STATE OF COLORADO

DEPARTMENT OF TRANSPORTATION

Office of the Chief Engineer
Property Management Section
15285 S. Golden Road, Bldg. 47
Golden, Colorado 80401

LA JUNTA TRAINING ROOM

SAP #21914

100% BID SET

SPECIFICATIONS

JUNE 14, 2017

STATE OF COLORADO
ERIN K. LUCERO
401302
LICENSED ARCHITECT

COLORADO REGISTERED
DENNIS G. MOYER
16134
06-14-2017
PROFESSIONAL ENGINEER

ELECTRICAL

COLORADO REGISTERED
MARK C. SCOTT
06-14-2017
26792
PROFESSIONAL ENGINEER

PLUMBING AND MECHANICAL

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June 14, 2017
CDOT #21914

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SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project Information and Contacts are:

1.	Project Title:	La Junta Training Room CDOT Project Number #21914
2.	Project Location:	Colorado Department of Transportation 28201 W. Highway 50 La Junta, CO 81020
3.	Owner: (Denver)	Colorado Department of Transportation 15285 South Golden Road, Building 47 Golden, CO 80401
4.	CDOT Project Manager: And Architect	Erin Lucero 15285 S. Golden Road # 47 Golden, CO 80401 (P) 303-512-5535; (F) 303-512-5550; (M) 720-737-6591 e-mail: erin.lucero@state.co.us
5.	Mechanical, Electrical, Plumbing Engineer	MEP Engineering, Inc. Kevin Przytarski 6402 S Troy Circle, Suite 100 Centennial, CO 80111 (P)303-936-1633; (F)303-934-3200 Email: kevin@mep-eng.com

B. The Work consists of the Architectural, Mechanical, Plumbing, and Electrical work as shown on the Drawings, specified in the Specifications and as otherwise amended by Addendum prior to bidding. Bidding General Contractors to verify tie-ins to Gas, Electrical and Water prior to submitting bids.

1. Work includes all labor, material, equipment, means and methods to perform the construction of all infrastructure, site work and buildings as shown on the Drawings.

C. Submittal Log is provided as part of the Project Documents. Submittals are due from the Contractor to the CDOT Representative on the specific dates indicated. This log delineates due dates based on the Notice to Proceed date of the project. Failure to meet these deadlines will have an effect on Contractor's overall rating as part of the Contract Management System requirements.

1.3 CONTRACTOR USE OF PREMISES

A. General: The Contractor shall have full use of the premises during the construction period.

Coordinate with owner before disrupting utilities to occupied structures.

B. Limit use of premises to areas indicated or directed. Do not disturb portions of the area and site beyond the areas indicated or directed.

C. Site is currently not in use by owner. Allow for Owner occupancy and use if required.

D. Keep driveways and entrances clear. Unless directed, do not use these areas for parking or material storage. Schedule deliveries to minimize on-site storage of materials and equipment.

E. Work currently underway at the Site: The Contractor shall be made aware if construction work is planned or is currently underway at the site.

F. Partial Owner Occupancy: The Owner does not plan to occupy and use the site during construction. Cooperate with the Owner to minimize conflicts and facilitate Owner usage if required. Do not interfere with the Owner's operