work.
- C. Mounting Heights: The mounting height of a wall mounted outlet box shall be construed to mean the height from the finished floor to the horizontal center line of the cover plate. On exposed tile, block or brick construction, mount outlet boxes at the nearest bed joint to the mounting height indicated. Wall Mounted Switch, Receptacle and Signal Outlets: On columns, pilasters, etc., mount so the centers of the columns are clear for future installation of partitions. Install outlet boxes near doors or windows close to trim. Install outlet boxes near the doors on the lock sides (see architectural drawings for correct door swings).
- D. Identification: Identify all exposed junction boxes according to the system carried by means of painted-on stencils or labels with legible letters and contrasting colors and without abbreviations. In general, use yellow color. Painting shall be in accordance with DIVISION 9 - FINISHES.

3.5 PULLBOXES

- A. Provide additional pullboxes wherever necessary to meet requirements for maximum length of conduit runs and maximum numbers of bends.

3.6 FLOOR BOXES

- A. Install level with top covers adjusted flush with finished floor or floor tile.

3.7 FIXTURE CONNECTIONS

- A. Recessed or surface light fixtures in lay-in or accessible ceilings shall be connected with minimum 1/2-inch flexible metallic conduit, 4 to 6 feet long with grounding provisions.

3.8 CLOSING OF OPENINGS

- A. Wherever slots, sleeves or other openings are provided in floors or walls for the passage of conduits or other forms of raceway, such openings, if unused, or the spaces left in such openings, shall be filled, or closed in an approved manner.

3.9 IDENTIFICATION

- A. Refer to Section 260500 - General Electrical Provisions for identification requirements for raceways and boxes.

END OF SECTION

26 0533

SECTION 26 0553**IDENTIFICATION FOR ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Underground warning tape.

1.2 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; National Fire Protection Association; Latest Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. NFPA 70E - Standard for Electrical Safety in the Workplace; latest edition.

1.3 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 - PRODUCTS**2.1 IDENTIFICATION REQUIREMENTS**

- A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchboards:
 - i) Identify voltage and phase.
 - ii) Identify power source and circuit number. Include location when not within sight of equipment.
 - iii) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Motor Control Centers:
 - i) Identify voltage and phase.
 - ii) Identify power source and circuit number. Include location when not within sight of equipment.
 - iii) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - c. Panelboards:
 - i) Identify voltage and phase.
 - ii) Identify power source and circuit number. Include location when not within sight of equipment.
 - iii) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.

- iv) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - d. Transformers:
 - i) Identify power source and circuit number. Include location when not within sight of equipment.
 - e. Enclosed switches, circuit breakers, and motor controllers:
 - i) Identify voltage and phase.
 - ii) Identify power source and circuit number. Include location when not within sight of equipment.
 - f. Busway:
 - i) Identify power source and circuit number. Include location when not within sight of equipment.
 - ii) Provide identification at maximum intervals of 40 feet (12 m).
 - iii) Use identification nameplate to identify load(s) served for each plug-in unit. Include location when not within sight of equipment.
 - g. Enclosed Contactors:
 - i) Identify voltage and phase.
 - ii) Identify load(s) and associated circuits controlled. Include location.
 - h. Transfer Switches:
 - i) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
 - ii) Identify load(s) served. Include location when not within sight of equipment.
- 2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
 - c. Use identification nameplate at each piece of service equipment to identify the available fault current and the date calculations were performed.
- 3. Emergency System Equipment:
 - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
 - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
- 4. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
- 5. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
 - a. Minimum Size: 3.5 by 5 inches.
 - b. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash hazard study performed in accordance with Section 26 0573:
 - i) Include orange header that reads "WARNING" where calculated incident energy is less than 40 calories per square cm.
 - ii) Include red header that reads "DANGER" where calculated incident energy is 40 calories per square cm or greater.
 - iii) Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or

approved equivalent.

C. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less as follows:

- a. The phasing of all conductors (#8 and larger) shall be identified by color coding tape. Conductors sizes #10 and smaller shall have colored insulation. The grounded (neutral) conductor sizes #6 and smaller shall be white or light gray or have 3 continuous white stripes on other than green insulation. Grounded (neutral) conductors larger than size #6 shall be color coded white with coding tape. Grounding conductors sizes #6 and smaller shall have green insulation or be bare the entire length. Grounding conductors larger than size #6 shall be color coded green with coding tape.

- 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises have feeders or branch circuits served by more than one nominal voltage system.

D. Identification for Boxes:

- 1. Use voltage markers to identify highest voltage present.
- 2. Use voltage markers or color coded boxes to identify systems other than normal power system.
 - a. Color-Coded Boxes: Field-painted in accordance with Section 09 9000 per the same color code used for raceways.
 - i) Fire Alarm System: Red.

E. Buried Electrical Lines: Underground warning tapes.

F. Communication Cabinets: Nameplates.

G. Control Device Station: Labels.

H. Electrical Distribution and Control Equipment Enclosures: Nameplates.

I. Junction Box Load Connections: Wire markers.

2.2 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Seton Identification Products: www.seton.com/aec.

C. HellermannTyton: www.hellermannntyton.com.

2.3 IDENTIFICATION NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, black letters on white background, unless indicated otherwise for nameplates for Essential Power System equipment.

- 1. Engraving stock shall be melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
- 2. Nameplates and labels shall have punched or drilled holes for mechanical fasteners.
- 3. Nameplates and labels shall be fastened using self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts with flat and lock washers.

B. Locations:

- 1. Each electrical distribution (switchboards, distribution panels and panelboards) and control equipment enclosure.
- 2. Communication cabinets.
- 3. All special systems cabinets.

- C. Letter Size:
 - 1. Use 1/8 inch letters for identifying individual equipment and loads.
 - 2. Use 1/4 inch letters for identifying grouped equipment and loads.
- D. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations, and identified specialized power devices.

2.4 WIRE AND CABLE MARKERS

- A. Manufacturers:
 - 1. Brady Corporation: www.bradyid.com.
 - 2. Seton Identification Products: www.seton.com.
 - 3. HellermannTyton: www.hellermannntyton.com.
- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch.
- F. Color: Black text on white background unless otherwise indicated.
- G. Description: Vinyl cloth type self-adhesive wire markers.
- H. Locations: Each conductor at panelboard gutters, pull boxes, and junction boxes each load connection.

2.5 UNDERGROUND WARNING TAPE

- A. Manufacturers:
 - 1. Brady Corporation: www.bradyid.com.
 - 2. Seton Identification Products: www.seton.com.
 - 3. HellermannTyton: www.hellermannntyton.com.
- B. 4" Polyethylene tape, Foil-backed Detectable Type Colored Red Tape: 4" inches wide, with minimum thickness of 4 mil, with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.2 INSTALLATION

- A. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker.
- B. Install line marker for underground wiring, both direct buried cables and cables in raceway.
- C. Paint fire alarm junction boxes red.
- D. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other

designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout.

- E. Electrical Gear and Equipment Identification Labels: Engraved plastic laminate shall be installed on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch-high lettering on 1-1/2-inch-high label. Where two lines of text are required, use labels that are 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of electrical gear and equipment using mechanical fasteners:
1. Interior and exterior of switchgear, switchboards, distribution panelboards, panelboards, motor control centers, electrical cabinets, enclosures, and other equipment.
 - a. Main Overcurrent Protection: Identify main device and service disconnects.
 - b. Switchboards and Switchgear: Identify equipment, label main and distribution overcurrent protection showing load served and location (identify room numbers, where possible).
 - c. Distribution Panelboards: Identify Distribution Panelboard designation and circuit serving distribution panelboard. Label main and distribution overcurrent protection showing load served and location (identify room numbers, where possible).
 - d. Branch Panelboards: Identify distribution panel and circuit serving panelboard.
 - e. Motor Control Centers: Identify equipment designation, voltage, phases, and full-load current capacity. Label main and distribution overcurrent protection.
 - f. Disconnect Switches: Identify equipment designation, voltage and horsepower rating or full-load current capacity.
 - g. Enclosed Circuit Breakers: Identify equipment designation, voltage, and full-load current capacity.
 - h. Motor Starters: Identify equipment designation, voltage and horsepower rating or full-load current capacity.
 - i. Power Transfer Equipment (Manual and Automatic): Identify equipment designation, power sources, voltage, and full-load current capacity.
 2. Identification Labels for Other Electrical Equipment: Engraved plastic laminate shall be installed on each unit of equipment. Unless otherwise indicated, provide a single line of text with 1/2-inch-high lettering on 1-1/2-inch-high label. Where two lines of text are required, use labels that are 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of electrical gear and equipment using mechanical fasteners:
 - a. Transformers.
 - b. Frequency converters.
 - c. Power inverters.
 - d. Lighting contactors.
 - e. Push-button stations and other control stations or devices.
 - f. Telephone switching equipment.
 - g. Battery racks.
 - h. Power-generating units.
 - i. Nurse call system master station.
 - j. Paging system master station.
 - k. TV/audio-monitoring master station.
 - l. Fire alarm system master station or control panel.
 - m. Fire alarm system extender or battery panel.
 - n. Security-monitoring master station or control panel.
 - o. Master clock or program equipment.
- F. Provide framed, typed circuit schedules for all panelboards with explicit description and identification of items controlled by each individual circuit breaker.
1. Existing Panelboards: Identify existing circuits as well as new circuits with new, typed circuit schedules.

- a. 208 Volt System: Black
 - b. Other Special Systems: Yellow.
- G. Circuit Identification Labels: Provide external labels for all installed device face covers and junction boxes prior to installation of conductors. Circuit identification shall be as shown below.
 - 1. Labeling Legend for Junction Boxes: Provide permanent, waterproof label listing panel and circuit number.
 - 2. Circuit Identification Labels on Cover or Face Plates: Install labels externally for all installed wiring device plates indicating panel and circuit number.
 - a. Clear preprinted adhesive labels.
- H. Color-Coding for Secondary Phase Conductors: Color code switch legs, travelers, and other wiring for branch circuits other than those listed below. Permanently post color code at each branch panelboard. Use the following colors for service, feeder, and branch-circuit phase conductors: (Ref: NEC # 210.4, 200.6, 250.119.)
 - 1. 208/120-Volt, 3-Phase System Conductors:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral (Common): White.
 - e. Ground (Earth): Green.
 - 2. 480/277-Volt, 3-Phase System Conductors:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - d. Neutral (Common): Gray.
 - e. Ground (Earth): Green.
- I. Circuits Operating at More Than 600 Volts: Identify raceway and cable with "DANGER--HIGH VOLTAGE" in black letters 2 inches high, stenciled with paint at 10-foot (3-m) intervals over a continuous, painted orange background. Identify the following:
 - 1. Entire floor area directly above conduits running beneath and within 12 inches of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to conduits concealed within wall.
 - 3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in the building, or concealed above suspended ceilings.
 - 4. Entire surface of exposed conduits.

END OF SECTION**26 0553**

SECTION 26 2416**PANELBOARDS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section

1.2 DESCRIPTION OF WORK

- A. Furnish and install complete, all panelboards.

1.3 RELATED WORK IN OTHER SECTIONS

- A. Cabinets; Motor & Circuit Disconnects; Fuses; Service and Distribution; Grounding; Conductors, Raceways, Boxes and Fittings.

1.4 SUBMITTALS

- A. Submit complete shop drawings with outline dimensions, descriptive literature and complete descriptions of the frame size, trip setting, class, and interrupting rating of all overcurrent devices. Identify available spaces. Complete description of physical layout of panelboards showing conformance with drawings.

PART 2 - PRODUCTS**2.1 GENERAL**

- A. Dead front, safety type, with voltage and amperage ratings as scheduled. Panelboards shall be of the type required for the short circuit and duty ratings indicated on the drawings or specified. All panelboards shall have a neutral bus and an insulated ground bus. Panelboards shall be as manufactured by General Electric, Cutler-Hammer or Square D and shall be as scheduled.

2.2 CABINETS

- A. Each panelboard shall be enclosed in a sheet metal cabinet with front doors, catches, locks, etc., as specified in Section 262716, Cabinets.
- B. Door-in-Door: Both surface and flush panels shall be door-in-door. The door over the interior of the panel shall be provided with hinges and combined lock and latch. The outside door over the panel gutters shall be provided with hinge(s) on one side and combined lock and latch. Machine screws into threaded holes in the panelboard cabinet, in lieu of combined lock and latch, to secure the outside door are not acceptable.

2.3 FUSIBLE PANELBOARD

- A. Fusible panelboards shall be factory assembled, each fused switch shall have an etched micarta nameplate secured by two cadmium plated screws. The panelboard shall have a neutral bus and a ground bus connected with a removable link.

General Electric	"QMR" up to 1200 amps
Square D	"QMB" up to 1200 amps
- B. Quick-make, quick-break fusible switch units to be of type with external operating handle suitable for padlocking in OFF position. Provide interlock to prevent opening cover when switch is in ON position unless interlock release is operated. Provide frame and fuse clip ratings as

indicated in the panelboard schedules. Switch and fuse holder shall be rated for 200,000-amp interrupting capacity. Fuse holders shall be provided with Class R rejection feature.

- C. Fuses shall be provided for all switches. Fuses for switches serving motors shall be Bussman Fusetrons, sized for heavy service motor running protection. Fuses for other services shall be as designated on the drawings. Proper fuse amp ratings shall be indicated on inside of switch cover, through the use of "Tapewriter" and should read "Use Fusetrons Only" (indicate amperage size as shown on plans).
- D. Space Only: Where "space only" is noted on the drawings, provide necessary connectors, mounting brackets, etc., for the future insertion of an overcurrent device. Spaces shall be sized 200 amps unless noted otherwise.

2.4 CIRCUIT BREAKER PANELBOARDS

- A. Panelboard interiors shall be constructed on pre-drilled and tapped channel rails. Main busses shall be pre-drilled and tapped to accommodate any combination of circuit breaker units without further modification. All panelboards shall be complete with doors. Units shall be complete with combination latch and cylinder locks. All locks shall be keyed alike. All bussing shall be of the "sequence type". All connections shall be bolted.
- B. Circuit breakers shall be molded case type (minimum 10,000-amp interrupting capacity, larger as required). All multi-pole breakers shall have a common trip and all breakers shall be interchangeable in any combination of poles with the same frame size. All branch circuit straps shall have the capacity of the maximum breaker size in the frame space (i.e., 100-amp strap for 100-amp frame). Minimum 100-amp straps will be accepted.
- C. All main and branch breakers shall be of the size and have the interrupting rating scheduled on the Drawings. All incoming and outgoing terminals shall have solderless lugs. Provide, where required, lug landing to accommodate number and size conductors shown on the Power Riser. Panelboards shall be factory assembled.
- D. Single pole circuit breakers shall be suitable for switching duty and marked "SWD".
- E. Bolted Type: Circuit breaker current carrying connections to the bus shall be of the bolted type, factory assembled. Stab in type not permitted. Provide bus bars for three phase panelboards of the sequence phased type connection and arranged for 3 phase, 4 wire mains, unless otherwise indicated on the drawings.
- F. Space Only: Where "space only" is noted on the drawings, provide necessary connectors, mounting brackets, etc., for the future insertion of an overcurrent device. Provide blank cover for each space.
- G. Directories: Provide typewritten circuit descriptions referencing permanent room numbering assigned in lieu of the room numbering shown on the drawings.
- H. Spare Conduit: Provide three spare 1" conduits for each panel. Extend empty conduit with pullwire into accessible ceiling space and stub-out for future use.

2.5 NAMEPLATE

- A. Labels for identifying the breakers shall be engraved laminated plastic strips attached by screws (see "Nameplates" Specifications in Section 260500) or labels supplied by Panel Manufacturer.
- B. Nameplates on Panelboards shall give voltage characteristics phase and number of wires. Example: Panel A, 120/208V, 3-phase, 4W.
- C. Individual circuit breakers or switches, panelboards, disconnect means and motor starters shall have nameplate showing the load served.
- D. Blank name plates shall be mounted on each "spare" unit or on "space" in distribution panels.

2.6 SKIRTS

- A. Where noted on the drawings, panelboards shall be skirted with complete metal enclosures and barriers separating the panel interior.

2.7 BUS BARS

- A. All bus bars shall be copper. Use of aluminum bus bars will not be permitted.

2.8 CONNECTORS AND LUGS

- A. Contractor shall review one-line and other Drawings to assure that proper lugs are provided in termination equipment such as switches, panels, switchboards, mechanical equipment, etc. Due to voltage drop conductor sizes and/or numbers may not be accommodated by the equipment affected. If manufacturer cannot provide the proper number and size of lugs within their equipment the Contractor shall provide enclosures and properly sized terminals to convert the oversized cable, number and size that is compatible to the equipment affected.

PART 3 - EXECUTION**3.1 PANELBOARDS**

- A. Panelboards shall be located where indicated on the drawings. Panelboards shall have neatly typed circuit directories behind clear plastic. Identify circuits by area designations and use. "Spare" and "Space" shall be indicated with erasable pencil, not typed.
- B. Circuiting of all branch circuits shall be as designated on the drawings. Breaker and switch arrangement in panels shall be exactly as specified and all circuits will terminate in the positions indicated.

3.2 PHASE ROTATION

- A. Phase A, left bus; phase B, center bus; phase C, right bus (front viewing).

END OF SECTION

26 2416

SECTION 26 2726**WIRING DEVICES AND PLATES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions for the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Furnish and install all wiring devices and plates as required for the complete installation and operation of all systems throughout the project.

1.3 RELATED WORK IN OTHER SECTIONS

- A. Conductors, Conduit, Boxes and Fittings.

PART 2 - PRODUCTS**2.1 WALL SWITCHES**

- A. Unless otherwise specified, each wall switch (flush tumbler-toggle) shall be of the A.C. General use type for mounting in a single gang spacing, fully rated 20 amperes minimum at 120/277 volts, conforming to minimum requirements of the latest revision of the Underwriter's Laboratories, Inc., UL 20 Fifth Edition Standard Snap Switches, and further requirements herein specified. Specification grade, heavy duty, single pole, 3-way or 4-way, of the maintained, momentary or lock type as indicated on the drawings. Switches shall operate in any position and shall be fully enclosed cup type with entire body of molded phenolic, urea or melamine with cover of molded phenolic, urea or melamine. Fiber, paper, or similar insulating material shall not be used for body or cover. Ivory color handles unless otherwise indicated. Silver or silver alloy contacts. A.C. 120/277-volt general use snap switches shall be capable of withstanding tests as outlined in NEMA Publications and shall be as follows unless otherwise noted:

Switch	Hubbell	P & S	Bryant	Leviton
1P	1221-I	20-AC-1-I	4901-I	1221-I
2P	1222-1	20-AC-2-I	4902-I	1222-I
3-Way	1223-I	20-AC-3-I	4903-I	1223-I
4-Way	1224-I	20-AC-4-I	4904-I	1224-I
3-pos. 2 cct maintained	1385-I	1225-I	4922-I	
3-pos. 2 cct momentary	1557-I	1251-I	4921-I	
Lighted handle pilot lgt.	1221-PL	2251-SP	4901-PL	1220-PL

2.2 RECEPTACLES

- A. General: Configuration and requirements for all connector or outlet receptacles shall be in accordance with NEMA Publications. Fire resistant, non absorptive, hot welded, phenolic composition or equal bodies and bases with metal plaster ears (integral with the supporting member). Single or duplex as shown or noted on drawings. Ivory color unless otherwise noted on the drawings. Double grip contacts for each prong.

- B. Grounding Type: All receptacles shall be grounding type with a green colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper (based on Table 250-95 of the NEC with minimum size No. 14 AWG). Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke. Unless otherwise noted, receptacles shall be as follows:

Receptacle	Hubbell	P & S	Bryant
20A-125V AC 2P 3W	5362-I	6300-I	5362-I
20A-208V AC 4P 4W	7250	7250	7250
30A-250V AC 3P 3W	9350	L1030R	9303
30A-600V AC 4P 4W	3430	3430	3430
Special	Receptacles for special applications shall be as indicated on the drawings.		

- C. Load Controllable Type:
1. Meet all aspects already detailed in specifications.
 2. Permanent controlled markings on face of receptacle compliant with ASHRAE 90.1, CA Title 24, and NEC.
 3. Half-controlled versions include welded, pre-wired lead that control top half of receptacle for split circuit applications.
 4. Refer to plans for specific model and control options.

2.3 PLUG CAPS

- A. Except for duplex receptacles, and cleaning combination receptacles one matching plug cap shall be provided for each receptacle. No plug caps are required for duplex receptacles. Provide watertight, male plug caps in damp locations or where exposed to weather.

2.4 DEVICE PLATES

- A. General: Provide plates for each switch, receptacle, signal and telephone outlet and special purpose outlet. Do not use sectional gang plates. Provide multi gang outlet plates for multi gang boxes. All plates on finished walls shall be Leviton #84000-40 series, stainless steel. Screws shall be of metal with countersunk heads with finish to match the finish of the plate. Device plates shall be of the one-piece type, of suitable shape for the device to be covered.
- B. Exposed: Plates for exposed screw jointed fittings shall match the fittings with edges of plates flush with edges of fittings. To be heavy cadmium plates, steel, with gasket. Plates for cast type boxes at locations subject to wet or rain conditions, shall be of the cast, vapor tight type. Provide hinged lift covers for devices.
- C. Communications: Plates for telephone and signal outlets shall each have a 3/8-inch bushed opening in the center. Wall plates for push button and buzzer outlets shall have openings to suit the push buttons and buzzers.
- D. Plates for special purpose outlets shall be of a design suitable for the particular application.

2.5 CLOCK OUTLETS

- A. Flush, single receptacle, regressed in stainless steel device plat.

2.6 REMOTELY CONTROLLED SWITCHES OR RELAYS

- A. Electro-magnetically operated, mechanically held with clearing contacts for maintained contact control unless otherwise required. Rugged construction conforming to NEMA and IEEE test standards for industrial type power relays and the requirements of UL 508, Standards for Safety Industrial Control Equipment. Ratings as indicated on the drawings suitable for the application. Contacts shall be double break renewable, solid wiping type, silver-to-silver Tungsten alloy, self-aligning, quick-make, quick-break, with a minimum inductive load rating of 20 amps. Relays

shall be as manufactured by Allen-Bradley, Cutler-Hammer, General Electric, Square D or Westinghouse, equal to Allen-Bradley Bulletin 700 Control Relays. Provide sound deadening mounting and enclosure.

2.7 MOMENTARY CONTACT SWITCHES

- A. Tumbler type single pole double throw momentary contact for 3 wire circuit, with Off position when tumbler handle is in the center, similar in appearance to the conventional snap switch. Handle or key operated as indicated on drawings. 15 ampere at 120/277 volts for control of 30, 60, or 100 ampere remotely controlled switches or relays rated 101 amperes and above. Provide nameplate to identify the circuit or equipment controlled.

PART 3 - EXECUTION

3.1 OUTLET LOCATIONS

- A. Shall be as indicated on the drawings. Align devices and plates horizontally and vertically.
- B. It shall be the responsibility of the Contractor to determine from the architectural drawings and by actual determination on the site, the exact location of each and every outlet. The outlet locations shall be modified from those shown on the plans to accommodate changes in door swings or to clear other interferences that may arise from job construction details as well as modifications within room spaces. These modifications shall be made with no change in contract price and shall be a matter of job coordination at the expense of the Contractor. The Contractor shall check these conditions throughout the entire job and shall notify the Architect/Engineer of discrepancies as they occur before proceeding with the installation of the work to verify the modifications, if any. Wall boxes shall be set in advance of wall construction, shall be blocked in place and secured. All wall boxes shall be set flush with finished building construction and the Contractor shall furnish and install extension sleeves as required to extend boxes to the finished surfaces of special furring. No switches shall be located behind doors without specific written authorization by the Architect.

3.2 YOKES

- A. Wiring device yokes shall be installed in physical contact with the plaster ring. Where the above contact cannot be obtained, a green covered bonding conductor shall be installed.

3.3 PLATES

- A. Shall be installed with all four edges in continuous contact with finished wall surface without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed vertically and with an alignment tolerance of 1/16".
- B. Device cover plates for each and every device shall be furnished and installed by this Contractor.

3.4 RECEPTACLES

- A. Shall have a separate ground wire from the grounding screw to a grounding stud in the outlet box. All receptacles shall be installed with the "U" slot in the upper position. Substitutions for duplex convenience outlets as listed in 16140 - 2.2 shall only be considered if rated as "Specification Grade".

END OF SECTION

26 2726

SECTION 26 5119**LED INTERIOR LIGHTING****PART 1 - GENERAL****1.1 Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.****1.2 RELATED WORK IN OTHER SECTIONS**

260500	GENERAL ELECTRICAL PROVISIONS
260519	LOW VOLTAGE CONDUCTORS
260526	GROUNDING
260533	RACEWAYS, BOXES, AND FITTINGS
262726	WIRING DEVICES AND PLATES

1.3 SECTION INCLUDES:

- A. Interior solid-state luminaires that use LED technology.
- B. Lighting fixture supports.
- C. Construction and installation requirements.

1.4 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire".
- D. IP: International Protection of Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.5 SUBMITTALS

- A. Product Data: For each type of product, arranged by designation.
- B. Product Schedule: For luminaires and lamps. Use same designation indicated on Drawings.
- C. Refer to Section 260500 for additional requirements.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Product Certificates: For each type of luminaire.
- C. Sample warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.8 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Recessed Fixtures: Comply with NEMA LE 4.
- C. CRI and CCT shall be as scheduled on contract documents.
- D. Rated life of 50,000 hours.
- E. Dimmable from 100 percent to 10 percent of maximum light output.
- F. Internal driver.
- G. Nominal Operating Voltage: as specified on the drawings.
- H. Housings:
 - 1. Extruded-aluminum housing and heat sink.
 - 2. Clear powder-coat finish.
 - 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.2 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
 - 1. Prismatic acrylic.
 - 2. Acrylic: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 3. Lens thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Housings:
 - 1. Extruded-aluminum housing and heat sink.
 - 2. Clear powder-coat finish.

2.3 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

- B. Single-Stem Hangers: ½-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports: Sized and rated for luminaire weight.
- E. Flush-Mounted Luminaire Support: Secured to outlet box.
- F. Ceiling-Mounted Luminaire Support:
 - 1. Ceiling mount with two 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length. Brace to limit sway or swinging.
- G. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging or sway.
 - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
- L. Comply with requirements in Division 26 for Power Conductors and Cables for wiring connections.
- J. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 for Identification for Electrical Systems.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare Test and inspection reports.

END OF SECTION

26 5119

SECTION 26 6000**MECHANICAL AND ELECTRICAL COORDINATION SCHEDULE****PART 1 - GENERAL****1.1 REQUIREMENTS:**

- A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.
- B. It is the responsibility of the Contractor to carefully coordinate all trades to provide a complete and operational system that conforms to the contract documents.

1.2 DEFINITIONS

- A. "Furnished by" shall mean that the materials, equipment, wiring, etc. shall be provided to the project by the noted contractor unless specifically noted otherwise in the contract documents.
- B. "Install by" shall mean that the materials, equipment, wiring, labor, etc. shall be installed (mounted in field) at coordinated locations for complete system and shall be completed by the noted contractor unless specifically noted otherwise in the contract documents.
- C. "Control wiring" shall mean that the controls wiring including all supports connections, etc. shall be installed complete by Contractor noted unless specifically noted otherwise in the contract documents.
- D. "Power wiring" shall mean that the power wiring including all supports connections, etc. shall be installed complete by the Contractor noted unless specifically noted otherwise in the contract documents.
- E. "Connected by" shall mean that all required materials and labor shall be provided to and for the complete installation of all devices and equipment and shall be completed by the noted contractor unless specifically noted otherwise on the contract documents.

- 1.3 SCOPE:** Make all connections to motors and controls for equipment furnished and/or installed under Mechanical and Electrical Specifications according to the following schedule unless otherwise noted on the contract documents:

Item	Furnished By	Installed By	Control Wiring By	Power Wiring By	Connected By
Fire/Smoke Dampers	Div. 23	Div. 23			
Fire/Smoke Dampers Linkages	Div. 23	Div. 23			
Fire/Smoke Dampers Actuators/Smoke Detectors	Div. 23	Div. 23	Div. 28 (d)	Div. 28 (e)	Div. 28 (d)
Item	Furnished By	Installed By	Control Wiring By	Power Wiring By	Connected By
Fire Alarm Panel and Interfacing with A/C Systems	Div. 28 (d)	Div. 28 (d)	Div. 28 (d)	Div. 26 (d)	Div. 28 (d)
Hydronic Valves	Div. 25	Div. 25			
Hydronic Valves Actuators	Div. 25	Div. 25	Div. 25	Div. 26(e)	Div. 25
Flow Control Regulators	Div. 25	Div. 25	Div. 25	Div. 26(e)	Div. 25
Pneumatic Valve	Div. 25	Div. 25			
Duct Smoke Detectors	Div. 25	Div. 25	Div. 28 (d)	Div. 26 (d)	Div. 28 (d)

Pneumatic Valve Actuators	Div. 25	Div. 25			Div. 25
Pneumatic Thermostats	Div. 25	Div. 25			Div. 25
Pneumatic Tubing Runs	Div. 25	Div. 25			Div. 25
Pneumatic Terminal Controls	Div. 25	Div. 25			Div. 25
Pneumatic Zone Control Panels	Div. 25	Div. 25			Div. 25
PE & EP Switches	Div. 25	Div. 25	Div. 25	Div. 25	Div. 25
Volume Control Dampers	Div. 23	Div. 23			
Volume Control Dampers Linkages	Div. 23	Div. 23			
Volume Control Dampers Actuators	Div. 23	Div. 23	Div. 23		Div. 23
120V Thermostat Backboxes & Wall Conduit	Div. 26	Div. 26			
DDC Electronic Thermostats	Div. 25	Div. 25	Div. 25		Div. 25
DDC Terminal Controls	Div. 25	Div. 25	Div. 25	Div. 26 (b)	Div. 25
DDC Zone Control Panels	Div. 25	Div. 25	Div. 25	Div. 26 (b)	Div. 25
DDC Backboxes and Cabinets	Div. 25	Div. 16			
Non-DDC Control Relays	Div. 25	Div. 25	Div. 26	Div. 25	Div. 25
Non-DDC Thermostats, Time	Div. 25	Div. 25	Div. 26	Div. 25	Div. 25
Non-DDC Control Transformers	Div. 25	Div. 25	Div. 25	Div. 26 (e)	Div. 25
HVAC Instrumentation (electronic temperature sensors, etc.)	Div. 25	Div. 25	Div. 25	Div. 26 (e)	Div. 25
Equipment Motors	Div. 23	Div. 23	Div. 26	Div. 26	Div. 26
Motor Control Centers with Starters, Overload Heaters, H-O-A Switches, Pilot Lights, Push Buttons, etc.	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Motor Starters & Overload Heaters Outside Motor Control Centers	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Fused & Unfused Disconnect Switches Thermal Overload & Heaters	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Manual Operating & Multispeed Switches (Low Voltage – Less than Line Voltage)	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Pushbutton Stations & Pilot Lights	Div. 26	Div. 26	Div. 25	Div. 26	Div. 26
Fire Protection Sprinkler System Control Supervisory Panels and Devices O.S.O.&Y. Switch, Flow Switch	Div. 21	Div. 21	Div. 28 (d)	Div. 26	Div. 28 (d)
Heat Taping for Mechanical Systems	Div. 23	Div. 23	Div. 23	Div. 26 (e)	Div. 26 (e)
Variable Frequency Drives	Div. 23	Div. 26	Div. 23	Div. 26	Div. 26
Heat Tape for Roof drains or Gutters	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26

Table Notes:

- a. Unless specified to be furnished under Division 25 by the equipment supplier.
- b. A dedicated isolated power circuit to Direct Digital Controls (DDC) Central Control Station shall be furnished and installed under Division 26.
- c. Smoke damper EP's and pneumatic actuators shall be wired into the fire alarm system Division 28.
- d. Performed by the Fire Alarm Sub-Contractor Division 28
- e. 120V connections by Div. 26

1.4 SUBSTITUTIONS: If the substitution of equipment, devices, or systems furnished under this Division result in changes to the Contract Drawings, Specifications and/or changes to the installation requirements, the complete responsibility and costs shall be assigned to the section of these Specifications under which the equipment is furnished with no additional costs to the Owner.

- 1.5 SUBMITTALS:** In conjunction with the temperature control, Fire Extinguishing System, and DDC submittals, complete submittal data for each individual Electrically operated or Electrically controlled item of equipment or device furnished under this Division of these Specifications shall include Electrical wiring diagrams and elementary control diagrams (ladder form) showing all internal and external wiring connections and services and shall clearly indicate field wiring furnished and installed under Division 25, differentiated from field wiring furnished and installed under Division 26. The submittal data shall itemize all Electrical characteristics that are of a special nature or critical to the Electrical installation or control system. Such equipment and devices will not be considered for approval until these requirements are met. All submittal data shall be reviewed and approved by the General Contractor, Mechanical, Electrical and Controls Sub-Contractors prior to submission of the complete Temperature Control, Fire Extinguishing System and DDC submittal to the Architect. The submittals shall indicate all components that are to be wired into the control power circuit by the Electrical Sub-Contractor, with all terminals for external connections of the components identified and labeled to correspond to the manufacturer's designations. Internal or factory installed wiring of package-type components need not be shown. The Shop Drawings for the system to be installed by the Temperature Controls, Fire Extinguishing System and DDC Sub-Contractors shall be prepared as complete submittals including all wiring requirements as described herein. Color coding designations shall be indicated for the control power circuit wiring.

PART 2 - PRODUCTS

- 2.1 REQUIREMENTS:** The materials, equipment, and devices related to the Electrical System controls are specified under other sections of these Specifications.

PART 3 - EXECUTION

3.1 CHANGES DURING CONSTRUCTION

- A. The complete responsibility and costs for revision during construction arising as a result of equipment substitutions, and any resultant changes to the installation requirements, shall be assigned to the respective section of these Specifications, under which the equipment is furnished at no additional costs to the Owner.
- B. In the event of conflict in the delineation of responsibilities for the furnishing and installation of items of Mechanical equipment and the associated control and interlock wiring between Division 26, Division 25 shall provide all required material, labor, etc., to complete the work as shown in the contract documents.

- 3.2 INSTALLATION:** No control work shall be performed until the reviewed and marked submittal data have been reissued to the Contractor, unless written permission is obtained from the Architect.

END OF SECTION

26 6000

Division Twenty Seven
COMMUNICATIONS

SECTION 27 0000**COMMUNICATIONS INDEX****PART 1 - GENERAL****1.1 GENERAL REQUIREMENTS**

- A. All bids shall be based on the equipment as specified herein. The specifying authority must approve any alternate system.
- B. Bidders wishing to submit alternate equipment shall submit to the specifying authority, at least 10 days prior to bid opening, the equipment proposed to provide a precise functional equivalent system to meet specifications. Bidder shall provide adequate information prior to bid date such as specification sheets, working drawings, shop drawings, and a demonstration of the system. Alternate supplier-contractor must also provide a list to include six installations of the identical system proposed which have been in operation for a period of two years.
- C. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate system at the contractor's expense.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this Section:
 - 1. Basic Electrical Requirements.
 - 2. Basic Electrical Materials and Methods.

1.3 COMMUNICATIONS DIVISION INDEX

270500	COMMON WORK RESULTS FOR COMMUNICATIONS
270526	GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
270528.1	PATHWAYS FOR COMMUNICATIONS SYSTEMS
270528.2	PATHWAYS
270553	IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
270800	COMMISSIONING AND ACCEPTANCE
271116	CABINETS, RACKS, FRAMES, AND ENCLOSURES
271119	TERMINATIONS BLOCKS AND PATCH PANELS
271323	FIBER OPTIC BACKBONE CABLING
271413	COPPER RISER AND INTRABUILDING CABLING
271523.1	FIBER OPTIC CABLE
271523.2	FIBER OPTIC HORIZONTAL CABLING
271543	FACEPLATES AND CONNECTORS
272133	DATA COMMUNICATIONS WIRELESS ACCESS POINTS

END OF SECTION**27 0000**

SECTION 27 0500**COMMON WORK RESULTS FOR COMMUNICATIONS****PART 1 - GENERAL**

- A. The Contractor is held responsible to be familiar with the provisions of all contract division contained herein and with other Sections of these Specifications as applicable to the completion of the installation of all communication systems as indicated in the contract documents. The Contractor is held responsible to be familiar with the requirements contained herein and shall possess the knowledge, manpower, and material applied to the completion of the installation.
- B. This section describes the installation locations for the products and materials, as well as methods and specification standards associated with the Information Technologies installation portions of the project. These specifications, along with the drawings shall be followed during the construction and installation of all Division 22 systems.
- C. The contractor is required to be currently listed as a registered Manufacturer Certified Installer and Warranty Provider of the products to be installed.
- D. Contractors shall provide all labor personnel for cabling and infrastructure installations who are trained and certified by the manufacturer in the installation of the submitted products, and requirements of this document.

1.1 SCOPE OF WORK

- A. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the construction, installation, termination, testing, and labeling of all information technology infrastructure as described on the drawings and/or required by these specifications.
- B. The Contractor is required to be knowledgeable in all of the related sections contained within the specifications standards to ensure that common work results are achieved.
- C. In addition to the installation and construction requirements of these documents, all project-related design and construction shall meet the requirements of the contract documents.

1.2 RELATED SECTIONS

DIVISION 26 ELECTRICAL
DIVISION 27 COMMUNICATIONS

1.3 INTENT OF DRAWINGS AND SPECIFICATIONS

- A. These Specifications and Drawings shall depict the Information Technology infrastructure and cabling requirements for installation. Contractors shall furnish labor and material shown and/or called for on the Drawing but not mentioned in the Specifications, or vise/versa, that are necessary for the installation and support of communications cabling whether or not specifically called for in both documents. In addition, the Contractor shall provide incidental equipment and material required for the completion of systems included in this contract whether or not specified or shown on the drawings.

1.4 DEFINITIONS

- A. **Approved/Approval:** Written permission to use a material, installation method, or system agreed upon by the Engineer and Architect.
- B. **Air Blown Fiber: - ABF:** Fiber Optic Cable designed to be installed in a Micro Duct system with air pressure.

- C. **Bonding Conductor - BC:** An insulated copper conductor that bonds the Telecommunications Main Grounding Busbar to the Service Equipment (power) Ground.
- D. **Backbone:** A facility (e.g., pathway, cable, or conductors) between telecommunications rooms, or floor distribution terminals, the entrance facilities, and equipment rooms, within or between buildings.
- E. **Backbone Cabling:** Cabling and connections hardware that provides interconnections between telecommunications rooms, equipment rooms, and entrance facilities.
- F. **Building Distribution Frame – BDF:** The BDF is designated as the point where the outside plant cable terminates on the building entrance terminal (first-level backbone). These Building entrance terminals include provisions for optical fiber/twisted-pair cabling coming from the campus telephone switch facility where the Main Distribution Frame (MDF) is located.
- G. **Connector (Jack):** A female telecommunications connection that may be keyed or unkeyed and may have 2 to 8 contacts connections that may be positioned, but not all the positions need to be equipped with contacts. Jacks are typically used to terminate cable at the endpoint and are inserted into faceplates to create a connection point for the user's equipment cord.
- H. **Electromagnetic Interference – EMI:** Radiated or conducted electromagnetic energy that has an undesirable effect on electronic equipment of signal transmission.
- I. **Equipment Room – ER:** An environmentally controlled centralized space for telecommunications that houses a main or intermediate cross-connect. An ER can contain equipment to support all of the following: (BDF) entrance protection, cable infrastructure pathway, data, and voice services, PBX, demarcation point, wireless, paging, fire/smoke detection, security alarm systems, radio, area of rescue assistance equipment, CATV and video conference.
- J. **Furnish:** Supply and deliver installed in the approved designated area.
- K. **Horizontal Cabling:** The cabling between and including the work area telecommunications outlet connector and the horizontal cross-connect/patch panels in the telecommunications room. This is a typical Category 6, 6A, 4 pair cable, but can also include multiple fiber cables for the desktop, coaxial cables, and other multi-media types of cables that provide service to end-user equipment.
- L. **Install:** Mount and connect equipment and associated materials ready for use.
- M. **Intermediate Distribution Frame – IDF:** A frame, rack, or termination block that connects to the BDF with copper optical fiber riser cables and distributes horizontal wiring to rooms (Second Level). In some situations, a BDF may serve this function.
- N. **Inter Building Cable Plant:** Outside plant cable or infrastructure connecting two or more buildings for distribution of telephone, data, video, and control signals.
- O. **Intra-Building Cable Plant:** Inside cabling or infrastructure within a building for the distribution of telephone, data, video, coaxial, and control signals.
- P. **Multi Duct - MD:** Multiple small ducts typically 8mm OD by 6.5 mm ID within an outer duct used for air blow fiber made by Dura-Line. Materials are made to match NEC Code requirements.
- Q. **Outside Plant:** Telecommunications infrastructure designed installation exterior to buildings.
- R. **Power Over Ethernet – POE:** POE or "Active Ethernet" eliminates the need to run 110/120 VAC power to a Wireless Access Point and other devices on a wired LAN. Using POE systems installers need to run only a single Communications cable capable to handle the power requirements of the network device, both data and power are carried on the cable. This allows greater flexibility in locating the WAPs and network devices and significantly decreases installation costs in many areas.

- S. **Private Branch Exchange – PBX:** A private telecommunications switching system.
- T. **Protector:** A device to protect facilities and equipment from abnormally high voltages or currents.
- U. **Provide:** Furnish, install connect readily for use.
- V. **Pull Point:** A Pull Point is a space or assessable electrical box used to access cabling between floors for backbone and horizontal cabling within a building riser system.
- W. **Required:** Necessary mandatory must be done.
- X. **Shall:** A required practice, procedure, or method, mandatory requirement.
- Y. **Structured Cabling System (Universal Cabling System):** The complete collective configuration of telecommunications cabling and associated hardware at a given location. A structured cabling system is a cabling system where voice, data, video, and other low- voltage services are provided over the same cable media. All new cabling systems shall be of a structured design. The purpose of a structured cabling system is to cable a building for information needs without knowing specifically what equipment or services will be utilized on it. A structured cabling system is geared toward long-term sustainability and flexibility.
- Z. **Telecommunications:** A branch of technology concerned with the transmission, emission, and reception of signs, signals, writing, images, and sounds: that is information, of any nature by cable radio, optical, or other electromagnetic systems.
- AA. **Telecommunications Bonding Backbone - TBB:** An insulated copper conductor that bonds all TGBs to TMGB.
- BB. **Telecommunications Bonding Backbone Interconnecting Bonding Conductor – TBBIBC:** An insulated copper conductor that bonds two or more TBBs together in a multistory building.
- CC. **Telecommunications Grounding Busbar – TGB:** A copper grounding busbar is installed in every TR and is bonded to the TMGB by the TBB. All metallic items in the TRs are connected to TGB.
- DD. **Telecommunications Main Grounding Busbar – TMGB:** A copper ground busbar installed in the BDF or EDF and is bonded to the Service Equipment (power) ground by the Bonding Conductor (BC). It serves as a dedicated extension of the building grounding electrode system for telecommunications.
- EE. **Telecommunications Outlet – TO:** The standard telecommunications outlet is a device in the work area where a horizontal cable is terminated. This outlet is typically provisioned with three ports and the unused ports are blanked. The maximum capacity is six ports of Category 6, 6 Augmented cables, optical fiber, and/or coaxial cables Face plates should match existing face plates in the area and the electrical faceplates on new projects.
- FF. **Telecommunications Room – TR:** A TR is a special-purpose room designed to provide IT services on a single floor. In buildings with multiple floors, TRs shall be vertically stacked to form a backbone pathway. The TR is a termination point in the voice and data infrastructure that the backbone and horizontal distribution cabling are connected. to each other. A TR can contain equipment to support all of the following: cabling infrastructure, data and voice communications, wireless (satellite), paging, fire/ smoke detection, security alarm systems, radio, area of rescue assistance equipment, CATV, and video conferencing. (may be listed as ITTR, IT Closet, Telecommunications Closet TC).
- GG. **Universal Cabling System - UCS:** A USC is a cabling system where voice, data, video, and other low-voltage services are provided over the same cable media. All new cabling systems shall be of a UCS design. The purpose of a UCS is to cable a building for information needs without knowing specifically what equipment or services will be utilized on it. A UCS is geared toward long-term sustainability and flexibility.

HH. **Wireless Access Point – WAP or AP:** Wireless access points are specially configured nodes on wireless local area networks (WLANs). Access points act as the central transmitter and receiver of WLAN radio signals.

II. **Voice over Internet Protocol – VoIP:** VoIP is the transmission of voice traffic over IP- based networks.

1.5 ACRONYMS

A. AFF	Above Finished Floor
B. ARCH	Architectural
C. MEP	Mechanical, Electrical, Plumbing
D. CAT	Category
E. CATV	Cable Television
F. ER	Equipment Room
G. EMI	Electromagnetic Interference
H. F/UTP	Foiled Shield Twisted Pair
I. MH	Maintenance Hole
J. IT	Information Technology
K. PB	Pull Box
L. PP	Pull Point
M. TGB	Telecommunications Grounding Busbar
N. TMGB	Telecommunications Main Grounding Busbar
O. TR	Telecommunications Room
P. PBX	Private Branch Exchange (Phone Switch)
Q. UTP	Unshielded Twisted Pair
R. WAP	Wireless Access Point

The BICSI Telecommunications Manuals are available as references for additional definitions and acronyms.

1.6 REFERENCES ORGANIZATIONS

- A. The following organizations publish telecommunications construction standards with provisions that, through reference in this text, constitute provisions of this specification:
1. Building Industry Consulting Services International (BICSI)
 2. Telecommunications Industry Association (TIA)
 3. Electronic Industry Alliance (EIA)
 4. National Electrical Code (NEC)
 5. National Electrical Safety Code (NESC)
 6. National Fire Prevention Association (NFPA)
 7. American National Standard Institute (ANSI)

1.7 STANDARDS AND REFERENCES

- A. The following list of methods and standards included in the References Organizations are considered part of the requirements of this specification. This is a list of primary references and

does not limit the applicability of other standards that are incorporated into the list of References Organizations applicable to the work described in these practices, described in Standards documents (and addenda) published by recognized standard bodies and organizations. All references listed are considered to be of the latest edition printed. These include standards published by the Telecommunications Industry Association / Electronics Industries Alliance (TIA/EIA) and Building Industry Consultant Services International (BICSI).

1. BICSI TDMM and Specialty Manuals, Building Industry Consultant Services International, *Telecommunications Distribution Methods Manual*.
2. ANSI/TIA/EIA 568, *Commercial Building Telecommunications Cabling Standard*.
3. ANSI/TIA-568-C.0-2009+A1:2010+A2:2012, *Generic Telecommunications Cabling for Customer Premises*.
4. ANSI/TIA-568-C.2-2009+A1:2010, *Balanced Twisted-Pair Telecommunications Cabling and Components Standard*
5. ANSI/TIA-568-C.3-2009+A1:2011, *Optical Fiber Cabling Components Standard*.
6. ANSI/TIA-568-C.4-2011, *Broadband Coaxial Cabling and Components Standard*.
7. ANSI/TIA/EIA 569, *Telecommunications Standard for Pathways and Spaces*.
8. ANSI/TIA/EIA 607, *Commercial Building Grounding and Bonding Requirement*.
9. ANSI/TIA/EIA 758, BICSI *Customer-Owned Outside Plant Telecommunications Cabling Standard*.
10. ANSI/TIA/EIA 862 *Building Automation Systems Cabling Standard Cabling for Commercial Buildings*.
11. ANSI/NFPA 70, National Electrical Code, (NEC).
12. TIA-526-7 (OFSTP-7)-2002+A1:2008, *Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant*.
13. TIA-526-14-B-2010 (OFSTP-14), *Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 Edition 2, Fibre-Optic Communications Subsystem Test Procedure- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement*.
14. Building Industries Consulting Services International (BICSI) *Telecommunications Distribution Methods Manual (TDMM)*.

PART 2 - PRODUCTS

2.1 PRODUCTS STANDARD

- A. All materials shall conform to the currently applicable industry standard including, but not limited to:
 1. Electronic Industries Alliance (EIA)
 2. American National Standard Institute (ANSI)
 3. National Electrical Manufacturers' Association (NEMA)
 4. American Society for Testing and Materials (ASTM)
 5. Insulated Cable Engineers Association (ICEA)
 6. Institute of Electrical and Electronic Engineers (IEEE)
 7. National Electrical Safety Code (NESC)
- B. In addition, all material shall be Underwriters Laboratories Listed unless otherwise indicated.
- C. The approved product manufacturers are listed as an Appendix to this specification.
- D. All products shall be new.
- E. Products substitutions shall be managed according to the following guidelines:

1. All product submittals shall be approved by the Architect or Engineer before purchasing by the Contractor.
2. Where specified only by reference standard, select any approved product meeting standard of the manufacturer.
3. Where specified by naming several products or manufacturers, select any product and manufacture named in this Standard Specification.
4. Where specified by naming one or more products or manufacturers, but indicating "or approved equivalent" after the specified listing, the specified product is the preferred quality standard. The Contractor shall submit a request for the equivalent product for approval.
5. Where specified by naming only one product and manufacture: There is no option and no substitutions that will be allowed without prior approval.
6. Submit requests for substitution within 10 days of contract award, or sooner if required to maintain the construction schedule.
7. The Contractor must submit sufficient information to show that a proposed substitute is equivalent to the item specified.
8. Acceptance of substitutions is at the discretion of the Architect or Engineer. The Architect or Engineer reserve the right to determine the suitability of the substitute product and reject any material submitted for substitution.
9. All substituted products and materials must be approved for substitution by the Architect or Engineer in writing before installation.
10. Products rejected or otherwise judged unsatisfactory by the Architect or Engineer will not be authorized for use in completing the work. Any unapproved products discovered as part of the installation will be removed by the Contractor and replaced with specified and approved products at the Contractor's expense.
11. Project Drawings may be based on the equipment configuration of a particular manufacturer. If a substitution is approved, the Contractor shall make changes needed to accommodate the substitution at no expense to the project, including work under other divisions.

PART 3 - EXECUTION

3.1 IT INSTALLATION

- A. Each Contractor shall be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate common work results with all trades.
- B. The Contractor shall be responsible for furnishing all materials on the drawings, specifications, and addendums as specified herein for a complete IT system.
- C. All IT infrastructures shall be installed in a "workmanlike manner" acceptable to the Architect and Engineer; any work not acceptable to the Architect and Engineer shall be removed and installed at Contractor's expense.
- D. All work shall be completed in a "workmanlike manner" as specified by the NFPA standards.
- E. All work by the Contractor must comply with applicable standard listed in this Specification.
- F. The contractor is required to provide all drawings and obtain all permits from the proper jurisdiction for all work associated with this specification.
- G. All IT infrastructures shall be installed to ensure optimal performance.
- H. All existing and new IT infrastructure shall be installed to accommodate new work and modifications.

- I. All work performed in occupied space shall be in a manner that allows the Owner to operate the existing facilities continuously.
- J. All work that will affect the user connectivity, including wireless access points, shall be submitted for approval to the Owner two weeks before starting.
- K. New Telecommunication Rooms must be free from dust, dirt, and other foreign materials before the installation of any termination hardware or the termination of copper or fiber optic.
- L. The contractor shall provide a Manufacturer's Warranty of not less than 20 years on the structured cabling systems and components.
- M. All work by the contractor must comply with the manufacturer's product- recommended installation and warranty requirements.
- N. The Contractor shall provide all redlines, station documentation, and test results two weeks before substantial completion or end user move-in, whichever is first.
- O. The Contractor shall abide by all work rules, safety and security requirements, schedules, and other requirements established by the General Contractor related to the work area or project.

3.2 SCHEDULES

- A. Information Technologies (IT) Milestones shall be included and updated in all project schedules. Updates for these IT Milestones shall be provided at all construction meetings.
- B. An IT project schedule shall be provided and approved by the Owner before the commencement of any work.
- C. The Contractor is responsible for scheduling inspections with the Owner which are required after the following milestones but not limited to:
 - 1. Site Utility Locations.
 - 2. Communication Site Utility Rough-in, before covering (Concrete/backfill, etc.).
 - 3. Pathways and Electrical Rough-in before covering (In-wall/Ceilings/Floors).
 - 4. IT room Rough-in.
 - 5. IT room to build out (i.e., Cable tray, grounding, equipment racks, sleeves, firestop systems, power, etc.).
 - 6. Cable installation.
 - 7. Cable termination.
 - 8. Labeling.
 - 9. Testing.
 - 10. IT punch list.
 - 11. Final acceptance.

3.3 DELIVERABLES

- A. IT Subcontractor (before start)
 - 1. Qualifications
 - 2. Certifications
- B. Product Submittals, including specification data, prior to purchase.
- C. Schedules including timelines and milestones before starting any work and updated when changed.
- D. Test Results. (after testing and a minimum of 2 weeks to planned activation)

- E. Telecommunications Outlet Numbering Plan/Intra Building Numbering Sheets (IBNS) and a copy of the working as-built drawings. (after testing and a minimum of 2 weeks before planned activation).
- F. Final As-built Drawings shall be delivered to the Architect and Engineer two weeks after occupancy in both hard and electronic format. Any new outside plant or specified project as-built drawings require Auto Cad update.

PART 4 - APPENDIX FOR APPROVED PARTS LIST

4.1 The following table lists the most commonly used components of the AMP NetConnect Category 6 & 6A copper horizontal cabling system, Corning Cable Systems LANscape fiber backbone system, and Chatsworth Products ladder rack, racks, cable managers and grounding components. These systems contain too many parts to list them all in this document. Consult the manufacturer's websites for the most current item descriptions and part numbers. Any substitutions must be approved by ICT.

4.2 ATTENTION ELECTRICIANS, TELECOMMUNICATIONS, AND FURNITURE CONTRACTORS

- A. Modular furniture, tombstones, poke-throughs, and in-floor boxes will require careful consideration when purchasing these items. Not all bezels are compatible with AMP NetConnect modular jacks. Do not install incompatible fixtures where telecommunications outlets are required.

AMP NetConnect

620 Series, Category 6 UTP Cable, CMR, Blue	TE620P-BL RB
620 Series, Category 6 UTP Cable, CMR, White	TE620P-WT RB
620 Series, Category 6 UTP Cable, CMP, Blue	TE620R-BL RB
620 Series, Category 6 UTP Cable, CMP, White	TE620R-WT RB
640 Series, Category 6A U/UTP Twisted Pair Cable, CMR, Blue	TE640P-BL 02
640 Series, Category 6A U/UTP Twisted Pair Cable, CMR, White	TE640P-WT 02
640 Series, Category 6A U/UTP Twisted Pair Cable, CMP, Blue	TE640R-BL 02
640 Series, Category 6A U/UTP Twisted Pair Cable, CMP, White	TE640R-WT 02
Category 6A, 48 Port, Angled Patch Panel	2111573-1
Category 6A, Modular Jack, Orange	1933476-5
Category 6A, Modular Jack, Blue	1933476-6
Category 6A, Modular Jack, Black	1933476-2
Category 6A, Modular Jack, Yellow	1933476-8
Category 6A, Modular Jack, Green	1933476-9
Category 6, 48 Port, Angled Patch Panel	1375015-2
Category 6 Modular Jack, Orange	1375055-5
Category 6 Modular Jack, Blue	1375055-6
Category 6 Modular Jack, Yellow	1375055-8
Category 6 Modular Jack, Black	1375055-2
Category 6 Modular Jack, Green	1375055-9

SL Series Multimedia Inserts, Almond	Various
Faceplate 4-Port, SG, Almond	558088-1
Faceplate 2-Port, SG, Almond	557505-1
Faceplate 4-Port, DG, Almond	83935-1
Corning LANscape	
Fiber Fan Out Kit 12 Pos/25	FAN-BT 25-12
Wall Mount Housing F-12 WCH-12P	WCH-12P
6P Panel Rack CCH SC SM CCH-CP12-59	CCH-CP12-59
LANscape Wall Mount Splice Housing WSH-16SPT	WSH-16SPT
Splice Protection Heat Shrink (pkg-50)	2806031-01
Unicam ST MM 95-000-50	95-000-50
Fiber 48F SM LT Altos	048EU4-T 4701D20
24/96-F Rack Mount Enclosure CCH-02U	CCH-02U
12/48-F Rack Mount Enclosure	CCH-01U
Fiber 48-F MIC SM Plenum	048E88-61131-29
Connector Splice Housing CSH-05U	CSH-05U
SM / MM Splice Tray M67-048	M67-048
Corning Splice Tray/12 - M67-060	M67-060
Fiber Enclosure BGE LANscape EDC-06P-NH	EDC-06P-NH
Wall Mount Splice Cabinet WCH-SSH-4-12	WCH-SSH-4-12
Wall Mount Connector Housing WCH-04P	WCH-04P
Closet Connector Housing, 12 Panel	CCH-04U
FUSELITE SC SM BLUE PRE-POLISHED FERRULE	AS236342
Fiber 96F SM Altos	096EU4-T 4101D20
MIC SM PVC Fiber Optic Cable	012E81-33131-24
Fiber Clean Wipes	FC-45-1
Chatsworth Products Inc.	
UNIVERSAL CABLE RUNWAY, Black, 12 inch wide	10250-712
Butt-Splice Kit, Black 16301-701	
Intelligent Fan Kit, For ThinLine II Wall-Mount Cabinet	13051-001
G3 Double-Sided Cable Managers	35523-701
G3 Combination Vertical Cable Managers	35573-701
Universal Rack, 7' high, 19", Black	46353-701
Evolution Horizontal Cable Manager, 2U, Black	35441-700
ThinLine II Wall-Mount Cabinet, Beige	13050-222
Intelligent Fan Kit, For ThinLine II Wall-Mount Cabinet	13051-000

G3 Double-Sided Cable Managers	35523-702
G3 Combination Vertical Cable Managers	35573-702
Universal Rack, 7' high, 19", Black	46352-702
Evolution Horizontal Cable Manager, 2U, Black	35441-701
ThinLine II Wall-Mount Cabinet, Beige	13050-223
Intelligent Fan Kit, For ThinLine II Wall-Mount Cabinet	13051-001
G3 Double -Sided Cable Managers	35523-703
G3 Combination Vertical Cable Managers	35573-703
Universal Rack, 7' high, 19", Black	46352-703
Evolution Horizontal Cable Manager, 2U, Black	35441-702

END OF SECTION**27 0500**

SECTION 270526**GROUNDING AND BONDING FOR COMMUNICATION SYSTEMS****PART 1 - GENERAL****1.1 SCOPE OF WORK**

- A. The Contractor is held responsible to be familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation. The Contractor is held responsible to be familiar with the provisions contained herein and is assumed to possess the knowledge, manpower, and materials necessary for the completion of the installation.
- B. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing otherwise specified, and performing the following operations recognized as necessary for the complete installation, termination, and labeling of ground and bonding infrastructure as described on the Drawing and /or required by these specifications.
- C. Listed manufacturers and products are required. Architect/Engineer-approved equal products and systems are also acceptable with the prior written approval of submittals.

1.2 RELATED SECTIONS

DIVISION 26	ELECTRICAL DIVISION
DIVISION 27	COMMUNICATION SYSTEMS

PART 2 - PRODUCTS**2.1 GROUNDING BUSBARS**

- A. Telecommunications Grounding Main Grounding Busbar (TMGB).
 - 1. Predrilled, copper, non-anodized BICSI/TIA/EIA/ANSI approved (4"W x 1/4"H x 12"L) ground bus bar with insulators and standoffs. (Chatsworth 40153-012 or approved equal)
- B. Telecommunications Grounding Busbar (TGB)
 - 1. Predrilled, copper, non-anodized BICSI/TIA/EIA/ANSI approved (2"W x 1/4"H x 12"L) ground bus bar with insulators and standoffs. (Chatsworth 13622-012 or approved equal)

2.2 GROUNDING JOINTS AND SPLICES

- A. Grounding conductor joints/ splices shall be mechanical type, copper alloy, with a minimum of two bolts and a spade section for each conductor.
- B. Grounding conductor terminations (lugs) shall be a single barrel, mechanical screw type, copper alloy with machined contact surfaces.

2.3 BONDING CONDUCTORS

- A. Cable Tray Bonding Conductor.
 - 1. Green # 6 AWG insulated bonding jumper with appropriate lugs or manufactured braided copper grounding jumper.

- B. Equipment Frame Bonding Conductor.
 - 1. Chatsworth TRGK672 Telecommunications Rack Grounding Kit or approved equal.
- C. Bonding Conductor (BC)
 - 1. Green insulated copper bonding conductor, size as required by NEC.
 - 2. The BC shall be, as a minimum the same as the TBB.
- D. Telecommunications Bonding Backbone (TBB)
 - 1. Green insulated copper conductor, a minimum size of #6 AWG. The TBB shall be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 3/1 AWG Insulation shall meet fire ratings of its pathway or be in conduit.

SEE TABLE 1 BELOW

TABLE 1					
Sizing of Telecommunication Bonding Backbone (TBB)					
TBB length FT	Grounding Conductor Size (AWG)	DC Resistance Per 100 Ft (Copper Conductor)	Short-Time Rating (A)		
< 13 Ft	6	0.0491	621		
14 - 20 Ft	4	0.0308	988		
21 - 26 Ft	3	0.0245	1245		
27 - 33 Ft	2	0.194	1571		
34 - 41 Ft	1	0.0154	1981		
42 - 52 Ft	1/0	0.0122	2499		
53 - 66 Ft	2/0	0.00967	3150		
> 66 FT	3/0	0.00766	3972		
	4/0	0.00608	5008		
	kcmil				
	250	0.00515	5917		
	300	0.00429	7101		
	350	0.00367	8284		
	400	0.00321	9467		
	500	0.00258	11834		
	AWG = American Wire Gauge				
	DC = Direct Current				
	kcmil = Thousand circular mils				

PART 3 - EXECUTION**3.1 TELECOMMUNICATIONS INSTALLATION**

- A. Bonding and grounding all conduits, cable trays, enclosures, cables, protectors, and other conductive infrastructure as per the requirements of the NEC and TIA 607 to main building ground.
 - 1. Nonconductive coatings (such as paint, lacquer, and enamel) on equipment to be grounded shall be removed from threads and other contact surfaces to ensure good electrical continuity or be connected utilizing fittings designed to make such removal unnecessary.
- B. Installation of the TMGB in ER/TR.
 - 1. Install the TMGB at the bottom of the plywood backboard near the entrance conduits within the ER/TR Room.
 - 2. TMGB shall be installed so that the BC is as short and straight as possible, with the proper bend radius.
 - 3. The BC shall be a green insulated conductor installed exposed per Table 1.
 - 4. Connection at TMGB from the main electrical service ground shall be installed to meet NEC 250.94 and TIA/EIA requirements type. Ground resistance shall not exceed 2 ohms unless approved by the Architect or Engineer.
 - 5. Busbar shall be predrilled for future connections. (Chatsworth 40153-012 or approved equal.)
 - 6. Provide a label (Do Not Disconnect) on the connection to the main electrical service ground.
- C. Installation of TGB in TR.
 - 1. Install the TGB at the bottom of the plywood backboard near the copper riser terminations.
 - 2. TGB shall be installed so that the TBB for telecommunications is as short and straight as possible, with the proper bend radius.
 - 3. The BC shall be Green insulated conductor sized from Table 1.
 - 4. Busbar shall be predrilled for future connections. (Chatsworth 13622-012 or approved equal.)
- D. Installation of the TBB.
 - 1. Installation mechanical type, copper alloy, with a minimum of two bolts and separate sections for each conductor or copper compression type with two (2) indents
- E. Installation of Grounding Conductor Joints/Splices.
 - 1. Install manufactured insulating cover or heavy tape insulation over joints/splices.
- F. Grounding of Cable Tray/Ladder Rack/Basket Tray
 - 1. Install Green #6 AWG bonding jumper (12 inches max) with appropriate lugs at each cable tray joint or install a manufactured braid copper grounding jumper. In place of bonding jumpers, use manufactures approved grounding type connectors to connect sections of cable trays will be permitted.
 - 2. Install Green #6 AWG grounding conductor with appropriate lugs from the side of the cable tray down to TMGB or TGB. Drill the side of the cable tray and install a 1/4" fine thread appropriate length bolt, making sure that the bolt does extend into the wire management part of the tray.

- G. Ground of Equipment Frame.
 - 1. Install Telecommunications Rack Grounding Kit approved by the Architect or Engineer, from equipment frame to ground cable tray, TMGB or TGB.
- H. Grounding of Telecommunications Duct banks.
 - 1. Provide a continuous # 4/0 bare-stranded copper conductor within the concrete at the bottom of all Duct banks. Terminate the bonding ribbon in telecommunications maintenance holes.
- I. Grounding of Telecommunications Maintenance Holes and Handholes.
 - 1. Provide bonding jumper to reinforcing steel in each section.
 - 2. Install a bonding ribbon horizontally around the bottom of each maintenance hole and attached it to all the cable racks and metallic hardware within the maintenance hole. Continue installation vertically between the bonding clamps so both the top and bottom halves are bonded together on each side. (The bonding ribbon will be used to bond and ground all future splice cases and hardware placed within the maintenance hole).
 - 3. Provide a ground rod near a corner within 6" of the corner in each maintenance hole and handhole. Bond to the ribbon in the maintenance hole.

END OF SECTION

27 0526

SECTION 27 0528.1**PATHWAYS FOR COMMUNICATIONS SYSTEMS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Furnish and install a complete telephone/data system, including cabinets, conduit, outlet boxes, jacks, cabling, and device plates, as shown on the drawings.

1.3 RELATED WORK IN OTHER SECTIONS: General Provisions, Raceways, Boxes and Fittings, Conductors, Wiring Devices and Plates, Cabinets, Grounding.**1.4 TELEPHONE/DATA SYSTEMS, GENERALLY:** The telephone/data system shall be as indicated on the drawings and specified here-in with all service runs in concrete encased underground duct system. The main service shall terminal at the main telephone equipment board.**PART 2 - PRODUCTS****2.1 TERMINAL BOARDS**

- A. Telephone and data equipment shall share a common mounting board which shall be $\frac{3}{4}$ " plywood secured to the walls where indicated on the drawings (or as noted).

2.2 OUTLETS

- A. Telephone/data wall outlets shall consist of 4" square box, 2-1/8" deep, one RJ45 jack for telephone and one RJ45 jack for data, one device cover, up 18" unless noted otherwise on the drawings. Device plate finish shall be as specified for switches and receptacles.

PART 3 - EXECUTION**3.1 TELEPHONE CABLE:** Install 4-pair, Category 6, 23 gauge. solid plenum rated cable from each telephone jack to terminal board and terminate on punch down blocks.**3.2 TELEPHONE PUNCHDOWN BLOCKS:** Type 110 unless noted otherwise.**3.3 DATA CABLE:** Install 4-pair, unshielded Category 6/6A/6E plenum rated 23 gauge. Terminate per TIA-568a from each data jack to the terminal board and terminate on data cross connect blocks.**3.4 DATA CROSS CONNECT BLOCKS:** Hubbell type 110 12 port cross connect block unless noted otherwise.**3.5 GROUNDING:** Install No. 6 ground wire in 1/2-inch conduit from the telephone equipment board to the nearest cold water pipe unless otherwise noted.**3.6 COORDINATION, DETAILS:** Exact locations and arrangement of the telephone/data facilities shall be coordinated with and as recommended and approved by the local telephone company. This includes the location and orientation of lights, receptacles, service entrance conduits and conduit stubs in the equipment room.**END OF SECTION****27 0528.1**

SECTION 27 0528.2**PATHWAYS****PART 1 - GENERAL**

- A. The Contractor is responsible to be knowledgeable with provisions contained herein and with other Sections of this Specification as applicable to the work related to this section.

1.1 SCOPE OF WORK

- A. The scope of work under this section consists of providing conduits, boxes, raceways, pathways, and cable supports for telecommunications wiring included in this project.
- B. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, and material, unless otherwise specified, and performing the following operations are necessary for the installation and testing of all infrastructure required by this specification's standard.
- C. The horizontal infrastructure begins in the telecommunications room (TR) and is terminated at the telecommunications outlet that is located in the end user work area.
- D. Only the Architect/Engineer or Owner-approved manufacturers for structured cabling systems shall be installed in the pathways. The exact Category performance requirements are project specific. Verify and comply with manufacturer installation and warranty requirements when designing and installing structured cabling systems.
- E. The typical Telecommunications Outlet is a Category 6 faceplate that shall be provisioned to accept four (4) ports. The standard installation is two (2) Category 6 cables and two (2) 8P8C jacks. There will be applications where other cabling requirements are needed. When these cables are added to the Telecommunications Outlet such as (Category 6, 6A, F/UTP Fiber, or Coax) use approved jacks. The sizing of the pathway will need to be adjusted to meet additional cabling requirements. Initial installation shall have a 40% fill rate.
- F. Provide conduits and boxes for Code Blue Emergency Phones, Elevator Phones, mechanical and electrical metering equipment, and wall phones.
- G. Furnish and install an inter-building cabling infrastructure and pathways. Originate the system from the building's main equipment room and distribute it to the telecommunications room.
- H. Furnish and install raceways and cable tray systems in hallways and other accessible areas, above ceilings where applicable or as specified in the project documents and drawings.
- I. Transition cable tray to conduit systems in inaccessible areas. Must meet the same volume as the tray.
- J. Install cable tray and raceway systems according to the manufacturers' product installation instructions using the manufacturers' approved methods and components.
- K. Furnish, install, and document re-enterable UL-listed firestop assemblies at all firewall penetrations. (Architect or Engineer-approved firestop systems are Hilti and/or STI.) Document means the manufactures label is permanently attached to the wall located adjacent to the penetration along with a photo taken and submitted to Owner.

1.2 RELATED SECTIONS

DIVISION 26	ELECTRICAL DIVISION
DIVISION 27	COMMUNICATION SYSTEMS

1.3 RELATED REFERENCES

- A. All work performed under this section must comply with the manufacturer's approved methods and comply with the most recent versions of the following Industry Standards and Practices applicable to work being performed under this section. The contractor shall have working knowledge and possess the following documents of the Standards and Methods listed and must adhere to the most recent published edition.
 - 1. National Fire Protection Association
 - 2. National Electrical Code
 - 3. National Electrical Safety Code
 - 4. Telecommunications Industry Association (including but not limited to)
 - a. TIA/EIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces.
 - b. TIA/EIA 758 3Customer-Owned Outside Plant Telecommunications Cabling Standard.
 - c. TIA/EIA 568 Commercial Building Telecommunications Cabling Standard
 - d. TIA/EIA 607 Grounding
 - 5. Building Industry Consulting International (BICSI)
 - a. Telecommunications Distribution Design Manual

PART 2 - PRODUCTS

2.1 TELECOMMUNICATIONS OUTLETS BOXES, FLOOR BOXES and SURFACE RACEWAYS

- A. Telecommunication Outlets shall have the ability to accommodate a complete line of connectivity modules including those for UTP cables Category 6, Category 6 Augmented F/UTP, fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting.
 - 1. It is the responsibility of the project RCDD, Electrical Engineer and Contractor to verify that the design requirements which are specified below have been met.
 - 2. It is the responsibility of the contractor to submit an RFI for any noted incorrect designs or conditions found that do not meet the requirements of this Specification Standard.
- B. Furnish and install telecommunications outlets in studded drywall or masonry wall providing a 4 11/16" inch square 2 1/8" inch deep boxes with 1" inch mud ring provisioned with a 1" inch conduit knockouts. The box depth will be 3 1/8" inches. It is the responsibility of the designer, electrical contractor, and structured cabling contractor to identify and verify the conduit and box size to match the cabling requirements at each location.
 - 1. Fiber Optic, Category 6, and Category 6 Augmented F/UTP radius: The depth of the box shall accommodate a 1 1/4" inch cable bend radius, which meets or exceeds the specifications for fiber optic and UTP cabling per TIA/EIA-56 requirements for communications pathway. A 1 1/4" inch-controlled radius storage loop shall be installed.
- C. The minimum requirement for all telecommunications outlets is a 1" inch conduit(s) provisioned with a bushing on each and a measured pulled line secured at each termination point for horizontal cabling installation. The conduit sizing and fill ratio shall be verified in design and provided to meet the requirements of the TIA/EIA 568, 569 with an initial installation fill ratio of 40% percent.
- D. For all horizontal cabling pathways provide a minimum of a 1" inch conduit from the outlet box to the nearest cable tray or conduit system. Terminate conduits above cable trays at approximately 12 inches to the nearest side rail.
- E. In inaccessible as well as areas that are non-adjacent to spaces conduit shall be provided from the outlet box to the nearest cable tray or conduit system with no exceptions. Terminate conduits above cable trays at approximately 12" inches to the nearest side rail.

2.2 FLOOR BOXES

- A. Floor boxes provide the interface between power, communication, and AV cabling in an on-grade or above-grade concrete floor where power and communications services are required. Boxes shall provide flush or recessed device outlets that will not obstruct the floor area.
- B. Floor boxes and covers must be heavy-duty in construction, watertight, and easily accessible by users. Meeting and Exceeding Water Exclusion Standards in Poke-Thru Devices and Floor Boxes UL514A standards require that all concrete floor box covers and poke-thru devices meet a carpet water exclusion test. Water exclusion tests are designed to simulate typical maintenance procedures such as mopping tile floors and shampooing carpets.
- C. All floor boxes shall be submitted and approved by the Architect or Engineer.
 - 1. An acceptable pre-approved box is Wiremold RFB6.
- D. Communications Devices and Accessories: The floor box shall accommodate a complete line of connectivity outlets and snap-in modular inserts for UTP including Category 6, 6 Augmented F/UTP, fiber optic, coaxial, and other structured cabling types with matching faceplates and bezels to facilitate mounting. Where indicated, provide connectivity outlets and modular inserts. Bezels shall be supplied by the contractor furnishing the floor boxes.
- E. Furnish and install 1 ½" EMT conduit to each floor box. In new construction, conduits should be run continuously from the outlet box to the cable tray installing pull boxes where necessary to meet bend radius requirements. **DO NOT DAISY CHAIN FLOOR BOXES.**
- F. Covers and Bezels: Floor box options shall accept both brass and nonmetallic cover plates and flanges. Flanges for both brass and nonmetallic shall be available in one, two, and three gang applications and installed on boxes. Each flange shall provide ½" inch of adjustment to accommodate various floor covering and concrete depths.
- G. Floor Boxes on "Slab on Grade" must have OSP category cable installed. Must be suitable for "wet locations". A suitable substitute cable must be approved by the Architect/Engineer.

2.3 POKE THRU DEVICES

- A. Poke-thru devices provide a path for power and communications cabling in an above-grade concrete or steel deck floor and where the workstation is located where the power and data communication devices outlets are required.
- B. Poke Thru Devices and covers must be heavy-duty in construction, watertight, and easily accessible by users. Meeting and Exceeding Water Exclusion Standards in Poke-Thru Devices and Floor Boxes UL514A standards require that all concrete floor box covers and poke-thru devices meet a carpet water exclusion test. Water exclusion tests are designed to simulate typical maintenance procedures such as mopping tile floors and shampooing carpets.
- C. All Poke-thru devices shall be submitted and approved by the Architect or Engineer.
- D. Poke-thru devices shall be suitable for use in air handling spaces in accordance with Section 300-22 of the National Electrical Code.
- E. Furnish with necessary channels to provide complete separation of power and communication service. There shall be one minimum of 1 ¼" inch channels for communication cabling to the nearest cable pathway. The channels shall be arranged such that communication cables can be conduit protected and connected to the insert body.
- F. Activation covers shall provide spring-loaded slides that snap back into place when not in use to protect the flush-mounted power receptacle.
- G. Communications Devices and Accessories: Poke Thru Devices shall accommodate a complete line of connectivity outlets and snap-in modular inserts for UTP including Category 6, 6 Augmented F/UTP, fiber optic, coaxial, and other cabling types with matching faceplates and

bezels to facilitate mounting. Where indicated, provide connectivity outlets and modular inserts. Bezels shall be supplied by the contractor furnishing the Poke Thru.

- H. The poke-thru shall have an incorporated approved UL firestop system that meets the rating of the floor.
- I. Unit shall be installed per Manufacture Specifications.

2.4 SURFACE MOUNTING RACEWAYS (SMR)

- A. A submittal is required on all SMR, outlet, and accessories to the Architect or Engineer for approval before construction.
- B. Furnish and install surface raceways connecting EMT conduit system to the nearest Horizontal Distribution Infrastructure connection point. Size conduits to meet the cabling requirements of surface-mounted raceway system with 60% growth.
- C. Provide surface raceway systems for branch circuits and data networks voice and another low-voltage wiring. The surface raceway system shall consist of raceway covers; appropriate fittings and device mounting plates necessary for complete installation.
- D. Provide full capacity corners elbows and tees fittings to maintain the proper bend radius, meeting the specification for Fiber Optic and UTP cabling exceeding the TIA/EIA-569 requirements for communications pathways.
- E. Raceway Covers and Devices Plates: Raceway covers with the cable exiting the SMR shall have a hole cut with a grommet. Wiring connections of these devices shall be completed during installation.
- F. Ensure the depth of the surface raceway will provide sufficient space for jacks, and bend radius for terminations.
- G. Surface Mounted Raceway shall accommodate a complete line of connectivity outlets and snap-in modular inserts for UTP including Category 6, 6 Augmented F/UTP, fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting. Where indicated, provide connectivity outlets and modular inserts. Bezels shall be supplied by the contractor furnishing the SMR.

2.5 WIRE MESH CABLE TRAYS-Light to Medium Use

- A. Acceptable Manufacturers are Cablofil, Chatsworth, Cooper B-line.
- B. Wire mesh cable trays shall not be used within ERs or TRs.
- C. All wire mesh cable trays and accessories shall be submitted for approval.
- D. Furnish and install wire mesh cable tray system from the telecommunications room, in hallways and corridors inaccessible areas to complete a distribution infrastructure.
- E. Wire Mesh Cable tray will consist of a continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat, with UL Classified splices where the cable tray acts as Equipment Grounding Conductor (EGC).
- F. Provide manufacturer splices, supports, and other fittings necessary for a complete, continuously grounded system installed per the manufacturer's recommendations. No single center support systems.
- G. Cable Tray Size
 - 1. Depth: Cable tray minimum depth shall be a minimum of 2" inches.
 - 2. Width: Cable tray width will be designed per project.

- H. Cable tray fill
 - 1. The ratio may be filled to 40% of the total fill capacity on initial installation. Size cable tray to accommodate future cabling changes or additions.
 - 2. Load Span Criteria: Install and support the cable management system following the manufacturer's specifications.
- I. Supports
 - 1. Ceiling-mounted supports shall be mounted directly to the ceiling structure with a minimum of 3/8" inch or 1/2" inch threaded rod, and shall have a maximum of three threads beyond the nut.
 - 2. Wall-mounted supports where specified are acceptable and shall be installed per the manufacturer's specifications.
 - 3. Cable tray support systems shall be installed within raised floor systems. Install per manufacturer specifications or a minimum of 5/8" inches off the floor.
 - 4. Splices, including those approved for electrical continuity (bonding), as specified by the wire mesh cable tray manufacturer.
 - 5. Accessories: Install as specified by the manufacturer to protect and support, the wire mesh cable tray system. Waterfalls shall be used wherever cable enters or exits the tray or cable changes elevations without supports.
 - 6. Ground and bond according to the manufacturer's specifications or instructions and NEC Article 250.

2.6 CABLE TRAYS - Ladder Type

- A. Acceptable Manufacturers are Chatsworth, Cooper B-Line.
- B. All ladder-type cable trays, devices, and accessories shall be submitted to and approved by the Architect or Engineer.
- C. Provide metal cable trays with splice plates, bolts, nuts, and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards and the manufacturer's instructions; and with the following additional construction features.
 - 1. Material and finish specifications for each tray type are as follows: Aluminum or Steel.
 - 2. Ladder-type trays shall consist of two longitudinal members (side rails minimum four inches) with transverse members (rungs) attached to the side rails. Rungs shall be spaced 6", 9", or 12" inches on center. Spacing in radiuses fittings shall be 9" inches and measured at the center of the tray width. Rungs shall have a minimum cable-bearing surface of 7/8" inch with radiuses edges. No portion of the rungs shall protrude below the bottom.

****Each rung must be capable of supporting the maximum cable load, with a safety factor of 1.5 and 200 pounds concentrated load when tested under NEMA VE-1, section 5.4.**
- D. Tray widths shall be minimum of 12" inches or as shown on drawings.
- E. All fittings must have a minimum radius of 18" inches.
- F. Straight tray sections shall have side rails fabricated as I-Beams. All straight sections shall be supplied in standard lengths, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on drawings.
- G. Splice plates shall be the bolted type as specified by the manufacturer. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing the rated loading capacity of the cable tray.
- H. Cable Tray Supports shall be placed so that the support spans do not exceed the maximum span per manufacturer and NEC load rating. Supports shall be constructed from 12 gauge steel

formed shape channel members 1 5/8" inch by 1 5/8" inch with necessary hardware, Unistrut or equal. The trapeze hanger's supports shall be supported by 1/2" inch (minimum) diameter rods. Cable trays installed adjacent to walls shall be supported on wall-mounted brackets. Support shall be loading condition with a safety factor of 3.

- I. Barrier Strips shall be placed as required.
- J. Accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, waterfalls, etc.

2.7 NON-CONTINUOUS CABLE SUPPORTS – J-HOOKS

- A. Acceptable Manufacturers are Erico, Cable Cat, or approved equal.
- B. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with the required bend radii of high-performance cables (CAT 6 and Cat 6 Augmented); UL Listed.
- C. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
- D. Non-continuous cable supports shall have an electro-galvanized finish and shall be rated for indoor use in non-corrosive environments.
- E. Saddles can be installed as approved by the Architect or Engineer.

2.8 HORIZONTAL CONDUIT DISTRIBUTION:

- A. Furnish and install 4" inch EMT conduits in inaccessible areas to complete distribution infrastructure. Provide sufficient conduit capacity to meet the cabling capacity of the cable tray system. Furnish and install pull strings and bushing for conduit sections.
- B. Hinged pull boxes with the opening completely assessable from below without obstructions. Install as required per TIA/EIA where conduit runs exceed 100 feet and/or bends exceed a total of 180 degrees in a section of conduit. Pull boxes sized per BICSI TDMM.

2.9 FIRESTOP

- A. Acceptable Manufacturers: Hilti, STI, and Wiremold.
- B. Furnish and install re-enterable UL-listed fire-rated assemblies through fire-rated partitions, walls, and floors. Installed per UL system assembly requirements.
- C. Fire Rated Cable Pathways: Hilti Speed Sleeve, STI EZ-PATH™, and Wiremold modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
 - 1. Hilti Speed sleeve CP 653.
 - 2. Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway.
 - 3. Wiremold FS4R for conduit.
- D. Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate structured cabling provide re-enterable products that do not cure or dry. Submittals shall be submitted to the Architect or Engineer for approval.
- E. Cable trays shall not penetrate fire-rated walls or partitions and floors. Use Architect or Engineer-approved fire-rated assembly to penetrate walls and floors.

PART 3 - INTRA-BUILDING INFRASTRUCTURE

3.1 GENERAL REQUIREMENTS

- A. The intra-building pathways intend to provide the building with a route from the building's ER/TRs and spaces to the TOs at the end user's work area or equipment termination point.
- B. The installation of new pathways shall not interfere with existing utilities or pathways. The contractor shall coordinate the installation of the new pathways with other trades and project requirements. Minimum clearances shall be 6" inches on sides 3 inches below and 12" inches above.
- C. All pathways must remain accessible and useable after completion.
- D. All pathways must comply with the list of related references listed in Part 1 of this section and comply with installation instructions and methods specified by the product manufacturer.
- E. The contractor shall reference the related sections listed in Part 1 to determine any additional requirements necessary to complete the project.

3.2 TELECOMMUNICATIONS OUTLETS

- A. New construction telecommunications outlets shall be installed at a minimum of 18" inches AFF unless specified.
- B. The telecommunications outlet box will be a 4-11/16" inch square box with a 1" extension ring fitted with a single gang mud plate.
- C. The telecommunications outlet shall be provisioned minimum with a 1" inch EMT conduit that has bushings installed and a measured pull line installed and secured at the conduits terminations points.
- D. Telecommunications outlets are not to be installed back-to-back.
- E. Firestop the outlet box using a listed UL application in firewalls.
- F. Renovated Areas of Existing Buildings Alternate – When approved by the Architect or Engineer.
 - 1. In accessible ceiling areas, extend the conduit through the wall plate and bend the conduit 90° to face the nearest cable tray, or access conduit or sleeve.
- G. Provide a minimum of one (1) 2" inch EMT sleeve on non-rated walls from the cable tray into each room. On fire-rated walls use Architect or Engineer-approved firestop sleeve as per 2.11 Firestop. In inaccessible or semi-accessible ceiling areas, install a complete 1" inch minimum EMT conduit system from the telecommunications outlet box to the nearest or most available cable tray.
- H. Install system Category-compliant cable supports every 36" to 60" inches.
- I. Conduit needs to run in the most direct route possible, parallel with building lines and in a workman-like manner.
- J. The use of flexible metallic conduit is not permitted.
- K. Specify UL-listed fire-stopping application for conduit and sleeve penetrations using a code-compliant and re-enterable application as per 2.11 Firestop. Document and provide to the owner a photo of the application, the name of the listed application, the date of installation, and the name of the installer.

3.3 GENERAL CONDUIT REQUIREMENTS

- A. Horizontal conduit routes are to be designed to enable the cabling system to meet the link length requirements of 295 feet.

- B. Intra-building conduit runs shall contain no continuous sections longer than 100 feet. If runs total more than 100 feet, pull points or pull boxes shall be inserted.
- C. Conduit shall have no more than 180 degrees of cumulative bends between pull points or more than 90 degrees of bends at any one point.
- D. The use of a third conduit bend is only acceptable if:
1. The total conduit run does not exceed 33' feet.
 2. The conduit is increased to the next trade size.
 3. One of the bends is located within 12" inches of the cable feed end.
- E. Pull boxes are not to be used as a means to change the direction of conduit runs. Pull boxes are to be sized as per the latest version of the BICSI TDDMM.
- F. The use of EB's is not permitted. Only approver LB type bodies that are manufacturers for the use with communications cabling.
- G. Specify UL listed fire-stopping application for conduit and sleeve penetrations using a code-compliant application in the fire-stopping section. Install a Hilti or STI UL compliant and re-entenable application as per 2.11 Firestop. Document and provide to the owner a photo of the application, the name of the listed application, the date of installation, and the name of the installer.
- H. The following table provides general guidelines for cable capacity for conduits that have no more than two 90° bends and are not longer than 100 feet. It is based on a maximum 40% fill and includes a de-rating factor of 15 % for each of the two 90° bends. The final conduit design shall be compliant with the Related References in Part 1. The radius of conduit bends shall be at least 10 times the conduit diameter. Under certain conditions where 10 times bend radius is not achievable due to structural conditions, 6 times bend radius may be permitted.

Table 1 – Maximum Conduit Fill for Horizontal Cables Number of Cables or Wires

Wire O.D. mm	3.3	4.6	5.6	6.1	7.4	7.9	9.4	13.5
(in)	(.13)	(.18)	(.22)	(.24)	(.29)	(.31)	(.37)	(.53)
Conduit size								
1	8	8	7	6	3	3	2	1
1 ¼	16	14	12	10	6	4	3	1
1 ½	20	18	16	15	7	6	4	2
2	30	26	22	20	14	12	7	4
2 ½	45	40	6	30	17	14	12	6
3	70	60	50	40	20	20	17	7
3 ½	-	-	-	-	-	-	22	12
4	-	-	-	-	-	-	30	14

Note: Ensure that conduit/sleeve cable fill does not exceed specified fire-stopping methods.

3.4 INTERBUILDING BACKBONE CONDUIT REQUIREMENTS

- A. All conduits for backbone cabling shall be 4".
- B. Conduits entering telecommunications or equipment rooms from below the floor shall be terminated not more than 4" above the finished floor.
- C. Conduits for riser cables shall be continuous and separate from all conduit or enclosed raceway systems. Do not include more than two 90° bends between pulling points when installing riser conduits. Where junction boxes are required, they must be hinged-type boxes and located in accessible areas, such as above suspended ceilings in hallways.
- D. Factory bends are required for backbone conduit installations.
- E. A 40" inch bend radius is to be maintained at all turns in.
- F. A change in direction of the conduit run is not to be accomplished by adding a pull box.
- G. Optical Fiber Cable shall utilize Interlocking Armored Cable, which is appropriately color coded, without the use of innerduct or max-cell.
- H. Where shown or specified, install one (1) 1 1/4" inch plenum-rated inner duct for each optical fiber cable specified in all cable tray installations.
- I. Label optical fiber inner ducts at each end within six feet of the rack and within one foot of entering or exiting a conduit, label shall be preprinted caution labels that indicate optical fiber cables and describe the size and the termination points of the installed cable. Labels must be yellow with black text and waterproof.
- J. Install a single conductor locating wire of minimum 14 gauge solid insulated orange wire for all non-metallic optical fiber cables and terminate on cable's FDU.
- K. All multi-cell conduits and inner ducts and multi-cell inner duct shall be rated per NFPA 70 requirements.
- L. Conduits entering the entrance, equipment, or telecommunications rooms from below grade shall extend 4" inches above the finished floor. Location of entrance conduits shall be within 12" inches of room corners.
- M. Conduits shall be sloped downward from the building towards the manhole or handhole to prevent flooding in the building. Install a waterproof plug on each end of the conduit section.
- N. Terminate conduits entering the entrance, equipment, or telecommunications rooms from above the ceiling extend the conduit 4" inches below the finished ceiling or 12" inches above the cable tray.
- O. Entrance conduits shall be continued into the building and to the entrance, equipment, or telecommunications rooms. Securely fasten all entrance conduits to the building to withstand any cable placing operation.
- P. If the entrance conduits exceed the 180° of total bends limitation, Architect/Engineer-approved sized junction box, manhole, or handhole.
- Q. All conduits shall have a measured 1320 pull-strength mule tape installed and tied off at each end.
- R. Install bushings at the endpoint of all conduit sections.

3.5 SURFACE-MOUNTED RACEWAYS

- A. Install sufficient conduit capacity from the cable tray to Surface Mounted Raceways (SMR) to provision the cabling capacity of all outlets in the raceway system.

- B. Fit out each outlet in the SMR with the parts and accessories necessary to install the specified cabling system.
- C. Furnish and install raceway and boxes for renovations and daily work orders. The minimum cabling capacity of the SMR shall be one inch. Provide a complete system using approved manufacturer parts and approved methods. Secure the raceway system using screws and attachments. Install a minimum of three support screws per raceway section. Do not use adhesive strips as a final means of support.

3.6 CORRIDOR CABLE TRAY SYSTEM

- A. Complete wall-mounted or suspended aluminum or stainless cable tray system and necessary accessories shall be provided as shown on the plans. Install the entire cable tray system following the manufacturer's installation instructions and all local governing codes.
- B. Coordinate installation of cable tray with other trades to allow a minimum of 12" inches above, 6" inches in front, and 3" inches below of clearance from piping, conduits, ductwork, etc.
- C. Submittal drawings, in the form of 8 1/2" inch by 11" inch catalog cut sheets, shall be provided for the following items: cable tray, fittings, accessories, and load data.
- D. The cable tray shall not be loaded beyond 60% of the manufacturer's recommended load capacity.
- E. Coordinate cable tray installations with other trades.
- F. Where a new cable tray distribution system encounters an inaccessible area, install sufficient 4" inch EMT sleeves through the area so that cabling does not exceed a 40% fill ratio.
- G. Where the cable tray is exposed below the ceiling and is accessible to the public, install the appropriate solid bottom and cover inserts to conceal cables.
- H. Install the appropriate cable tray waterfalls and/or cable exits where large quantities of cables exit the distribution system.
- I. Install one 1 1/4" inch plenum-rated inner duct for each optical fiber cable specified in all cable tray installations, except where Interlocking Armored Optical Fiber is installed.
- J. Label optical fiber inner ducts at every start and end point and on each wall with preprinted caution labels that indicate optical fiber cables and describe the size and termination points of the installed cable. Labels must be yellow with black text and waterproof.

3.7 COMMUNICATIONS ROOM CABLE TRAY SYSTEM

- A. TR cable tray shall completely wrap all walls within the room.
- B. The cable tray shall extend over all equipment racks.
- C. The cable tray shall be a minimum width of 18" inches or such width to support cables with a 60% growth allowance.
- D. Typical cable tray installations will be at nine feet AFF or one foot above equipment racks.
- E. Bond and ground cable tray system to equipment racks using manufacturer approved methods and products.
- F. See section 2.8 Cable Trays - Ladder Type.

3.8 JUNCTION BOX REQUIREMENTS FOR STATION CONDUITS

- A. If the station conduit route exceeds the 180° of total bends limitation, an appropriately sized junction box is required within a straight section of the conduit run.
- B. A junction box shall not be used in place of a bend. All junction boxes in station conduit paths shall be installed within a straight section of the conduit run.

C. Junction Box Requirements for Station Cables.

JUNCTION BOX REQUIREMENTS FOR STATION CONDUITS			
Conduit Size	Size of Box		
	Width	Length	Depth
3/4"	4"	4"	3.5"
1"	4-11/16"	4-11/16"	3.5"
1 1/4"	6"	6"	4"
1 1/2"	6"	6"	4"
2"	8"	8"	4"
2 1/4"	12"	12"	6"
2 1/2"	12"	12"	6"

3.9 FIRESTOP

- A. Telecommunications pathways requiring fire-stopping shall utilize UL-listed re-enterable fire-stopping assemblies. See Section 2.11 Firestop (Hilti, STI, or Wiremold).
- B. In all buildings, floor/ceiling assemblies, stairs, and elevator penetrations shall be sealed with a 2-hour fire stop assembly at a minimum, unless otherwise noted.
- C. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction. Fire-rated construction is to be verified with Owner. All fire-stopping penetrations must be photographed and labeled with the UL1479 or ASTM E814 reference number, dated, and signed by the technician who installed the fire-stopping material. Submit firestop documentation to the Architect or Engineer before the final electrical inspection.

END OF SECTION**27 0528.2**

SECTION 27 0553**IDENTIFICATION FOR COMMUNICATIONS SYSTEMS****PART 1 - GENERAL****1.1 SCOPE OF WORK**

- A. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the labeling of the telecommunications infrastructure as described on the Drawings and/or required by these specifications.
- B. The University intends to create a Class 3 system of administration as per current ANSI/TIA/EIA 606 Standards. As such, all elements must be labeled with unique identifiers as described in the following sections. Labels shall be color coded as per TIA/EIA 568 Standards.
- C. This section includes minimum requirements for the following:
 - 1. Labeling Communications Cabling
 - 2. Labeling Closet Hardware
 - 3. Labeling Work Stations

1.2 RELATED SECTIONS

270528.1	PATHWAYS FOR COMMUNICATION SYSTEMS
270528.2	PATHWAYS
270553	IDENTIFICATION FOR COMMUNICATION SYSTEMS
271116	CABINETS, RACKS, FRAMES, AND ENCLOSURES
271119	TERMINATION BLOCKS AND PATCH PANELS
271323	FIBER OPTIC BACKBONE CABLING
271523.1	FIBER OPTIC CABLING
271523.2	FIBER OPTIC HORIZONTAL CABLING
271543	FACEPLATES AND CONNECTORS
272133	DATA COMMUNICATIONS WIRELESS ACCESS POINTS

PART 2 - PRODUCTS**2.1 LABELS**

- A. The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read.
- B. All labels are to be mechanically printed, no hand-printed labels are allowed for any component.
- C. Labels should be visible during the installation of and normal maintenance of the infrastructure. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat, or ultraviolet light) and should have a design life equal to or greater than that of the labeled component.
- D. Provide vinyl substrate with a white printing area and black print. If the cable jacket is white, provide a cable label with a printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.
- E. Labels shall be flexible vinyl or other substrates that apply easily and flex as cables are bent.

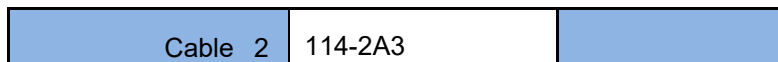
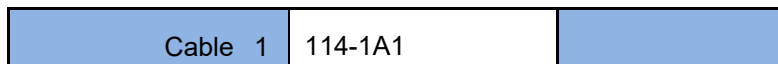
- F. Labels shall use aggressive adhesives that stay attached even to the most difficult jacketing.

PART 3 - EXECUTION

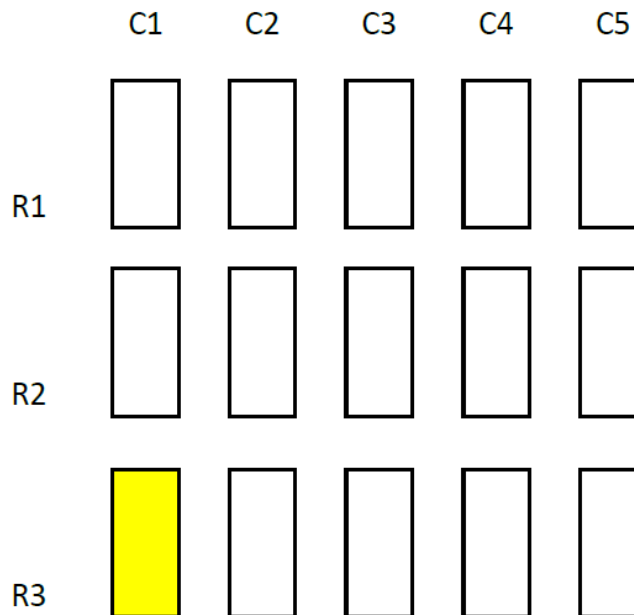
3.1 LABELING INSTALLATION

A. Horizontal Copper Cable Labeling:

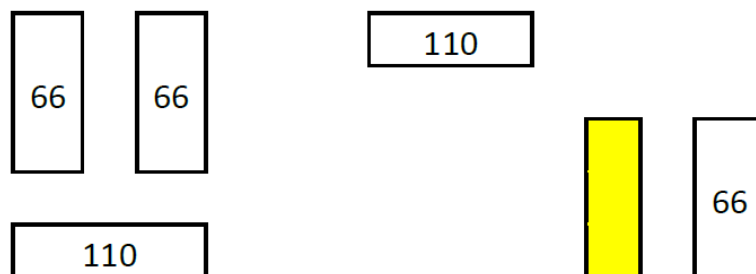
1. All horizontal cables shall be labeled with self-laminating marking tape, Brady ID-Pro labeler, Panduit LS7 labeler, Rhino, or equivalent labeling system. Identification shall be as follows:
2. At the TR end, the cables shall be labeled with the location of where the other end of the cable is terminated including room number, TO number, and jack position. Place a label on a visible part of the cable within 6 inches of the termination point for ease of identification after termination.
 - a. Example: Two cables going to room 114, first TO, first jack position would be labeled as 114-1A1. The second cable in the second TO, and the third jack position would be 114-2A3.



3. At the TO end, the cables shall be labeled 4 inches from termination with the following: Data. TR. Rack. Patch Panel. Port. This shall be visible by removing the outlet cover plate.
 - a. Example: Data, TR Room 114, rack 1, patch panel 1, port 03 would be: D.114. 1.1.03.
 - b. For voice cabling in an older building with separate voice closets and no patch panels, include the TR and as much information as practical such as column, row, block number, and port number or pairs.
 - i) Example: TR room 105, on a 66 block in the first column, third row down, port 4 would be: V.105.1.3.04



- ii) Example: TR room 105, no discernable pattern of columns or rows or ports, and/or mixed environment of 110 and 66 blocks, the label could be: V.105.E wall.24/25.



4. For CATV coaxial drop cables, at the splitter or tap, the cables shall be labeled with the location where the other end of the cable is terminated including room number, TO number, and jack position. If not collocated with a TO, indicate the room number at a minimum. Place a label on a visible part of the cable within 12 inches of the termination point for ease of identification after termination
 - a. Example: A cable going to room 114, first TO, sixth jack position would be labeled as C.114.1A6.
 - b. Generally speaking, coaxial cables will be in the sixth position when collocated with a standard TO.
5. For coaxial cables at the TO, they shall be labeled 4 inches from termination with the words "From Room" and the room number where the splitter or tap is. This shall be visible by removing the outlet cover plate.
 - a. Example: Room 115 would simply be: From Rm. 115.



B. Telecommunications Outlet (TO) Labeling Scheme:

1. TO's are labeled alphanumerically in a clockwise rotation around the room. Typically, the first TO located to the left of the main entrance of the room is labeled 1A, followed by 2A, 3A, etc. Where two entrances are present, designate one as the main entrance and label it accordingly.
 - a. The intent is to have unique identification for each TO. The starting point and nomenclature of the TOs are irrelevant to the location inside the room.
2. Floor box TOs shall be prefaced with "FB" to read FB1A, FB2A, etc. Wireless Access Point TO's in ceilings are to be prefaced with "WAP" to read WAP1, WAP2, etc. Elevators shall be prefaced with "Elev" to read Elev1. Audio Visual Projectors are to be prefaced with "AV" to read AV1.
3. On subsequent TO installations, the TO will be labeled alphanumerically depending on the new TOs location. If the new TO is between 1A and 2A, the new TO would be labeled as 1B. If another one is later added between 1B and 2A, it would be labeled 1C. If it is after the last TO in the room, 3A, it would be labeled:



4. Seek clarification from the Owner for any labeling issues that arise.

C. Faceplate Labels:

1. Faceplates will be labeled using the plastic insert to cover a printed identification tag. Each of the 2 labels in a faceplate is meant to have 2 lines for a total of 4 individual lines per faceplate.
2. The TO label will vary slightly depending on whether a unified cabling platform is used where all cables go to one TR, or separate voice and data closets are used.
3. See addendum 1 for an example of labeling on a faceplate.
4. See addendum 2 for an example of labeling on a faceplate with unified cabling.
5. See addendum 3 (1) for an example spreadsheet in MS Excel with dimensions for the labels.
 - a. Line 1 contains the preface "D" for Data, the specific TR, rack, patch panel, and the range of ports used for termination. In the case of separate voice and data closets, only the data information is conveyed here.
 - i) Example: For cables going to TR Room 114, rack 1, patch panel 1, ports 3-5, line 1 would read: D.114.1.1.03/05.
 - b. Line 2 also contains information regarding where cables are terminated in the closet but is used for subsequent cable installations to that specific TO.
 - i) Example: Another 3 cables were added to the same TO at a later date. For cables that go to TR Room 114, rack 3, patch panel 3, ports 22, 23, and 24, line 2 would read: D.114.3.3.22/24
 - c. Line 3 is only used if separate voice and data closets are being used. Line 3 contains the preface "V" for Voice, the TR, and the TO number and jack position.
 - d. Line 4 is the unique identifier for the TO.

D. Horizontal 110 and 66 Block Labeling for voice:

1. For 110 blocks, if the cables are for room terminations label the space for the port with the room number, TO, and jack position.
 - a. Example: A cable going to room 114, first TO, first jack position would be labeled as 114-1A1. A cable in the second TO, and third jack position would be 114-2A3.
2. For 66 type blocks, if the cables are for room terminations tag the cable with the room number, TO, and jack position with a loose paper tag with a string that is easily accessible and readable.
 - a. Example: A cable in room 114, first TO, first jack position would be labeled as 114-1A1. A cable in the second TO, and third jack position would be 114- 2A3.
3. If the 110 block is for the tie cable between the voice patch panel in the rack and the wallboard, label the space corresponding to the port with the rack, patch panel, and port information as per section 4.01.E.2. For tie cables between the rack and wallboard a 110 block shall be used.
 - a. Example: Rack 1, patch panel 1, would be: Rack1 Voice PP1.
 - b. See addendum 3 (2) for an example label.

E. Patch Panel Labeling:

1. For station cabling going to a TO, label each port on the patch panel with the room number, TO, and jack position.
 - a. Example: A cable in room 114, first TO, first jack position would be labeled as 114-1A1. A cable in the second TO, and third jack position would be 114- 2A3.
2. Example: A cable going to a floor box TO labeled FB1A in room 114 in the second jack position would be labeled as 114-FB1A2 For voice patch panels connected to a 110 block within the TR, label each port on the voice patch panel with the corresponding 110 block source information as per section 4.01.D.3.

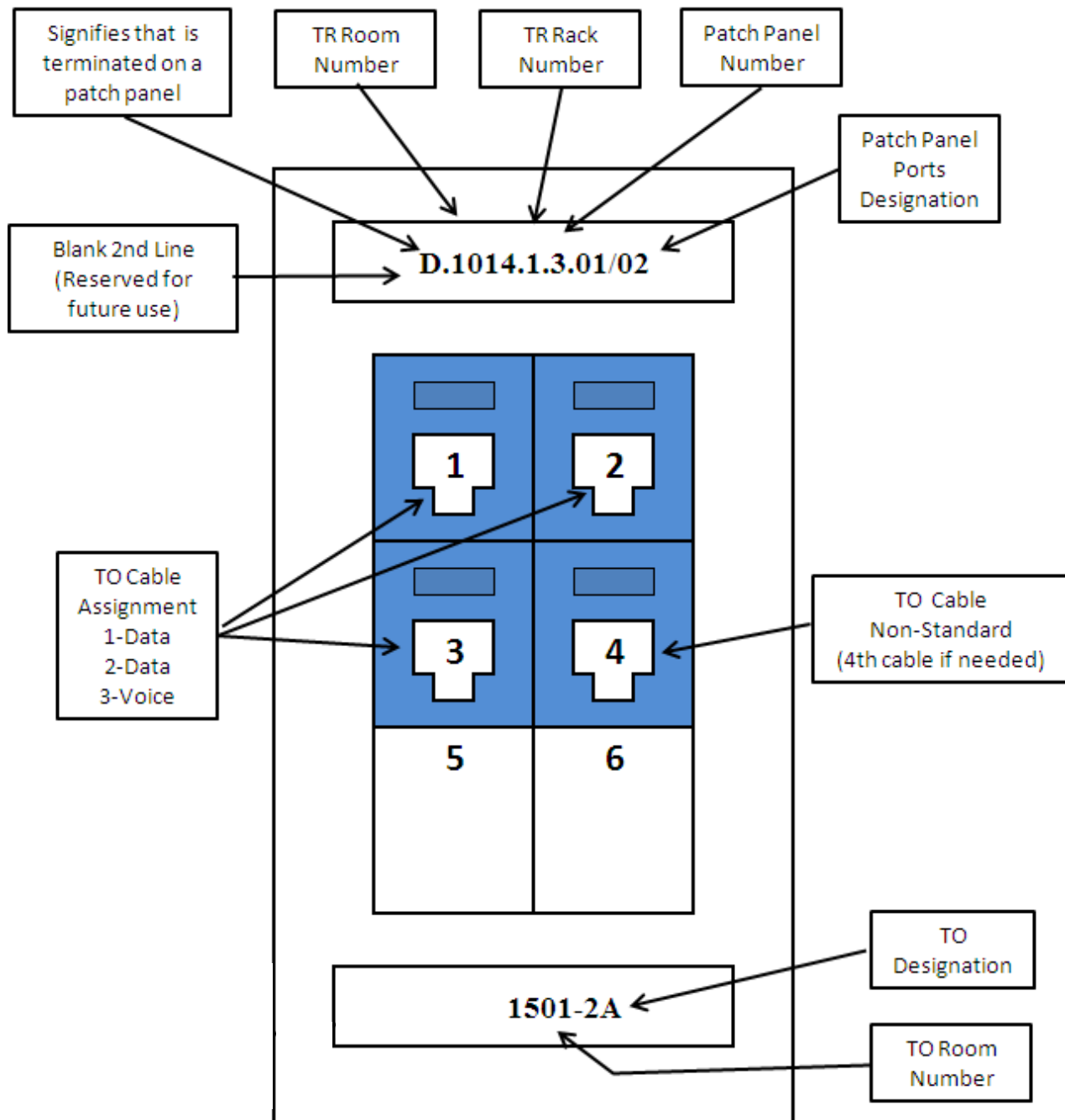
- a. Example: A 110 block in the first column, third row down, port 4 would be: 1.3.04
3. Due to the amount of space allocated for TO designation on patch panels, place the room number on top and TO on the bottom.
 - a. See addendum 3 (3) for an example label.
- F. Equipment Room:
 1. Equipment Racks shall be labeled with a one-inch self-laminating marking tape, Brady ID-Pro labeler, Brother P-touch labeler, Rhino, or equivalent labeling system at the base of the rack. Starting in front of the equipment rack, left to right, identification shall be as follows: Rack 1, Rack 2, and Rack 3.
 2. All patch panels shall be labeled with a 3/8 inch self-laminating marking tape, Brady ID-Pro labeler, Brother P-touch labeler, or equivalent labeling system. Starting from top to bottom in sequence. Place the label on the left side of the patch panel vertically, identification shall be as follows: PP 1, PP 2, PP3, and so on.
- G. Vertical/Riser/Intrabuilding Copper Cable Labeling:
 1. All riser cables shall be labeled with self-laminating marking tape, Brady ID-Pro labeler, Panduit LS7 labeler, Rhino, or an equivalent labeling system.
 2. At the TR, the copper riser cables shall be labeled with from/to, cable count, and pair information on both ends. Place a label on a visible part of the cable close to the wiring block for ease of identification after termination.
 - a. Example: From ER B065 to TR 114, first of 2, 100 pair cables would be: ER B065 to TR114 1-100. The second 100-pair cable between the rooms would be ER B065 to TR114 101-200.
 3. Label cabling on each side of wall penetrations.
- H. Vertical/Riser/Intrabuilding Fiber Cable Labeling:
 1. All riser cables shall be labeled with self-laminating marking tape, Brady ID-Pro labeler, Panduit LS7 labeler, or equivalent labeling system. Identification shall be as follows:
 2. At the TR, the fiber riser cables shall be labeled with from/to, fiber type, and fiber count on both ends. Place a label on a visible part of the cable and innerduct close to the fiber distribution unit (FDU) for ease of identification after termination.
 - a. Example: From ER B065 to TR 114, the first cable would be: ER B065 to TR114 24SM/24MM.
 - b. If a second fiber bundle between the rooms is installed with the same fiber count, place an (F2) and the end of the label.
 - i) Example: From ER B065 to TR 114, the second cable, would be: ER B065 to TR114 24SM/24MM. (F2)
 3. Label cabling on each side of wall penetrations.
- I. Vertical/Riser/Intrabuilding 110-Block Labeling:
 1. At the ER and TR, voice riser cables are terminated on their respective 110 blocks. Label each pair on each row of 110 blocks with the matching pair count information.
 2. Place the entire cable label of "from/to" in the center of the 110 block label as per section 4.01.G.
 3. See addendum 3 (4) for an example label.
- J. Coax Trunk Labeling (CATV):
 1. CATV coaxial trunk cables shall be labeled at each termination point with information indicating the location of the next termination point of the cable, such as an amplifier, DCT, splitter, or tap.
- K. Vertical/Riser/Intrabuilding and Campus Fiber FDU labels:

1. Labels shall indicate the type of fiber (single mode or multi-mode 50µm or 62.5 µm), "from/to" information, pair count, loss for each strand, and length of cable.
 2. See addendum 3 (5) for an example label.
- L. Interbuilding/Campus/Backbone Copper and Fiber Cable Labeling:
1. All interbuilding cables shall be labeled permanently with "from/to" information, cable type and size, installation date, and installing contractor at each end.
 - a. Example: From Bldg. 256 to Bldg. 203, a 200-pair copper cable, installed by Lobo Enterprises on September 22, 2008, would be: From Bldg. 256 to Bldg. 203 (200 Pair) Lobo Enterprises 9/08.
 - b. An as-built is to be provided to Owner of which manhole and pull-boxes the cable passes through. Provide butterfly drawings after installation is complete.

ADDENDUMS TO FOLLOW

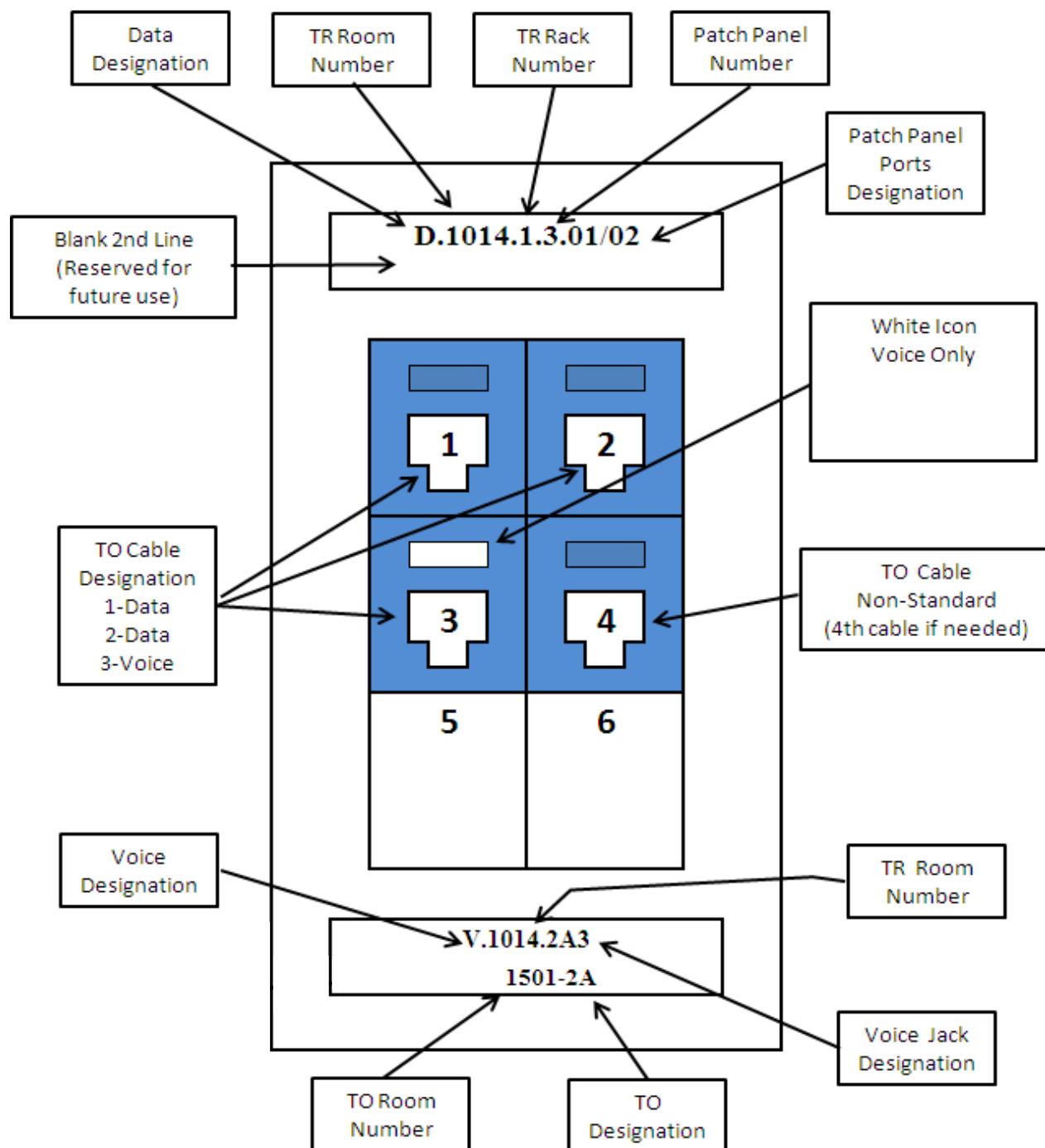
Addendum 1

Telecommunications Outlet Unified Labeling Scheme



Addendum 2

Telecommunications Outlet Labeling Scheme



Addendum 3 (1)

MS Excel with dimensions for the TO labels. Dimensions: Row = 16, Column = 21, Font Arial 11

Alignment: Rows 1 and 3 vertical bottom, horizontal center Alignment: Rows 2 and 4 vertical top, horizontal center

1	D.101.1.1.12/13 D.101.1.2.03	D.101.1.1.14/15	D.101.1.1.16/17 D.101.1.2.04	D.101.1.1.18/19
2				
3	V.101.1A3 255-114-1A	V.101.2A3 255-114-2A	V.101.3A3 255-114-3A	V.101.4A3 255-114-4A
4				

Addendum 3 (2): 110 block labeling for voice patch panels.

1-1	1-2	2-1	2-2	3-1	3-2	4-1	4-2	5-1	5-2	6-1	6-2	7-1	7-2	8-1	8-2	9-1	9-2	10-1	10-2	11-1	11-2	12-1	12-2		
Rack 1 Voice P/P 1																									
13-1	13-2	14-1	14-2	15-1	15-2	16-1	16-2	17-1	17-2	18-1	18-2	19-1	19-2	20-1	20-2	21-1	21-2	22-1	22-2	23-1	23-2	24-1	24-2		

Addendum 3 (3): Patch panel labeling.

B110 3A3	B110 3A4	B110 4A1	B110 4A2	B110 4A3	B110 4A4	B120 1A1	B130 1A1	B140 1A1	B140 1A2	B150 3A1	B150 4A1
B100 Elev 1A1	B100 Elev 2A1	B100 Elev 3A1	B100 Elev 4A1	B100 Elev 5A1	B100 Elev 6A1	Timeclock 1A1	Timeclock 1A2	Timeclock 2A1	Timeclock 2A2	B110 WAP1A1	B110 WAP1A2

Addendum 3 (4): Copper riser labeling

001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016	017	018	019	020	021	022	023	024	025	
001-200								ER B110 to TR B220 - C01, 001-100																	
026	027	028	029	030	031	032	033	034	035	036	037	038	039	040	041	042	043	044	045	046	047	048	049	050	

051	052	053	054	055	056	057	058	059	060	061	062	063	064	065	066	067	068	069	070	071	072	073	074	075	
001-200								ER B110 to TR B220 - C01, 001-100																	
076	077	078	079	080	081	082	083	084	085	086	087	088	089	090	091	092	093	094	095	096	097	098	099	100	

Addendum 3 (5): High pair count labeling

001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016	017	018	019	020	021	022	023	024	025
001-1800																								
026	027	028	029	030	031	032	033	034	035	036	037	038	039	040	041	042	043	044	045	046	047	048	049	050
051	052	053	054	055	056	057	058	059	060	061	062	063	064	065	066	067	068	069	070	071	072	073	074	075
001-1800																								
076	077	078	079	080	081	082	083	084	085	086	087	088	089	090	091	092	093	094	095	096	097	098	099	100

Building Name: _____

Workorder: _____

Building #: _____ Wiring Closet Room #: _____

Company: _____

Date: _____ Key Code: _____

Technician: _____

Room #	Plate	1	Port	2	Port	3	Port	4	Port	5	Port	6	Port
1012	1A	D.1.4.08		D.1.4.09		D.1.4.10							
1013	1A	D.1.4.11		D.1.4.12		D.1.4.13							
1014	1A	D.1.4.14		D.1.4.15		D.1.4.16							
1014	2A	D.1.4.17		D.1.4.18		D.1.4.19							
1014	2B	D.1.4.20		D.1.4.21		D.1.4.22							
1014	3A	D.1.4.23		D.1.4.24		D.1.4.25							

END OF SECTION

27 0553

SECTION 27 0800**COMMISSIONING AND ACCEPTANCE****PART 1 - GENERAL**

- A. This section intends to establish complete service requirements for inspection, testing, verification, and documentation of telecommunications infrastructure, cabling, and equipment following these specifications and applicable Owner requirements and codes.
- B. This specification includes requirements for all types of commissioning including continuous commissioning, milestone monitoring, acceptance commissioning, third-party verification, internal commissioning, acceptance, and network operability, depending upon the project's requirements.
- C. It includes the commissioning of all types of telecommunications infrastructure work including but not limited to structured cabling systems, network analysis, optical fiber cabling systems, coaxial cabling systems, outside plant cable, duct banks, multiduct, trenches, maintenance holes, and aerial pole line distribution.
- D. The Contractor, designated agent, or employee is held responsible to be familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation.

1.1 SCOPE OF WORK

- A. All services will be contracted and will be considered to be part of the project scope and budget. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and test equipment unless otherwise specified to verify compliance.

1.2 QUALIFICATIONS

- A. The Contractor shall send only fully qualified personnel to perform work under this section of work.
 - 1. The contractor shall have a fully qualified (RCDD or equivalently qualified) IT Commissioning Agent overseeing operations for the project.
 - 2. Any licensing requirements shall be fulfilled for all work.
 - 3. The Contractor shall provide, a complete list of personnel proposed to perform the work, listing their qualifications and experience with the type and size of work required by the project.
 - 4. Each Technician, Journeyman, and Equipment Operator will have a minimum of five (5) years of experience with all applicable telecommunications systems.
 - 5. The commissioning agents shall be certified by the manufacturer of the testing equipment used to perform the commissioning of the project.

PART 2 - PRODUCTS**2.1 PRODUCTS STANDARD**

- A. All work performed and commissioned shall be done following the most current version and requirements of the following references:
 - 1. Division 26 Electrical Division
 - 2. Division 27 Communications Systems
 - 3. BICSI Wireless Design Manual

4. BICSI Customer-Owned Outside Plant Design Manual
5. BICSI Telecommunications Distribution Design Manual
6. TIA Standards: 568, 569, 607, 758
7. National Electrical Code.
8. National Electrical Safety Code
9. Related NFPA Codes and Standards
10. Underwriters Laboratories or approved Testing Lab.
11. The manufacturer's specifications, installation, and warranty requirements.
12. The project plans and specifications.

PART 3 - EXECUTION

3.1 Commissioning Contractor Requirements

- A. **The IT Commissioning Contractor must be approved by the Owner to provide this service for communications projects both on and off campus.**
- B. The Owner owns, operates, and maintains copper and optical fiber cable distribution systems, structured cabling systems, infrastructure, and networks serving its Campuses. The Owner's building consists of voice and data networks, structured cabling systems, copper and optical fiber inter and intra- building cabling and infrastructure systems, wireless, voice, and data systems, and other support facilities.
- C. Because of the nature of many of the occupancies in the buildings, the efficient operability of voice and data networks is critical to the operations. The efficiency of voice and data networks cannot be verified until the network is operating at its highest potential or has undergone complete testing and verification under the Commissioning Specification Standard, third party verification and acceptance of voice and data facilities are necessary to provide guarantee of a system's optimal performance.
- D. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, test equipment, deficiency reports, and other requirements specified in the project plans and procurement documents.
- E. The cabling Contractor shall provide any field and verification reports, photographs, test reports, inspections, punch list, or other items and documentation identified in this section as requested by the Owner.
- F. The Contractor shall have the ability to provide complete testing and verification capabilities.
- G. All test equipment shall be certified and calibrated to meet manufacturers' requirements and meet the performance requirements of Underwriter's Laboratories (UL), ETL – SEMKO, the manufacturer's systems specifications/requirements, and most current TIA/EIA standards as it applies to the specified testing application.
- H. Each Contractor shall be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate their work with other trades.
- I. All work performed in occupied spaces shall be in a manner that allows the owner to operate the existing facilities continuously.
- J. All user outages, including wireless access points, shall be submitted to the Owner and Architect/Engineer for approval two weeks before starting work that will affect user connectivity.
- K. The Contractor is required to obtain all permits from the proper jurisdictions for all work associated with this specification.

- L. The Contractor is to provide to the Owner all reports, documentation, and test results at substantial completion in an approved format.
- M. All work performed or verified must be compliant with the Owner's Guide Specifications, and Design Guidelines and follow the installed product's manufacturer's instructions and procedures.
- N. The Owner shall provide technical assistance in identifying/specifying commissioning and testing requirements as they pertain to the specific project.
- O. The Owner will provide access to the buildings, premises, or facilities. In addition, the Contractor may obtain keys to the buildings and certain areas within them on an "as-needed" basis from the Owner. The Contractor is responsible to obtain all training and badges required to perform the work.
- P. The Commissioning Contractor shall arrange directly with the project's contractors for site access not controlled directly by the Owner. The Owner will assist the Contractor in obtaining access to these areas when needed.
- Q. The Owner will assist in obtaining entry/access to equipment rooms, tunnels, and facilities.
- R. The work under this contract shall consist of furnishing materials; test equipment and qualified labor to test, evaluate, and document communications layer one system throughout.
- S. The Commissioning Agent shall provide certified structured cabling system technicians on-site to perform operations related to the testing and evaluation.
- T. The Contractor is to commit to all listed and applicable standards including current Technical Service Bulletins (TSBs) and addendums.
- U. The Commissioning Agent shall deliver the following test and reports as specified in the work order for the project:
 - 1. Provide Field Verification and Deficiency Report(s), photographs, and installation evaluations of the structured cabling system's infrastructure and spaces. Verify to the most current versions of ANSI/TIA 569, the Specifications and References, Standards, the National Electrical Code, applicable codes/ordinances, the structured cabling manufacturer's warranty requirements, the infrastructure system's manufacturers specifications, and the project specification and drawings.
 - 2. Provide Field Verification and Deficiency Report(s), photographs, and installation evaluations of the structured cabling. Verify the most current versions of ANSI/TIA 568, the Specifications and References, Standards, test using the TIA 568 link performance requirements, the National Electrical Code, applicable codes/ordinances, the structured cabling manufacturer's warranty requirements, the cabling systems system's manufacturer's specifications, and the project specifications and drawings.
 - 3. Provide Field Verification and Deficiency report (s), photographs, and installation evaluation of the grounding and bonding system to TIA 607, Specifications and Guidelines, the National Electric Code specification, and drawings. Include verification of ohms of resistance at all ground bars.
 - 4. Provide Field Verification and Deficiency report (s), photographs, and installation evaluation of labeling for installed systems, infrastructure, facilities, and equipment according to the manufacturer's warranty requirements, specifications and guidelines, and the project's specification and drawings.
 - 5. Provide Network Verification and Deficiency report (s), including but not limited to: Network Service Availability, Ethernet Utilization and the presence of network error, port identification, verify link connectivity, verify Power Over Ethernet, service activation documentation, troubleshooting link and, and other network performance and documentation testing as per the manufacturer's specifications or as specified.

6. Provide Field Verification and Deficiency report (s), photographs, and installation evaluation of the outside plant copper and optical fiber cable, facilities, and infrastructure to EIA/TIA 758 BICSI Customer Owned Outside Manual Plant Manual, specifications and guidelines, the National Electrical Code, National Electrical Safety Code, applicable codes/ordinances, the structured cabling systems manufacturers warranty requirements, the infrastructure system's manufacturers specifications, cable systems manufacturers specifications, and the project specification and drawings. Include the following in-field verification.
 - a. Neat and workman-like manner
 - a. Installation evaluation
 - b. Placement
 - c. Conduits and seals
 - d. Multiducts
 - e. Labeling
 - f. Trench
 - g. Copper cable
 - h. Optical Fiber cable
 - i. Splices – bonding, color coding, neatness, fold back, etc.
 - j. Splice cases instructions
 - k. Manholes and apparatus
 - l. Pole setting and hardware
 - m. Grounding and bonding
 - n. Waterproofing compound
 - o. Cleanup & Restoration
7. Provide Field Verification and Deficiency report(s), photographs and installation evaluation of fire-stopping.
 - a. Verify proper use of listed applications to applicable codes
 - b. Verify photographs
 - c. Verify labeling
 - d. Verify submittals
8. Testing of the Optical Fiber
 - a. Test to all TIA/EIA specifications on all wavelengths.
 - i) TIA-526-7 for single mode fiber
 - ii) TIA-526-14 for multimode fiber
9. A test sample of structured cabling. Include in reports all test results, not only pass/fail using the current Fluke tester and software.
 - a. Category 6-testing as specified and providing test equipment specified and/or approved by the Owner or the Architect/Engineer.
 - b. Category 6 Augmented F/UTP – testing as specified and providing test equipment specified and/or approved by the Owner or the Architect/Engineer. Comparison of sample testing to contractor test results
10. Provide testing of outside plant copper cable pairs and grounds including:
 - a. Line mapping result: Pass/Fail
 - b. Proper wiring configuration for cable pairs and bundles
 - c. Open conductors – provide
 - d. Footage for failures
 - e. Split pairs
 - f. Reversed pairs

- g. Shorts – provide ohms & provide loop resistance in ohms
- h. Grounds – provide ohms & distance to fault on failures
- i. Crossed pairs
- j. Sheath and ground rod resistance test in ohms
- 11. Provide all test results in the following format.
 - a. Two (2) – paper copies bind in notebook form
 - b. Two (2) – electronic formats on a Thumb drive
 - c. Provide test results in EXCEL Format
- 12. Evaluate project drawings and specifications to determine and report deficiencies in the design.
- 13. Verify red lines (as-builts to submittals) to installation to determine and report deficiencies.
- V. Scheduling: Work performed under this Contract shall usually be performed during normal working hours (8 A.M. to 5 P.M.) and on normal working days, Monday through Friday, unless otherwise specifically requested and authorized by a duly designated agent of the Owner (See paragraph F. below). The contractor shall make every attempt to schedule the work so as not to interfere with the operations of the affected project, department, or user(s).
- W. Designated agent/designee: The name(s) of such duly designated agent(s) shall be supplied to the Contractor within ten (10) days after the date of Contract award.
- X. Work request: The Contractor shall be authorized to perform work through the issuance of a Work Order, executed proposal, or other written order issued by the duly designated agent(s) of the University. The order will specify the work location and a general description of the problem or work to be performed. The designee will also provide a briefing on the work to be performed. A copy of the work order authorization, reports, photographs, and drawings must be submitted with any invoice for payment and must be signed/authorized by the Owner.
- Y. Emergency Response: If the work is classified by the Owner's designee as an "Emergency Request", such work will be scheduled by the Contractor at once and shall automatically authorize the Contractor to perform overtime work if the work must be performed during non-standard working hours. Response to "Emergency Work" shall be immediate and shall be handled following this paragraph and the General Conditions.
- Z. Identification; while working on campus, all of the Contractor's employees are to wear identification cards in addition to uniforms, badges, etc. as required by the Owner, indicating the Company and preferably the employee's name. The commissioning agent and their representatives shall be attired professionally with the company's name and logo.
- AA. The Commissioning Agent and their representatives shall provide all personal protection equipment as required by the project.

END OF SECTION

27 0800

SECTION 271116**CABINETS, RACKS, FRAMES, AND ENCLOSURES****PART 1 - GENERAL****1.1 SCOPE OF WORK**

- A. The Contractor are held responsible to be familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation. The approved vendor or designated agent is held responsible to be familiar with the provisions contained herein and is assumed to possess the knowledge, manpower, and material to the completion of the installation.
- B. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation of the Information Technology Cabinets, Racks, Frames and Enclosures described on the Drawings and/or required by these specifications.
- C. The extent of the Information Technology Cabinets, Racks, Frames, and Enclosures Installation (The Project) will be as shown in the project drawings or as specified.

1.2 RELATED SECTIONS

- A. The project's architects, engineers, contractors, manufacturers, and designers are responsible to be knowledgeable about the provisions contained within the following and other related sections of these standards of the Owner's IT department as they apply to the completion of the project's installation and design.
 - 1. Division 26 Electrical.
 - 2. Division 27 Communications.
- B. Design, manufacture, test, and install the project's data cabling systems following the Owner's guidelines and standards, industry standards, and manufacturer's requirements and following NFPA 70 (National Electric Code), state codes, local codes, requirements of authorities having jurisdiction, and particularly the most recent editions of the following standards and specifications.
 - 1. Design Guidelines and Standards
 - 2. National Fire Protection Association
 - 3. National Electrical Code
 - 4. National Electrical Safety Code
 - 5. This Technical Specification and Associated Drawings
 - 6. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises, and its published addenda
 - 7. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard, and its published addenda
 - 8. ANSI/TIA-568-C.2, Copper Cabling Components Standard, and its published addenda
 - 9. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard, and its published addenda
 - 10. ANSI/TIA/EIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces, and its published addenda
 - 11. ANSI/TIA/EIA-606-A, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, and its published addenda

12. ANSI/J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, and its published addenda
13. Building Industries Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM)
14. ANSI/TIA-942, Telecommunications Infrastructure Standard for Data Centers, and its published addenda
15. Product manufacturer's published specifications and instructions
16. BICSI TDMM and associated standards

PART 2 - PRODUCTS

2.1 PRODUCTS EQUIPMENT FRAMES

- A. Approved four-post equipment racks (frames) are:
 1. Chatsworth Adjustable Quadra Rack™, 4-Post Frame for data equipment black unless otherwise specified.
 2. Frames shall be manufactured from aluminum and/or steel extrusion.
 3. Each frame will have two L-shaped top angles, two L-shaped base angles, a top and bottom pan, and four C-shaped equipment-mounting channels (a front and rear pair). The rack will assemble with nut and bolt hardware. The base angles and bottom pan will be pre-punched for attachment to the floor. The top pan will be pre-punched for attaching the ladder rack with J-bolts.
 4. Frames shall be manufactured from aluminum and/or steel extrusion and sheet.
 5. Each frame will have two L-shaped top angles, two L-shaped base angles, a top and bottom pan, and four C-shaped equipment-mounting channels (a front and rear pair). The rack will assemble with nut and bolt hardware. The base angles and bottom pan will be pre-punched for attachment to the floor. The top pan will be pre-punched for attaching the ladder rack with J-bolts.
 6. Equipment mounting channels will be 3" deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern to provide 45 rackmount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.
 7. When assembled with top and bottom pans and angles, equipment-mounting channels will be spaced to allow attachment of 19" EIA rack-mount equipment. Attachment points will be threaded with 12-24 roll-formed threads. The frame will include assembly and equipment-mounting hardware. Frames will include 100 each combination pan head, pilot point, and mounting screws.
 8. The assembled frame will measure 19"w X 29" D X 7'. There will be 29" between the front and rear mounting surfaces of the two pairs of mounting channels. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the frame or for frame-to-frame or frame-to-rack baying (frames must be able to bay with a 2-post relay rack). Special Part number TS1051925 includes 4 post racks, a Horizontal Ground bar, and Rack Isolation Kit. Black is the standard color, but other colors may be requested.
 9. The frame will be rated for 2,000 lb. of equipment.
 10. The finish is standard Black.
- B. Approved two post equipment racks (frames) are:
 1. Chatsworth Universal Rack™, free-standing, 2-post rack, 19" inch x 7 feet high black when specified by the Architect or Engineer.
 2. Install 2 post free-standing racks when specified and approved by the Architect or Engineer.
 3. Racks shall be manufactured from aluminum and/or steel extrusions.

4. Each rack will have two L-shaped top angles, two L-shaped base angles, and two C-shaped equipment-mounting channels. The rack will assemble with bolt hardware. Equipment-mounting channels will be threaded for easy assembly. The base angles will be pre-punched for attachment to the floor.
 5. Equipment mounting channels will be 3" deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern to provide 45 rackmount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.
 6. When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19" EIA (or 23" only when specified and approved by the Owner) rack-mount equipment. Attachment points will be threaded with 12-24 roll-formed threads. The rack will include assembly and equipment-mounting hardware. Each rack will include 50 combination pan heads, and pilot point mounting screws.
 7. The assembled rack will measure 7' (84") high, 20.3" wide, and 15" deep. The sides (webs) of the equipment-mounting channels will be punched to allow the attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
 8. The rack will be rated for 1,500 lb. of equipment.
 9. The rack will be UL Listed.
 10. The finish shall be an epoxy-polyester hybrid powder coat in the color of black.
- C. Racks are to be joined vertically using the Chatsworth Global Vertical cabling solution part number 12831-703 (6") and/or 12834-703 (10") prior approved equivalent. One unit shall be installed on both sides of the racks.
- D. For racks mounted "slab on grade" use Chatsworth Rack Base Insulator Kit.
- E. The junction plate at top of the equipment frame shall be Chatsworth 10595-704.
- F. Equipment Cabinets and Wall Mount Equipment Cabinets as specified and only when approved by the Owner.
- G. Wall Mount Equipment Racks and Cabinets are permitted only with prior approval from the Owner.

2.2 VERTICAL WIRE MANAGEMENT

- A. A. Vertical Cable Management for Racks/Frames (CCS Combination Cabling Section)
1. Every rack/frame will have a minimum of one vertical cable manager plus one additional per row. The vertical cable manager will create a space for storing and organizing cables and patch cords along the side of the rack/frame. The cable manager will maintain separation between patch/equipment/jumper cords and premise cables.
 2. The cable manager will be 12831-703 (6") and/or 12834-703 (10") installations as per required.
 3. A single vertical cable manager shall be used in between bayed racks/frames.
 4. The vertical cable manager will match the height of the rack(s)/frame(s).
 5. The vertical cable manager will bolt to the side of racks/frames with included hardware.
 6. The manufacturer of the vertical cable manager will sell compatible racks/frames.
 7. The front cover will be removable.
 8. The front of the vertical cable manager will have cable openings along both sides of the trough. The openings will be formed by evenly-spaced T-shaped cable guides. The T-shaped cable guides will be made from a composite plastic material (not metal) and will have rounded edges to protect the cables. When the cable manager is attached to a rack/frame, each cable opening will align with a rack-mount space (RMU) on the rack/frame. Each opening will pass a minimum of 24 each .25" OD patch cords.
 9. The cable manager will be delivered individually boxed, and available in several widths as specified below and in the contract documents. 9. The vertical cable manager shall be

manufactured from sheet aluminum and composite materials. 10. Finish shall be a black epoxy-polyester hybrid powder coat paint. Edge protectors, T-shaped cable guides, and latch hardware are black. Channels, Double-Sided, 10" Wide x 84" High x 14.6" Deep, Black.

2.3 EQUIPMENT

- A. **THERE ARE NO NOTABLE EXCEPTIONS TO THE AFOREMENTIONED PRODUCT STANDARDS WITHOUT A WRITTEN CHANGE REQUEST SUBMITTED AND APPROVED BY THE OWNER.**

END OF SECTION

27 1116

SECTION 27 1119**TERMINATION BLOCKS AND PATCH PANELS****PART 1 - GENERAL****1.1 SCOPE OF WORK**

- A. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of termination blocks and patch panels as described on the Drawings and/or required by these specifications.

1.2 RELATED SECTIONS

- DIVISION 26 ELECTRICAL DIVISION
- DIVISION 27 COMMUNICATION SYSTEMS

PART 2 - PRODUCTS**2.1 GENERAL**

- A. The materials and products specified herein reflect the minimum acceptable standards of fabrication and manufacture. All materials and products supplied by the Contractor and specified herein are to be new, unused, of first quality, and in original packaging or shipping containers and match the provided cabling system or as shown on drawings and described in Item 3.01.
- B. New buildings and major renovations will be treated differently than existing buildings.
- C. Approved horizontal cabling systems include those manufactured by:
 - 1. Ortronics / Superior Essex
 - 2. Leviton / Berk-Tek
 - 3. Siemon / Siemon
 - 4. Or as specified by the Architect/Engineer
- D. In existing areas, cabling shall match the previously installed base cabling system, unless specified otherwise in project documents.
- E. New building construction and owner-approved large-scale renovations will utilize Category 6 and/or Category 6A F/UTP cabling and matching termination hardware. Contact the Owner's Facilities Manager for approval of cabling systems before installation. All Category 6 cabling shall be a minimum of 23 AWG. 110 Termination Blocks for Copper Cables shall only be used for horizontal special applications (elevators, alarms Code Blue, etc.) and riser/distribution copper applications.

2.2 110 TERMINATION BLOCKS

- A. The 110 termination system shall match the horizontal cabling system.
- B. The 110 termination system shall include a wiring block, standoff legs, and vertical and horizontal wire management on all sides of the termination blocks. The system shall also include six (6) C-4's for 4-pair cable installations, and five (5) C-5's for 25-pair wiring strips, and labels.
- C. Voice Patch Panels to be 8 position modular (8P4C), high density, 48 port, Pins (3, 4, 5, and 6), with Female Telco connectors. Connect patch panel with 25 pair tails terminating on 110 blocks.

- D. The connection between terminal blocks is installed with a cross-connect wire.

2.3 BUILDING ENTRANCE TERMINALS AND PROTECTOR BLOCKS

- A. Circa 1880 ECA (110 to 110 connection) or 1880 B (cable stub) Type Multipair Protector Panels installed with Circa C3B1S 5 pin digital fault protected units or approved equal. Install per manufacturer's instructions.
- B. The Contractor is required to confirm with the Owner before purchasing to ensure proper application for PBX and Equipment Room installations.

2.4 PATCH PANELS

- A. Install category-compliant modular patch panels black in color.
- B. In mixed-use applications (Category 6/Category 6A F/UTP) install modular F/UTP patch panels capable of supporting both applications.
- C. Voice grade patch panels to be 8 positions (8P4C) modular, high density, 48 port, Pins (3, 4, 5, and 6), with Female Telco connectors. Connect patch panel with 25 pair tails terminating on 110 blocks.
- D. The connection between terminal blocks is installed with a cross-connect wire.
- E. Wire and Cable Management
 - 1. Horizontal Wire Managers shall be black and 2 RU in size.
 - 2. Vertical Wire Managers shall be black, a minimum of 6" wide x 9.30" deep with a removable cover and shall also be compatible with the installed rack (CPI PN 12833-703 for reference).
 - 3. Cable support managers are required at the rear of all patch panels.

2.5 FIBER ENCLOSURES, FIBER DISTRIBUTION UNITS (FDUs)

- A. Rack Mounted FDU
 - 1. Shall be sized according to fiber strand count.
 - 2. FDUs shall be dedicated to each cable installed.
 - 3. No cables shall be added to an existing FDU without prior approval from the Architect/Engineer.
 - 4. Provide duplex LC coupler panels. Blue for SM, Aqua for 50um MM, and Beige for 62.5um MM.
 - 5. Provide FDUs manufactured to include the required splice trays to support up to a 48-strand optical fiber cable.
 - 6. Provide separate splice tray enclosures for all cables over 48-strand optical fibers.
 - 7. Provide fusible LC connectors or 1-meter simplex pigtail assemblies with LC connectors to match the installed optical fibers and splice at the FDU.
 - 8. Vertical Wire Managers shall be black, a minimum of 6" wide x 9.30" deep with a removable cover and shall also be compatible with the installed rack (CPI PN 12833-703 for reference).

PART 3 - EXECUTION

3.1 110 TERMINATION INSTALLATION

- A. The 110-termination installation shall meet the manufacturer's requirements and specifications to provide a 20-year warranty.
- B. The ER and TR shall contain wiring blocks as required to terminate all incoming pairs and all outgoing pairs to all TRs.

- C. Locate telephone wiring blocks on fire-treated plywood backboards as specified on the drawings or as specified herein.
- D. Labeling for riser cables shall designate the corresponding destination TR wiring block.

3.2 PATCH PANEL INSTALLATION

- A. The patch panel installation shall meet the manufacturer's requirements and specifications to provide a 20-year warranty.
- B. Each TR shall contain patch panels as required to terminate all pairs on its respective floor or floors served.
- C. Install patch panels in 19" inch equipment racks as specified on the drawings or as specified herein.
- D. Wire management is to be mounted at the top and bottom of station cabling equipment racks and between every patch panel.
- E. Install no more than eight (8), 48 port patch panels (voice and data) per rack.
- F. Include a vertical cable manager in between and on both sides of the equipment rack.
- G. Patch panels for areas with a TR too small for an equipment rack shall utilize wall-mountable cabinets to mount the Chatsworth horizontal wire management and patch panels

3.3 OPTICAL FIBER ENCLOSURES, FDU INSTALLATION

- A. The optical fiber enclosures and FDU installation shall meet the manufacturer's requirements and specifications to provide a 20-year warranty.
- B. Install rack-mounted fiber FDUs at the top of the equipment racks where applicable.
- C. Install 1 FDU per fiber bundle. No sharing of FDUs without prior approval from the Architect/Engineer.

END OF SECTION

27 1119

SECTION 27 1323**FIBER OPTIC BACKBONE CABLING****PART 1 - GENERAL****1.1 SCOPE OF WORK**

- A. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of fiber optic backbone infrastructure as described on the drawings and/or required by these specifications.

1.2 RELATED SECTIONS

- DIVISION 26 ELECTRICAL
DIVISION 27 COMMUNICATIONS SYSTEMS

1.3 COORDINATION

- A. The contractor shall coordinate the work specified in this Section with the work in other parts of the Contract document.
- B. Plans in general are diagrammatic. It is the full responsibility of the Contractor to be familiar with the location of equipment involved under the work of other trades to eliminate conflicts between the fiber optic cable installation and the work of other trades.
- C. All questions and issues concerning coordination shall be directed to the Architect/Engineer.

1.4 SUBSTITUTIONS

- A. The intent of the specifications are:
1. Where specified only by reference standards, select any approved product meeting the standards of any manufacturer.
 2. Where specified by naming several products or manufacturers, select any approved product and manufacturer named that meets the specified requirements. Other products and manufacturers will not be considered.
 3. Where specified by naming one or more products or manufacturers but indicating "or equivalent" after the specified listing, the specified product is the preferred quality standard. The Contractor may submit a request for another product for acceptance.
 4. Where specified by naming only one product and manufacturer: There is no option and no substitution will be allowed.
- B. Submit requests for substitutions within 10 days of contract award, or sooner if required to maintain the construction schedule.
- C. The Contractor must submit sufficient information to show that a proposed substitute is equivalent to the item specified. Acceptance of substitutions is at the Architect/Engineer's discretion: Architect/Engineer reserves the right to determine the suitability of the substitute product and reject any materials submitted for substitution. All substitute products and materials must be approved for substitution by the Architect/Engineer in writing before installation. Products rejected or otherwise judged unsatisfactory by the Architect/Engineer will not be authorized for use in completing the Work. Any unapproved products discovered as part of the installation will be removed and replaced with specified and approved products at the Contractor's expense.

- D. Project Drawings may be based on the equipment configuration of a particular manufacturer. If a substitution is approved, the Contractor shall make changes needed to accommodate the substitution at no expense to the project, including work under other divisions.

1.5 QUALITY ASSURANCE

- A. Verification: the Owner will maintain inspection personnel on the job site. It is incumbent upon the Contractor to verify that the installation and materials used have been inspected by the Owner before it is enclosed within building features or otherwise hidden from view. The Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected by the Architect/Engineer.
- B. Equipment Qualifications: The Contractor shall use equipment and rigs designed for pulling, placement, and termination of backbone cable; including reel trucks, mechanical mules, sheaves, shoes, anchors, etc., and equipment for drilling masonry, installing anchors, etc., to install support and cable management hardware.

PART 2 - PRODUCTS

2.1 SINGLE-MODE FIBER CABLE

- A. Furnish all required single-mode fiber (SMF) OS1, steel armored, OSP-rated cable per Architect/Engineer request.
- B. Furnish all required single-mode fiber (SMF) OS1, blown fiber (ABF), and properly rated cable per Architect/Engineer request.

2.2 MANUFACTURER

- A. Approved Manufacturers:
 - 1. OSP - Ortronics/Superior Essex, Bertek, when specified
 - 2. ABF -AFL / Dura-Line ABF
 - 3. Sumitomo when specified

PART 3 - EXECUTION

3.1 FIBER OPTIC INSTALLATION

- A. This Section describes the installation locations for the products and materials, as well as methods and Standards associated with the Telecommunications Installation portions of the Project. These Specifications, along with the drawings and other supplied specifications shall be followed during the installation.
- B. All products shall be installed following the manufacturer's requirements.
- C. The Contractor is instructed to coordinate his efforts with the other tradesmen who may be working within the same vicinity to avoid conflict and lost time.
- D. The Contractor is required to supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.
- E. The Contractor shall verify space requirements and locations with site conditions before starting cable installations and terminations.
- F. The Contractor shall verify the cable type and jacket rating required with the Owner before starting fiber installation.
- G. The Contractor shall verify existing cable fill in conduit, raceway, or cable tray system before installation of additional cables so as not to exceed 40% cable fill. The contractor will be

responsible for the installation of additional conduit, raceway, and cable tray where additional cables to be added will exceed the 40% cable fill. See cable fill attachment, 3.1 Attachment #1.

- H. Verify that field measurements and cable routing and termination conditions are as shown on construction drawings conjoined with this specification. Provide notification, in writing, of conditions deviating from drawings.

3.2 FIBER AND TERMINATION PANEL LABELING

- A. Label the installed cables following Division 27, Section 27 0553.

3.3 CABLE SUPPORT

- A. Provide cable supports with a steel messenger cable to support the new cable.
- B. Stainless Steel strapping is required for cable banding applications that require various bundle sizes.
- C. Provide cable supports and clamps to attach cables to backboards and walls.
- D. Attach horizontal and vertical backbone cables at a maximum of three feet intervals using Architect/Engineer-approved supports to avoid cable sagging.
- E. All entrance cables shall have a minimum of a six feet slack loop up to the protector block.
- F. Attach cables to manhole racks using Owner-approved methods.

END OF SECTION

27 1323

SECTION 27 1413**COPPER RISER AND INTRABUILDING CABLING****PART 1 - GENERAL**

- A. The Contractor are held responsible to be familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation.

1.1 SCOPE OF WORK

- A. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of copper riser infrastructure as described on the Drawings and/or required by these specifications.

1.2 RELATED SECTIONS

- DIVISION 26 ELECTRICAL
- DIVISION 27 COMMUNICATIONS SYSTEMS

PART 2 - PRODUCTS**2.1 COPPER RISER CABLING**

- A. Riser Cable (Voice) - Provide riser cables from the ER/BDF to each TR/IDF as indicated on Drawings or as indicated herein.
 - 1. Riser cables shall consist of twenty-five pair bundled unshielded twisted pairs, 24 gauge, solid copper Category 3 rated. The jacket shall be CMR (ARMM) or CMP- rated to meet the application of the environment. The size of the cables and shielding will be determined by the project's requirements.
 - a. Category 5E Power Sum Riser Cables requirements are project specific.
 - 2. Manufacturer shall be Superior Essex or Bertek by specification only.
- B. Riser Termination Blocks and Patch Panels
 - 1. See Section 27 1119 Termination Blocks and Patch Panels

PART 3 – EXECUTION**3.1 TELECOMMUNICATIONS INSTALLATION**

- A. This Section describes the installation locations for the products and materials, as well as methods and Standards associated with the Telecommunications Installation portions of the Project. These Specifications, along with the drawings, shall be followed during the installation.
- B. The Contractor is instructed to coordinate his efforts with the other tradesmen who may be working within the same vicinity to avoid conflict and lost time.
- C. The Contractor is required to supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.
- D. The Contractor shall verify space requirements and locations with the Owner before starting cable installations and terminations.
- E. The Contractor shall verify the cable type and jacket rating required before starting the riser cable installation.

- F. The Contractor shall verify new conduit cable fill in riser conduit so as not to exceed 40% cable fill. The contractor shall notify the Architect/Engineer if the existing riser conduit will meet or exceed the 60% cable fill. The Architect/Engineer will determine if additional conduits are required.

3.2 RISER CONDUITS

- A. Provide a measure marked 1320 tensile strength mule tape in each empty conduit to facilitate future installation of cables.
- B. Communication pathways requiring fire stopping shall utilize re-enterable fire-stopping systems as per section 27 05 28 Pathways.
- C. All fire-stopping penetrations shall conform to the recommended practices listed in UL1479 or ASTM E814 and must be labeled with the UL1479 or ASTM E814 reference number, dated, and signed by the technician who installed the fire-stopping material.

3.3 RISER COPPER CABLING

- A. The Category 3 copper riser cabling will be terminated at the ER/BDF and TR/IDF on 110-type wiring blocks.
 - 1. A second set of 110 blocks shall be installed where the 25-pair pre-connectorized tails go to a voice-rated patch panel located near the top of the racks, and above the horizontal cable patch panels.
 - 2. A third set of 110 blocks shall be installed where life safety cables are installed.
 - 3. These blocks utilize cross-connection wires to complete the circuits.
- B. Category 5E Power Sum cabling shall be terminated such that wire pair twists are maintained as closely as possible to the point of mechanical termination. No greater than 0.5. Maintain cable sheath to the leading edge of the connector block.

3.4 GENERAL CABLE INSTALLATION

- A. Cable bends shall not be greater than that recommended by the manufacturer of the cable. Ensure the cable sheath is not deformed, perforated, kinked, or damaged in any manner.
- B. Care shall be taken so as not to damage the cable during the installation process and that manufacturer's pull tension specification is not exceeded. The damaged cable shall be replaced with a new one.
- C. When breaking out any multi-pair copper cable of 25 pairs or greater for splicing or termination, the binder groups shall have PIC color-coded cable ties attached to the cable at the point of fan out from supergroups for splicing, and at the point of fan out for termination on termination blocks. (Panduit Part Number PAN-TY PPC25X50F)
- D. Bond all metallic cable sheaths to the room's Telecommunications Main Ground Bar.
- E. Provide individual riser cables to each floor.
- F. Within TRs, cables shall be snugly wrapped using Velcro reusable cable ties, a minimum of every 3 feet inches for cable organization. Wire ties shall only be used on OSP cables and shall be tightened so as not to deform cable jackets and thus affect cable performance.
- G. Cable fill in riser conduits shall not exceed 40% cable fill on initial installation.
- H. New TRs must be free from dust, dirt, and other foreign materials before the installation of any termination hardware or the termination of copper or fiber optic cables. The door to the telecommunication rooms must be installed and closed during the termination and locked when not occupied. The Contractor is responsible for theft and damages when the IT Room is not locked and secured.

3.5 CABLE TESTING AND ACCEPTANCE

- A. The vertical multiple-pair copper riser cables shall be tested and documentation should be provided to the Architect/Engineer.
- B. Physical inspection requirements include:
 - 1. Installation evaluation
 - 2. Placement and support
 - 3. Conduits seals
 - 4. Splices – bonding, color coding, neatness, fold back
 - 5. Splice cases – NEC and Manufacturer's instructions
 - 6. Grounding and bonding
 - 7. Waterproofing compound
 - 8. Labeling
 - 9. Cleanup
- C. Testing and documentation requirements include:
 - 1. Line mapping result: Pass/Fail
 - 2. Proper wiring configuration for cable pairs and bundles
 - 3. Open conductors- Shall be repaired
 - 4. Split pairs
 - 5. Reversed pairs
 - 6. Shorts – provide ohms & provide loop resistance in ohms
 - 7. Grounds – provide ohms & distance to fault on failures
 - 8. Crossed pairs
 - 9. Pair Integrity – the Owner expects 100% Pair Integrity.
 - 10. Verify red lines or provide as-builts to submittals of the installation.
- D. Provide all test results in the following format.
 - 1. Electronic test reports and summary pages shall be submitted in a readable format to the Owner.

3.6 EQUIPMENT INSTALLATION AND CABLE TERMINATIONS

- A. All equipment shall be installed in a neat and workmanlike manner, arranged for convenient operation, testing, and future maintenance.
- B. All paired cables shall be installed and terminated by technicians experienced in the termination of cables on 110/66 connector blocks in the proper color code sequence.
- C. The Contractor shall employ manufacturer-certified system installation technicians who have at least 5 years of experience in the installation of similar and equivalent systems. The Contractor shall supply verification of experience, for this type of work, to the Owner for approval before performing any work.
- D. All cables shall be installed, terminated, and labeled in sequential order.

3.7 AS-BUILT INFORMATION

- A. The contractor shall provide as-built information to the Owner to accompany all test result information.
- B. As-built information shall be submitted to the Owner in electronic PDF format. Indicate the location of all riser conduit routes, distribution cable trays, junction boxes, and all additions and deletions related to telecommunications. Include riser labeling next to all telecom symbols (symbols are from the national CAD Standard and BICSI).

- C. If construction drawings are not utilized, the Contractor shall provide all telecommunications location information on an accurately scaled floor plan.
- D. The contractor shall perform all labeling requirements and provide testing documentation for verification as described herein.
- E. The contractor shall submit cable records to reflect all moves, adds, and changes

3.8 SYSTEM WARRANTY REQUIREMENTS

- A. The Contractor shall provide a 20-year Warranty for parts and labor on all riser cable installs.

END OF SECTION

27 1413

SECTION 27 1523.1**FIBER OPTIC CABLE****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This item shall govern for the furnishing and installation of fiber optic cable in designated locations as shown on the plans and as detailed in accordance with these Specifications.

1.2 GENERAL REQUIREMENTS

- A. All materials furnished, assembled, fabricated or installed under this Item shall be new, corrosion resistant and in strict accordance with the details shown on the plans and in the specifications.
- B. The Contractor shall furnish, install, splice and test all the required fiber optic cable. All splicing kits, fiber optic cable caps, moisture/water sealants, terminators, splice trays, pig tails and accessories to completed the fiber optic network shall be provided as incidentals. All equipment for installation, splicing and testing shall be provided by the Contractor.

PART 2 - PRODUCTS**2.1 PRODUCTS**

- A. The fiber optic cable shall be the primary central to field communications medium for voice, data and video. The cable shall be suitable for installation in an underground three-inch conduit environment including constant immersion in water. All cable shall be non-metallic.
- B. All fibers in the fiber optic cable shall be spliced and/or terminated as shown on the plans and as specified herein.
- C. All fiber optic glass shall be from the same manufacturer.

2.2 CABLE CONFIGURATION

- A. Single mode: 8.3 micron core, attenuation .7 dB/km maximum at 1310 nm.
- B. Multimode mode: 50 micron core, attenuation 1.2 dB/km maximum at 1300 nm with a bandwidth range of 500 to 1100 MHz.
- C. Multimode mode: 62.5 micron core, attenuation 2.7 dB/km maximum at 1300 nm with a bandwidth range of 300 to 700 MHz.

2.3 MECHANICAL REQUIREMENTS - FIBERS

- A. The quantity of fibers contained in the fiber optic cable shall be as shown on the plans.
- B. The fibers shall have a nominal core diameter of 8 to 10 microns. Fiber outer diameter shall be 125 plus or minus 3 microns.

2.4 CORE/CLAD CONCENTRICITY

- A. Core/Clad concentricity shall be within plus or minus 1 micron.

2.5 PRIMARY COATING

- A. Each fiber shall have a high density polymer coating of a minimum of 250 micro meters to prevent abrasion of the fiber surface or as approved by the Architect/Engineer.

2.6 BUFFERING

- A. Individual fibers shall be enclosed in oversized plastic tubes which are filled with a non-hygroscopic compound, or coated with a heavy polymer coating and enclosed in a tight flexible thermoplastic jacket to provide strength for practical handling, to prevent microbends and to preserve the individual fibers during installation and long-term service.

2.7 TENSILE STRENGTH

- A. The cable shall be capable of withstanding a pulling tension of 600 lbs. without changing the characteristics of the optical fibers. Requirements for a higher pulling tension shall be provided as directed by the Architect/Engineer.

2.8 BEND RADIUS

- A. The cable shall be capable of withstanding a minimum bending radius of 10 times its outer diameter during operations and 20 times its outer diameter during installation without changing the characteristics of the optical fibers.

2.9 CABLE CONFIGURATION

- A. The fiber optic cable shall have a reverse oscillation or planetary stranding structure.
- B. In each cable, the buffered fibers shall be grouped to the degree practical, either in separate unit tubes, layers or sub-bundles. Each grouping shall be distinctly color coded for quick and easy identification, even in dim light. Jacket construction and the configuration of the groups shall be such that they can easily be separated at splice points, permitting one set of fibers to be cut and spliced while the others remain continuous. The Contractor shall submit proposed cable designs for the Architect/Engineer's approval prior to procurement and installation of cable plant.
- C. All strength members shall be Kevlar or as approved by the Architect/Engineer, and shall provide the cable with the specified strength.
- D. The cable shall be fully filled with non-hygroscopic water blocking compound to prevent water and moisture penetration.
- E. The Contractor shall also demonstrate crush and abrasion resistance of final cable design and adequacy for conduit installation under full tensile loads and multiple bends.

2.10 DIAMETER

- A. The outer diameter of each cable shall be less than 1/2 inch.

2.11 COLOR CODING

- A. Each fiber buffer jacket shall be color coded separately. Within unit tubes or sub-bundles, each fiber shall have a distinctly different color coding.

2.12 INSTALLATION REQUIREMENTS

- A. The fiber optic cable installation techniques shall be such that the optical and mechanical characteristics of the cables are not degraded at the time of installation.

2.13 EXPERIENCE REQUIREMENTS

- A. The Contractor involved in the installation, splicing and testing of the fiber optic cable shall meet the following requirements:
 - 1. Three (3) years experience in the installation of fiber optic cables, including fusion splicing terminating and testing of single mode fibers.
 - 2. Two (2) installed systems where fiber optic cables are installed in outdoor conduits and the systems are in continuous satisfactory operation for at least two (2) years. The Contractor

shall submit as proof, photographs or other supporting documents, and the names, addresses and telephone numbers of the customers' operating and maintenance personnel who can be contacted regarding the fiber optic systems.

3. One (1) fiber optic cable system (which may be one of the two in the preceding paragraph) which the contractor can arrange for demonstration to the Architect/Engineer and/or his representatives.
4. Splicers shall have been trained and experience on the specific splicing equipment to be used.

2.14 INSTALLATION IN CONDUIT

- A. The cable pulling operation shall be performed so that the minimum bending radius of the cable shall not be exceeded in the unreeling and pulling operations. Entry guide chutes shall be used to guide the cable into the pull-box conduit ports. Lubricating compound shall be used to minimize cable-to-conduit friction. Corner rollers (wheels), if used, shall not have radii less than the minimum installation bending radius of the cable. A series array of smaller wheels can be used for accomplishing the bend if the array is specifically approved by the cable manufacturer. The pulling tension shall be continuously measured and it shall not be allowed to exceed the maximum tension specified by the manufacturer of the cable. Fuse links and breaks shall be used to ensure that cable tension shall not exceed 600 lbs.
- B. When simultaneously pulling fiber optic cable with other cables, separate grooved rollers shall be used for each cable.
- C. Conduits shall be sealed with a two part urethane after cable installation.
- D. Cable Installation between Pullboxes and Cabinets.
- E. When pulling the cable from the nearest manhole to the fiber hub the cable shall not be broken or spliced to a second interconnecting cable to complete the run. The cable shall be pulled through the hub while terminating only the fibers for the fiber optic terminal equipment. All remaining fibers shall remain continuous with no splices. Care shall be taken during this procedure to avoid bending the cable beyond its minimum bend radius.

2.15 SPLICING REQUIREMENTS

- A. All optical fibers shall be spliced or terminated by the Contractor as shown in the splicing diagrams in the plans. Splices shall be allowed only in locations as shown within the plans or as directed by the Architect/Engineer.
- B. All splices shall use the fusion technique. Fusion splicing equipment shall be provided by the Contractor and shall be cleaned, calibrated, and specifically adjusted to the fiber and environmental conditions at the start of each shift. Fusion splicing equipment used shall be approved by the Architect/Engineer. Splice enclosures, organizers and incidentals, and cable end preparation tools and procedures, shall be compatible with the cable type being delivered and approved by the Architect/Engineer.
- C. Each spliced fiber shall be packaged in a protective sleeving or housing. Bare fiber shall be completely re-coated with a protective 8 RTV, gel or similar substance, prior to application of the sleeve or housing, so as to protect the fiber from scoring, dirt or microbending.
- D. Rack mounted organizer trays shall be used to hold the spliced fibers, with each fiber neatly secured to the tray.
- E. All fibers shall be terminated or spliced inside fiber optic cable interconnect panel modules. The module is to be fully enclosed unit capable of supporting the specified cables shown within the plans.
- F. The interconnect panel modules shall be 19in rack mountable or as shown on the plans and compatible with any existing equipment.

- G. Each module shall be able to support a minimum of 48 ST connectors in bulkheads.
- H. The splice trays shall be capable of holding either fusion splices or mechanical splices.
- I. The cabinets will contain cabinet mounting brackets with four outside plant cable clamps for strain relief. The cable shall be installed according to the manufacturer's recommended standards for the cable distribution panel selected.
- J. A maintenance loop of at least five feet of cable will be coiled up and teed inside the interconnect module. This will allow for future splices in the event of a damaged splice. "Pigtails" shall be used to interconnect equipment.
- K. Splice loss shall not exceed a 0.07 dB.
- L. Splices that are made between two cables shall be tested using an Optical Time Domain Reflectometer (OTDR). These splices shall be tested at the required wavelength and printouts of the splice tests shall be provided.

2.16 TERMINATION REQUIREMENTS

- A. In cabinets where the optical fibers have to be connected to terminal equipment, the Contractor shall provide matching connectors.
- B. The connector loss for complete connection to the terminal equipment shall not exceed 0.4 dB. Connectors will be qualified and accepted on the basis of connector-to-connector mating using similar fibers.
- C. In the Control Center and at the ends of the system, 60 inches of the unused optical fibers shall be removed from the buffer tube(s) and the coiled fibers placed into a splice tray approved by the Architect/Engineer. The water blocking compound shall be cleaned from all fibers destined for splice tray usage.

2.17 FIBER OPTIC JUMPERS

- A. Fiber optic jumper cables shall be provided to cross connect the cable distribution panel to the fiber optic transmission equipment. These jumpers shall be orange in color for the multimode fiber, yellow in color for single mode fiber and shall have strain relief on the connectors. The fiber shall have a 900 micron or 1000 micron polymer coating with tight buffer tube, Kevlar strength member and a PVC jacket.
- B. The jumpers shall be one meter in length or as directed by the engineer. One end of each jumper shall have an ST connector and the other end shall have a connector that is suitable to be connected to the fiber optic transmission equipment selected.
- C. The Contractor shall inspect the Fiber Distribution Frame and provide all necessary items to terminate the fibers.

2.18 ENVIRONMENTAL REQUIREMENTS

- A. The cable shall function within specifications over its full life time for a temperature range of -20F to 180 F, and when totally immersed in water for indefinite periods of time.

PART 3 - EXECUTION

3.1 GENERAL

- A. The installation of the cable, the splicing of the fibers, the attachment of connectors and mounting of hardware in cabinets and the methods employed in the above "Mechanical Requirements" sections shall utilize the latest available installation machinery, jacking equipment, cable pulling machinery with appropriate tension monitors, splicing equipment and testing equipment and other miscellaneous tools.

- B. All installation techniques and fixtures shall result in ease of maintenance and ready access to all components for testing and measurements.

3.2 MECHANICAL COMPONENTS

- A. All external screws, nuts, and locking washers shall be stainless steel. No self-tapping screws shall be used unless specifically approved by the Architect/Engineer.
- B. All parts shall be made of corrosion resistant material, such as plastic, anodized aluminum or brass.
- C. All materials used in construction shall be protected from fungus growth and moisture deterioration.
- D. Dissimilar metals shall be separated by an inert dielectric material.

3.3 DOCUMENTATION REQUIREMENTS

- A. Ten (10) complete sets of operation and maintenance manuals shall be provided. The manuals shall, as a minimum, include the following:
 - 1. Complete and accurate schematic diagrams showing the fiber optic cable plant.
 - 2. Complete performance data of the cable plant showing the losses at each splice joint and each terminal connector.
 - 3. Installation, splicing, terminating and testing procedures.
 - 4. Complete parts list including names of vendors.
 - 5. Complete maintenance and trouble-shooting procedures.
 - 6. Two (2) months prior to installation, ten (10) copies of the Contractors Installation Practices shall be submitted for approval. This shall include practices, list of installation equipment, and splicing and test equipment. Field quality control procedures shall be detailed as well as procedures for corrective action.

3.4 TESTING REQUIREMENTS - GENERAL

- A. It is the policy of the Department to require performance testing of all materials and equipment not previously tested and approved. If technical data are not considered adequate for approval, samples may be requested for test by the Architect/Engineer. The contract period will not be extended for time lost or delays caused by testing prior to final Department approval of any items.
- B. The equipment covered by the specification shall be subject to Design Approval Tests and Factory Demonstration Tests at the equipment manufacturer's facility to determine conformance with all the specification requirements except that the Engineer may accept certification by an independent testing lab in lieu of the Design Approval Tests, to verify that the Design Approval Test have previously been satisfactorily completed. The Contractor shall arrange for and conduct the test in accordance with the testing requirements stated herein.
- C. Unless otherwise specified, the Contractor is responsible for satisfying all inspection requirements prior to submission of the Architect/Engineer's inspection and acceptance. Architect/The Engineer reserves the right to have his/her representative witness to all tests.
- D. The results of each test shall be compared with the requirements specified herein. Failure to conform to the requirements of any test shall be counted as a defect, and equipment shall be subject to rejection by the Architect/Engineer. Rejected equipment may be offered again for retest provided all non-compliances have been corrected and re-tested by the Contractor and evidence thereof submitted to the Architect/Engineer.
- E. Final inspection and acceptance of the fiber optic cable shall be made after the completion of the installation and testing and approval of the documentation described above.

3.5 MANUFACTURER'S CERTIFICATION

- A. Each reel of fiber optic cable shall be accompanied by the manufacturer's test data showing the conformance to the requirements described in this Special Specification.

3.6 PRE-INSTALLATION TESTS

- A. The fiber optic cable shall be tested at the site storage area prior to installation.
- B. Each optical fiber in the cable shall be tested from one end with an OTDR compatible with wavelength and fiber type. Testing shall check for continuity, length, anomalies, and approximate attenuation. Each measurement will be recorded with color, location and type of fiber measured. In the event that a meaningful measurement cannot be made from one end, it shall be performed from the opposite end of that fiber. If the tested loss per Km exceeds the loss from the manufacturer's test data the Architect/Engineer shall reject the cable.

3.7 POST-INSTALLATION

- A. After installation, each optical fiber in the cable shall be tested again for the loss characteristics. Both directions of operation of the fiber shall be tested.
- B. After each splice and connector installation, the cable shall also be tested and the data shall be submitted to the Architect/Engineer as basis for acceptance. OTDR and/or power meter/optical light source testing equipment, as specified by the cable manufacturer, shall be used for this testing.

3.8 TEST PROCEDURE

- A. The Contractor shall prepare and submit all test procedures and data forms for the pre-installation and post-installation tests to the Architect/Engineer for approval. The Contractor shall furnish data forms containing all of the data taken, as well as quantitative results for all tests. The data forms shall be signed by an authorized representative of the Contractor. At least one copy of the data forms shall be sent to the Architect/Engineer.

3.9 TRAINING CLASS

- A. The Contractor shall conduct a training class (minimum of forty (40) hours) for up to ten (10) representatives designated by the Department on procedures of installation, splicing, terminating, and testing of fiber optic cable. Training material shall include, as a minimum, code compliance, pulling and installation techniques, use of installation tools, splicing and terminating equipment and test instruments and methods of recording installation and test data. The Contractor shall submit, to the Architect/Engineer for approval, ten (10) copies of the training material at least thirty (30) days before the training begins.

3.10 MEASUREMENTS

- A. This Item will be measured by the linear foot of cable furnished, installed, spliced, connected, and tested in accordance with these specifications.

3.11 PAYMENT

- A. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Fiber Optic Cable" of the type specified. This price shall be full compensation for furnishing, and installing all cable, for pulling through conduit or duct, testing, splicing, connecting, and for all materials, labor, tools, equipment, documentation, training and incidentals necessary to complete the work.

END OF SECTION**27 1523.1**

SECTION 27 1523.2**COMMUNICATIONS OPTICAL FIBER HORIZONTAL CABLING****PART 1 - GENERAL****1.1 SCOPE OF WORK**

- A. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of horizontal optical fiber infrastructure as described on the Drawings and/or required by these specifications.

1.2 RELATED SECTIONS

- DIVISION 26 ELECTRICAL
- DIVISION 27 COMMUNICATIONS SYSTEMS

PART 2 - PRODUCTS**2.1 FIBER CABLING**

- A. Single-mode Fiber Optic Outlet Cable - Provide horizontal fiber optic cable from the outlet through conduits to the cable tray and then through the cable tray to TR or ER.
- B. Each single-mode fiber optic cable shall be a MIC-type tight buffered fiber. Typical fiber outlets consist of a two-strand fan out type. The number of strands may vary depending on the project.
- C. Multimode Fiber Optic Outlet Cable - Provide horizontal fiber optic cable from the outlet through conduits to the cable tray and then through the cable tray to TR or ER.
- D. Each multimode fiber optic cable shall be a MIC-type tight buffered fiber. Typical fiber outlets consist of a two-strand fan-out type fiber. The number of strands may vary depending on the project.

2.2 MANUFACTURER

- A. Approved Manufacturers:
 - 1. Ortronics/Superior Essex
 - 2. AFL / Dura-Line
 - 3. Ber-Tek

PART 3 - EXECUTION**3.1 FIBER OPTIC CABLE INSTALLATION**

- A. This Section describes the installation locations for the products and materials, as well as methods and Standards associated with the Telecommunications Installation portions of the Project. These Specifications, along with the drawings and other supplied specifications shall be followed during the installation.
- B. The Contractor is instructed to coordinate his efforts with the other tradesmen who may be working within the same vicinity to avoid conflict and lost time.
- C. The Contractor is required to supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.

- D. The Contractor shall verify space requirements and locations with the Owner before starting cable installations and terminations.
- E. The Contractor shall verify the cable type and jacket rating required before starting fiber installation.
- F. The Contractor shall verify existing cable fill in conduit, raceway, or cable tray system before installation of additional cables so as not to exceed 40% cable fill. The contractor will be responsible for the installation of additional conduit, raceway, or cable tray where additional cables to be added will exceed the 40% cable fill. See cable fill attachment, 3.1 Attachment #1.

3.2 EMPTY STATION CONDUITS

- A. Provide a nylon pull cord in each empty conduit and extended it in the raceway to openings for faceplates to facilitate future installation of cables.

3.3 HORIZONTAL FIBER CABLING

- A. The horizontal fiber cabling will be terminated at the TR or ER in a rack-mountable enclosure.
- B. The contractor is responsible to obtain and follow manufacturer installation instructions for cable installation, correct termination, and fiber management of cables.

3.4 FIBER COLOR CODES

- A. Fiber Color Code
 - 1. Blue
 - 2. Orange
 - 3. Green
 - 4. Brown
 - 5. Slate
 - 6. White
 - 7. Red
 - 8. Black
 - 9. Yellow
 - 10. Violet
 - 11. Rose
 - 12. Aqua

3.5 GENERAL FIBER INSTALLATION

- A. Cable lengths within boxes shall be adequate to permit installation and removal of the device for inspection without damage to cable or connections (minimum of 12").
- B. Cable bends shall not be greater than that recommended by the manufacturer of the cable.
- C. Care shall be taken so as not to damage the cable during the installation process and that manufacturer's pull tension specification is not exceeded.
- D. Route cables so that no horizontal cable exceeds 90 meters between TR termination and device jack termination.
- E. Provide a minimum of 8'-0" and a maximum of 10'-0" of slack. Loop at the TRs shall be contained within the fiber enclosure.
- F. Within TRs, cables shall be snugly wrapped using Velcro reusable cable ties, a minimum of every 3'-0" for cable organization. Velcro ties shall be tightened so as not to deform cable jackets and thus affect cable performance.
- G. Cable fill in station conduits, raceway, and cable tray shall not exceed 40% cable fill.

- H. New TRs must be free from dust, dirt, and other foreign materials before the installation of any termination hardware or the termination of copper or fiber optic cables. The door to the telecommunication rooms must be installed and closed during termination. The door shall be locked when unoccupied. The IT room shall be dust free during the termination process and remain so thereafter.

3.6 CABLE TESTING

- A. A 100% verification by the Contractor of all horizontal fiber cable tests will be performed. The Contractor shall notify the Owner before the start of testing.
- B. The fiber optic cables shall be tested utilizing a power meter and stabilized light source capable of testing at 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single mode. The contractor shall complete a fiber optic post-installation report at the time of testing containing meter readings at both 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single mode in one direction (TR to outlet) on each fiber. Actual loss and other pertinent data regarding the cables tested, including model and the serial number of test equipment, cable part #, installed fiber length, building span loss at 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single-mode and date tested. The fiber optic post-installation report shall be in a form substantially similar to 3.7 Attachment 1. The testing required is 100%. Place in a 3-ring binder, preceded by a tabbed divider, and label as "Horizontal Fiber". Span loss calculations are required on the final test sheet for loss at 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single mode.

$$(D \times L) + (C \times \# \text{ connectors})$$

D = Length; L = Loss; C = Connector loss (Max 0.5 dB)

1 ft. = Per Part NO. & Manufacturer Specification

- C. The Owner will perform random verification testing as part of the acceptance of all fiber optic cable testing.

3.7 EQUIPMENT INSTALLATION AND CABLE TERMINATIONS

- A. All equipment shall be installed neatly and professionally and arranged for convenient operation, testing, and future maintenance.
- B. All fiber cables shall be installed and terminated by technicians experienced in the installation and termination of fiber cables.
- C. The Contractor shall employ certified system installation technicians and have at least 5 years of experience in the installation of similar and/or equivalent systems.
- D. The Contractor shall supply verification of experience, for this type of work, to the Architect/Engineer for approval before performing any work.

3.8 AS-BUILT INFORMATION

- A. The Contractor shall provide as-built information to the Owner to accompany all test result information.
- B. As-built information shall be in electronic format (PDF). Indicate the location of all outlets, distribution cable trays, junction boxes, and all additions and deletions related to telecommunications. Include correct outlet labeling next to all telecom symbols.

3.9 SYSTEM WARRANTY REQUIREMENTS

- A. All work shall be done to the Manufacturer's warranty requirements.
- B. The Contractor shall perform all labeling requirements and provide testing documentation for verification as described herein.
- C. The Contractor shall submit cable records to reflect all moves, adds, and changes.

- D. The Contractor shall provide floor plans showing the locations of all telecommunication outlets and spaces.

END OF SECTION

27 1523.2

SECTION 27 1543**FACEPLATES AND CONNECTORS****PART 1 - GENERAL****1.1 SCOPE OF WORK**

- A. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of faceplates and connectors as described on the Drawings and/or required by these specifications.

1.2 RELATED SECTIONS

270528.1	PATHWAYS FOR COMMUNICATION SYSTEMS
270528.2	PATHWAYS
270553	IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
271116	CABINETS, RACKS, FRAMES, AND ENCLOSURES
271119	TERMINATION BLOCKS AND PATCH PANELS
271323	FIBER OPTIC BACKBONE CABLING
271523.1	FIBER OPTIC CABLE
271523.2	FIBER OPTIC HORIZONTAL CABLING

PART 2 - PRODUCTS**2.1 PRODUCTS STANDARD**

- A. The materials and products specified herein reflect the minimum acceptable standards of fabrication and manufacture. All materials and products supplied by the Contractor and specified herein are to be new, unused, of first quality, and in original packaging or shipping containers or as shown on drawings and described in Item 3.01.
- B. New buildings and major renovations will be treated differently than minor remodels in existing buildings.
1. Match existing cabling systems and termination hardware for all adds moves and changes with a minimum of Category 6 (Superior Essex Series 66 or as specified) termination hardware including voice and data unless directed otherwise by the Owner, even those areas where separate voice and data closets are utilized.
 2. New building construction and renovations will utilize a minimum of Category 6 termination hardware or as specified by the Owner.
- C. Contact the Owner for approval of cabling systems before installation. Verify exact cabling requirements with the Architect/Engineer.
- D. The Owner will provide patch cords and make all connections to the campus network and phone system unless otherwise specified.
- E. The standard work area outlets consist of 2 Category 6 ports.
- F. Wall phones shall consist of 1 Category 6 connector to be installed within a single gang, modular one-port stainless steel faceplate.
- G. Wireless TOs mounted in ceilings have 2, Category 6 connectors.

2.2 STANDARD TELECOMMUNICATIONS OUTLET (TO)

- A. Standard work area Telecommunications Outlets (TO) shall utilize blue modules/inserts with 45°-degree angled jacks and faceplates and blanks shall be white or shall match the color of electrical faceplates. Floor boxes require flat jacks.
- B. Approved Manufacturers and products shall be:
 - 1. Ortronics
 - 2. Leviton
 - 3. Siemen
 - 4. Or as specified
- C. Horizontal Fiber Terminations:
 - 1. At the TO and in the TR, use the manufacturer's matching module and the type of connector as required by the application, LC mechanical connectors, or match existing.
 - 2. The link Loss budget shall meet all manufacturers' specifications.
- D. Existing Copper TO Locations:
 - 1. Where new jacks are being installed in existing TO locations, match with the existing connector hardware and patch panel manufacturer.
- E. CATV Terminations
 - 1. Coaxial RG-6 Cable Installations
 - a. Terminate all RG-6 cables with F-type crimp or compression connectors and correctly sized tools.
 - 2. CATV outlet within a TO shall utilize F type insert module.

PART 3 - EXECUTION

3.1 GENERAL

- A. This Section describes the installation locations for the products and materials, as well as methods and Standards associated with the IT Installation portions of the Project. These Specifications, along with the drawings and other specifications shall be followed during the installation.
- B. The contractor is required to be currently listed as an approved manufacturer registered Certified Installer and provide personnel for IT installations who are certified and meet warranty requirements established by the manufacturer.
- C. The Contractor is instructed to coordinate his efforts with the other tradesmen who may be working within the same vicinity to avoid conflict and lost time.
- D. The Contractor is required to supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.
- E. The Contractor shall verify space requirements and locations with the Owner and/or the Architect/Engineer before starting cable installations and terminations.
- F. All terminations are to use TIA T568B wiring standards.
- G. Terminate according to the manufacturer's instructions

3.2 TERMINATIONS

- A. Twisted pair cable.
 - 1. All twisted pair cables shall be terminated as specified by the manufacturer with the proper tools.

- B. Coax Cable
 - 1. All Coax cables shall be terminated using connectors matching cable type and application, tool assembly matching connector type for crimp or compression type connectors, and follow Manufacturer procedures for termination.
- C. Optical Fiber Cable.
 - 1. Optical Fiber terminated at the desktop will be with LC connectors following the manufacturer's instructions. Optical fiber terminated in TR/ER shall be fusion type LC connectors or fusion spliced pigtails using LC connectors when specified, on all new projects, and existing projects where optical fiber is being added confirm in writing the connector type with the Architect/Engineer.

3.3 EQUIPMENT INSTALLATION AND CABLE TERMINATIONS

- A. All equipment shall be installed in a neat and workmanlike manner, arranged for convenient operation, testing, and future maintenance.
- B. All telecommunications cables, faceplates, and connectors shall be installed and terminated by manufacturer-certified technicians experienced in the installation and termination of telecommunications items listed herein.
- C. The contractor shall provide licensed manufacturer-certified technicians and installers.

3.4 AS-BUILT INFORMATION

- A. The Contractor shall provide 1 set of preliminary as-built information to the Owner, along with all test result information 2 weeks before occupancy or substantial completion. Partial as-builts shall be submitted as cabling is completed. A final as-built shall be submitted with all corrections made a maximum of 30 days after the cabling installation is complete.
- B. As-built information shall be in electronic DWG and PDF format. Indicate the location of all TOs, pathways, distribution cable trays, junction boxes, and all additions and deletions related to telecommunications. Include correct TO labeling next to all telecom symbols.
- C. If construction drawings are not utilized, the contractor shall provide all telecommunications location information on an accurate and scaled floor plan.

3.5 SYSTEM WARRANTY REQUIREMENTS

- A. The Contractor shall perform all labeling requirements and provide testing documentation for verification as described herein.
- B. The Contractor shall submit cable records to reflect all moves, adds, and changes.
- C. The Contractor shall provide floor plans showing the locations of all telecommunication outlets and spaces.
- D. The Contractor shall perform these requirements for category 6 and 6A permanent link configurations and submit to the hardware manufacturer such paperwork and test results as necessary to obtain a minimum 20-year system performance guarantee as defined by the cable and hardware manufacturers. The 20-year minimum system warranty shall be provided to the Owner before final payment for this work.

END OF SECTION

27 1543

SECTION 27 2133**DATA COMMUNICATIONS WIRELESS ACCESS POINTS****PART 1 - GENERAL****1.1 SCOPE OF WORK**

- A. All Wireless Access Points (WAPs) connected to or making use of THE Owner's network infrastructure shall be registered with the Information Technology Department. Such registrations shall indicate whether the device is a telecommunications device, wireless access point, or bridge.
- B. All access points shall operate in 802.11(ac) and/or (ax) "infrastructure" mode.
- C. As directed by the Owner's IT, channel/frequency allocation on WAPs and devices shall be done to minimize interference with other wireless services on campus. In general, devices with the ability to automatically select the best channel shall be configured to use this feature. However, it may be necessary to consult with the Information Technology Department to determine what channels are available in a particular area.
- D. As directed by the Owner's IT, wireless devices shall be configured to make use of the minimum possible radio transmission power to achieve their objective and coverage area.
- E. All WAPs used on campus shall conform to a set of minimum specifications as published from time to time by the Information Technology Department. These specifications are intended to maintain the security and interoperability of wireless devices on campus.
- F. The Director of Information Technology Networks must approve any exceptions to the general provisions set out above.

1.2 RELATED SECTIONS

DIVISION 26	ELECTRICAL
DIVISION 27	COMMUNICANTS SYSTEMS

PART 2 - PRODUCTS**2.1 WIRELESS ACCESS POINTS**

- A. General: The products specified herein reflect the minimum acceptable standards of fabrication and manufacture. All materials supplied by the Contractor and specified herein are to be new unused, of first quality, and in original packaging or shipping containers.
- B. New buildings and renovations will be treated differently than existing buildings.

2.2 RECOMMENDED WAPS

- A. General: This section outlines those products and/or solutions.
- B. The WAP is a single-band lightweight access point (LWAP) with dual diversity antenna connectors for challenging RF environments. They offer the same versatility, high capacity, security, and enterprise-class features demanded by industrial wireless LAN customers.
- C. The Cisco Aironet 1500 Series Outdoor Access Point/Bridge (hereafter called the *access point/bridge*) is a wireless device designed for building-to-building wireless connectivity. Operating in the 2.4-GHz band (2.400 to 2.497 GHz), using the IEEE 802.11g standard, the access point/bridge delivers 1 to 54 Mbps data rates without the need for a license. The access point/bridge is a self-contained unit designed for indoor or outdoor installations, providing

differing antenna gains as well as coverage patterns. It supports point-to-point and multipoint bridging configurations.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. This wireless specification guideline intends to develop a set of standards for the deployment of wireless devices on campus. These standards will continue to evolve as the Wireless LAN products and standards evolve. This document will be updated periodically.
- B. Installation of new wireless devices shall not interfere with existing services in such a way that services are interrupted, not available, or not in compliance with University policies and standards.

3.2 PORT WIRING FOR WIRELESS ACCESS POINTS

- A. Port wiring for WAPs will follow the universal wiring plan adopted by these specifications with the following exceptions.
 - 1. Port shall be placed in the wall 3" to 6" inches above the drop ceiling. Exceptions shall be approved by the Architect/Engineer.
 - 2. A minimum of two Cat 6 cables 23 AWG and approved network jacks is required for all WAPs.
 - 3. Where a drop ceiling does not exist, consult the Owner for placement guidelines
 - 4. The wireless port shall be no further than 3 feet away from any Wireless Device unless special provisions exist.
 - 5. If a wireless device cannot be powered off the Ethernet switch, power will need to be included in the scope of work.

END OF SECTION

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Division Thirty Two

**EXTERIOR
IMPROVEMENTS**

SECTION 32 5200**SYNTHETIC TURF****PART 1 – GENERAL****1.01 WORK**

- A. Furnishing, delivery, installation and warranty of a complete non-infill synthetic turf system suitable HIIT-type training.

1.02 RELATED SECTIONS

- A. CONCRETE SUBFLOORS – 03 3000
1. The general contractor shall furnish and install the concrete subfloor depressing the slab sufficiently to accommodate the turf system. The slab shall be steel troweled smooth to a tolerance of 1/4" in any 10' radius by the general contractor. High spots shall be ground level, and low spots filled in with approved leveling compound by the general contractor to the full approval of the flooring contractor.
 2. Concrete subfloors on or below grade shall be adequately waterproofed beneath the slab and at the perimeter walls and on earth side of below grade walls by general contractor using suitable type membrane.

1.03 REFERENCES

- A. ATSM Standard Test Methods
- **D1577** – Standard Test Method for Linear Density of Textile Fiber
 - **D5848** – Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
 - **D418** – Standard Test Method for Testing Pile Yarn Floor Covering Construction
 - **D1338** – Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
 - **D1682** – Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
 - **D5034** – Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
 - **F1015** – Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
 - **F1551** – Standard Test Methods for Water Permeability
 - **D2859** – Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
 - **F355** – Standard Test Method for Shock-Absorbing Properties of Playing Surfaces
 - **F1936** – Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field
 - **D1557** – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- B. ASBA Sports Fields Contractor Manual
- C. Carpet & Rug Institute suggested guidelines.

D. STC Suggested Guidelines for the Essential Elements of Synthetic Turf Systems

1.04 SITE EXAMINATION

- A. **A 24 Hour Relaxation Period is recommended before gluing down turf to prevent shrinking and /or expanding after glue down. IDEAL temperatures should be above 70 degrees.**
- B. **When turf is delivered:** Check its texture, color, and style; make sure there are no visible defects before installation. Be sure the installer will adhere to the CRI 105 installation methods (www.carpet-rug.com). Among other things, it requires for proper installation that turf must be power-stretched to minimize wrinkling and rippling. Seam edges must be sealed with appropriate adhesive to prevent delaminating and edge ravel.
- C. **Floor Preparation (when not using seaming tape):** Each subfloor shall be inspected to determine the special care required to make it a suitable foundation for turf. All cracks 1/8 inch (3 mm) wide or protrusions over 1/32 inch (.8 mm) should be filled or leveled.
- D. **Temperature and Humidity:** The environment in which the turf is to be installed must be controlled with the temperature between 65o F and 95o F (18o C and 35o C) and the relative humidity between 10%and 65%. If installing over concrete, the slab temperature should not be less than 65o F (18o C). These conditions must be maintained for at least 48 hours before, during, and 48 hours after the installation.
- E. **Concrete:** Concrete shall be cured, clean, and dry. If the turf is to be installed using an adhesive, the concrete shall be free of paint, dirt, grease, oil, curing or parting agents, and other contaminants, including sealers, that may interfere with the bonding of the adhesive. Whenever a powdery or porous surface is encountered, a primer compatible with the adhesive shall be used to provide a suitable surface for the glue-down installation. Patching of cracks and depressions shall be made with appropriate and compatible latex or polymer fortified patching compound. Do not exceed manufacturer's recommendations for patch thickness. Large patched areas must be primed.
- F. **Moisture Testing (when not using seaming tape):** Concrete floors, even with adequate curing time, can present an unacceptable moisture condition by allowing excessive amounts of moisture vapor to pass through to the surface. This can be a problem even on suspended concrete floors. All concrete floors should be tested for moisture emission rate by utilizing an anhydrous calcium chloride moisture test kit available from installation supplies and accessories distributors. This quantitative method is very precise and must be conducted carefully, with strict attention to the test kit manufacturer's detailed instructions. Moisture emission rate is expressed in lbs/1000 sq. ft. /24 hours. Because the calcium chloride test for emission rate requires 3 days to conduct, proper installation planning is a must. As a general guideline, an emission rate of 3 lbs (1.4 kg) or less is acceptable for most turf. In the range from 3 lbs to 5 lbs (1.4 to 2.3 kg), carpet with porous backings can usually be installed successfully; but the risk of moisture-related problems increases. Since some floor covering products are less tolerant of moisture than others, always consult the individual manufacturer to determine the emission rate for specific products. When any or all corrective procedures have been completed, the finished sub-floor surface must be re-inspected, with the same representatives attending as the initial inspection. If required, additional repair and inspections are to be conducted until the sub-floor surface is deemed acceptable by the Engineer and Synthetic Turf Installer

- G. Once the sub-floor surface has been deemed acceptable, the Contractor shall submit a written certificate indicating the acceptance of:
1. The sub-floor construction finished surface as totally suitable for the application of the selected synthetic turf system, and
 2. The sub-floor construction as totally suitable for work under this section to proceed with the final installation and fully warrant the athletic surface installation for the period and conditions specified herein.
- H. Commencement of work under this section shall constitute acceptance of the work completed under other sections by the Contractor, acceptance of dimensions of the sub-floor, and hence, no claims for extra work based upon these conditions will be permitted.

1.05 ENVIRONMENTAL CONDITIONS

- A. Install synthetic turf surfacing only when ambient air temperature is 45 F or above and the relative humidity is below 35% or as specified by the product manufacturer. Installation will not proceed if rain is imminent.
- B. Install product only when prepared sub-floor is suitably free of dirt, dust, and petroleum products, is moisture free and sufficiently secured to prevent unwanted pedestrian and vehicular access.

1.06 QUALITY CONTROL

- A. **Manufacturer Qualifications:** Company specializing in manufacturing products specified in this section. The Turf Manufacturer:
1. Basis of design shall be "Fast Grass AT740" synthetic turf system as provided by Sporturf™. (800) 562-4492, www.sporturf.com
 2. Materials other than those listed must be approved 15 days prior by written addendum. Materials from non-approved manufacturers will not be accepted.
 3. Must be experienced in the manufacturing of synthetic grass systems with the same fiber as specified.
 4. Manufacturer must be a member in good standing with the STC.
 5. Manufacturer must be owned and operated in the U.S.A.
 6. Manufacturer must have no periods of insolvency over the last 30 years.
- B. **Installer Qualifications:** Company specializing in performing the work of this section.
1. The Synthetic Turf Installer must provide competent workmen skilled in this type of synthetic grass installation. All technicians must have installed tall pile synthetic turf.
 2. The designated Supervisory Personnel on the project must be certified, in writing by the Turf Manufacturer, as competent in the installation of this material and including seaming.
- C. Prior to the beginning of installation, the Synthetic Turf Installer shall inspect the sub-floor. The installer will accept the sub-floor in writing when the general contractor provides test results that are in compliance with the synthetic turf manufacturer's recommendations and as stated herein.

- D. Remove defective Work, whether the result of poor workmanship, defective products or damage, which has been rejected by the Engineer as unacceptable. Replace defective work in conformance with the Contract Documents.

1.07 SUBMITTALS

A. Submit the following with Proposal:

1. Submit the exact product name/description as well as the name and location of the manufacturers and suppliers of each component. Manufacturers and suppliers must not be changed after the contract is awarded unless approved by the Owner in writing.
2. Submit two (2) samples, 12"x12" minimum size, illustrating details of finished product as bid, turf, and infill material if required.
3. Product Literature: Submit two (2) copies of manufacturer's recommended installation and maintenance information, including any technical criteria for evaluation of the installed product. Descriptions of all equipment recommended for the maintenance and repair of turf product, as well as a list of any activities not recommended relative to the warranty.
4. Submit a 1-lb sample of the selected bid infill material(s) if required.
5. A letter and specification sheet certifying that the products of this section meet or exceed specified requirements.
6. Certified copies of independent (third-party) laboratory reports on ASTM tests as follows:
 - a. Pile Height, Face Width & Total Fabric Weight, ASTM D418 or D5848
 - b. Primary & Secondary Backing Weights, ASTM D418 or D5848
 - c. Tuft Bind, ASTM D1335
 - d. Grab Tear Strength, ASTM D1682 or D5034
 - e. Verification that product meets Pill test minimums for ASTM D-2859 for life of installation.
7. ASTM test submittals may vary by no more than ¼" and 6 oz. of the specified product to bid. Bid winner must show NEW ASTM TESTS with contract submittals.
8. Name and experience of the designated supervisory personnel assigned to this project shall be submitted with the proposal. Changes to this assignment after contract can only be made if approved in writing by the Owner. Include a listing of other on-site personnel and their experience.
9. The Synthetic Turf Installer and Turf Manufacturer shall provide evidence that the turf system does not violate any other manufacturer's patents, patents allowed or patents pending.
10. The Synthetic Turf Installer and the Turf Manufacturer shall provide complete information on its warranty/insurance policy and coverage, as noted in Section 1.08. Provide a complete sample copy of all warranty documentation.

B. Prior to ordering of materials:

1. The Contractor shall submit Shop Drawings indicating:
 - a. Field Layout.
 - b. Field Marking Plan and details for Soccer, Men's Lacrosse, and Women's Lacrosse if required.

- c. Mid-field emblem layout with color samples.
 - d. Roll/Seaming Layout.
 - e. Methods of attachment, field openings and perimeter conditions.
2. The Turf Manufacturer must submit the fiber manufacturer's name, type of fiber and composition of fiber.
3. **Shop Drawings:** Shop drawings are to be submitted for review by the Engineer prior to manufacture of product and are to contain information regarding locations of seams, anchorage details, goal post/insert details, line and event marking locations and dimensions, turf roll widths and dimensions.

C. Prior to Final Acceptance, the Contractor shall submit to the Owner:

1. Two (2) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and markings. Also address remedial measures for graffiti removal.
2. Written verification of a suitable training session for the Owner's maintenance staff on how to maintain the completed installation.
3. Project Record Documents: Record actual locations of seams, drains or other pertinent information.
4. Enter into a contract with the Owner to provide annual operations and maintenance assistance for two (2) years. Provide contract, contact information and schedule first visit. Quarterly each year provide operations and maintenance that includes:
 - a. On-site inspection analysis of seams, infill, inlay, edge, and field inserts.
 - b. The contractor shall sweep and groom the field at each quarterly visit.
 - c. Synthetic turf report with results of inspection analysis, photos, results of cleaning process, recommendations for future cleaning/maintenance.
 - d. The Contractor must execute an annual operations and maintenance assistance contract before substantial completion can be approved.
5. Test Results: Test certifications issued by an independent testing agency that the synthetic surface meets with the requirements of the ASTM tests noted herein are to be submitted.
6. Sub-floor Conditions Acceptance: Prior to installation of the synthetic turf system, the Contractor is to submit in writing an acceptance of the sub-floor as being acceptable by the turf manufacturer and suitable for the successful installation of the proprietary synthetic turf system.

1.08 WARRANTY

- A. The Contractor shall provide a minimum five (5) year warranty policy by the manufacturer, against defects in materials and workmanship. Defects shall include, but not be limited to ultraviolet ray fading, degradation, or excessive wear of fiber.
- B. Submit information listing the owner on the COI (Certificate of Liability Insurance).
- C. Limited Warranty shall be for replacement of any damaged product within the warranty period. Warranty shall be comprehensive and sufficient to replace entire field if necessary.
- D. Warranty shall become effective from the date of substantial completion.

- E. Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURER QUALIFICATIONS

- A. The Turf Manufacturer: Basis of design shall be "Fast Grass AT740" synthetic turf system as provided by Sporturf™. (800) 562-4492, www.sporturf.com

2.02 SUPPLIER QUALIFICATIONS

- A. The Owner has conducted an extensive review of synthetic turf products, including visiting installed sites and review of other agencies' review criteria. Based upon their research, they have established the following criteria for acceptance of a synthetic turf product. No variation from these criteria shall be allowed. The Owner's review is considered final.
- B. The Synthetic Turf Installer shall have been in business for at least 5 years, actively selling, installing and maintaining sports flooring.
- C. The Synthetic Turf Installer must provide a list of references based on previous installations.
- D. Installation team shall be established, insured installation firm experienced as a premium turf installer with suitable equipment and supervisory personnel, with a minimum of 5 years' experience.
- E. Installation team shall be trained and certified, in writing, by the turf manufacturer, as competent in the installation of the specified material, including seaming and proper installation of the infill mixture.

2.03 TURF SYSTEM

- A. **Turf Fiber:**
 - 1. The turf fiber must be tufted to the ArmorLoc™3L and coated with SilverBack™ with a minimum tuft bind of 8 pounds.
 - 2. The tufted fiber weight shall be a minimum of 40 ounces per square yard.
 - 3. The turf fiber shall be polyethylene slit film and texturized nylon.
 - 4. The turf fiber shall be non-abrasive and a minimum of 100 microns thick.
 - 5. The turf fiber must contain less than 100 ppm of lead in all colors.
 - 6. The turf fibers must be from the same dye lots.
 - 7. The turf fibers must be guaranteed for a period of Eight Years not to fade or fail (as distinguished from a change in texture) or have a pile height decrease to 50% of pile height as result of UV degradation.
 - 8. The infill must be within ¼" of the tips of the fibers upon completion of the install if required.
 - 9. The turf fiber must retain a minimum of 75% of its original fibril width after 10,000 cycles on the Lisport Studded Roll Test Machine.
 - 10. The pile fiber shall possess the following characteristics:

Characteristic	Value	Test
Linear Density (Denier)	9,000 Combined	ASTM D 1577
Yarn Thickness	100 Microns (slit); 100 Microns (mono)	ASTM D 3218
Pile Weight*	40 oz./yd ²	ASTM D 5848
Fiber manufacturer must be from the same source		
The above specifications are nominal. *Values are +/- 5%.		

1. The pile fabric shall possess the following physical characteristics:

Product Weight (total)*	125 oz./yd ²	ASTM D 3218
Primary Backing Weight*	7.4 oz./yd ²	ASTM D 2256
Secondary coating Weight**	78 oz./yd ²	ASTM D 5848
Fabric Width	15' (4.5m)	ASTM D 5793
Tuft Gauge	1/4"	ASTM D 5793
Grab Tear Strength	200-1b-F	ASTM D 5034
Tuft Bind	>8-1b-F	ASTM D 1335
Except where noted as a minimum, the above specifications are nominal.		
* Values are +/- 5%. **All values are +/- 3 oz./yd ² .		

B. Backing Material

1. Primary Backing:
 - a. Primary backing must be a dual layered woven polypropylene material, ArmorLoc™3L.
 - b. Primary backing system weight must be a minimum of 7.0 ounces/square yard.
 2. Secondary Backing:
 - c. Secondary backing 5mm cushioned SilverBack™ system weight must be a minimum of 75 ounces/ square yard.
- C. Turf roll seams:** to be glued on site so that no openings larger than the porous backing mat openings are created. Roll width to coincide with tufted-in sports line markings where possible. All turf fabric edges to be securely bound as per the perimeter detail design. Adhesives for joining seams of turf together shall be Nordot 34G, Mapei 2K, Turf Claw or equivalent. No substitutions.
- D. Fabric surface:** shall be constructed and installed in minimum widths of 12 feet with no longitudinal or transverse seams, except for inlaid lines with a finish roll assembly. Seams shall be 15'-0" apart. Rolls that do not comply with the proper length or conform to the seaming diagram, as approved prior to installation, shall be rejected from the site. No fitted pieces shall be allowed to true alignment. Parallel seams only are acceptable in the main playing areas.
- E.** The entire system shall be resistant to weather, including ultra-violet light and heat degradation; insects, rot, mildew and fungus growth and be non-allergenic and non-toxic.

- F. Fiber Colors: Submit samples for owner approval prior to placing order for turf including at a minimum the below listed color:
- Color 1: **MAROON** color, as selected by the Owner/Architect
 - **The color shall match the NMSU MAROON samples exactly.**
- G. The turf material shall be non-combustible and pass the DIN standard Pill Burn test or ASTM D 2859.

2.04 LINES, MARKINGS AND IN-LAID TURF

- A. Inlaid material as indicated on the drawings to be identical, except for fiber color, as the main turf field.

2.05 SYNTHETIC GLUE MATERIAL

- A. Adhesive products shall be Nordot 34G, Mapei 2K, Turf Claw or equivalent as approved by the engineer.
- B. Any adhesive products required for the installation of a proposed turf system shall be purpose-suited to the system. The material and application methods shall be as recommended by the adhesive manufacturer.
- C. Disposal of adhesive containers and unused adhesives as well as any fees resulting from such disposal shall be the responsibility of the Contractor.

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation of the synthetic turf system is to comply with the manufacturer's recommendations, requirements and the reviewed and approved shop drawings.
- B. Perform all work in strict accordance with the Contract Documents and the manufacturer's specifications and instructions. Only those skilled technicians proposed in the bid phase are to be assigned to this project by the Contractor.
- C. The designated Supervisor for the Synthetic Turf Installer must be present during any and all construction activity associated with the field installation, including testing, cleanup and training.
- D. All products and equipment are to be from sources approved by the authorized turf manufacturer and conform to the specifications.

3.02 PRODUCT DELIVERY, STORAGE & HANDLING

- A. Deliver products to site in original containers and wrappers as agreed between the Engineer and Contractor. Inspect products upon delivery for damage.
- B. Store products in a location and in a position that protects them from crush damage or any other defects.
- C. Handle and store (on and off site) all materials safely to ensure their physical properties are not adversely affected and that they are not subject to vandalism or damage.
- D. Adhesives shall arrive in dry, sealed containers.

3.03 PLUGS AND FITTINGS

- A. All permanent field fittings penetrating the turf indicated on the drawings shall be securely sealed to the turf surface.

3.04 TURF INSTALLATION

- A. Install synthetic turf system in accordance with the manufacturer's written installation instructions.
- B. All inlaid areas shall have full fastenings and no loose areas. At no time can pulling on the section separate the material.
- C. Turf shall be attached to the perimeter edge as shown in the construction plans and as per the manufacturer.
- D. All terminations shall be as detailed and approved in the shop drawings.

3.05 CLEANING AND COMPLETION

- A. Protect all installed work from other construction activities as installation progresses.
- B. The Contractor shall keep the area clean throughout the construction period and free from the installation process.
- C. Upon completion of the installation, thoroughly clean surfaces and site of all refuse resulting from the installation process.
- D. Any damage to existing fixtures or facilities resulting from the installation of the synthetic turf system shall be repaired to original condition at the Contractor's expense prior to Substantial Completion and commencement of the Warranty Period.
- E. A deficiency list will be produced by the Engineer at the conclusion of the project. All installation project deficiencies not in dispute must be remedied by the Contractor prior to the issuance of a certificate of Substantial Completion.
- F. Contractor to provide a written acceptance by the Turf Manufacturer that the turf and base system is installed in accordance with their recommendations prior to final completion.

END OF SECTION 32 5200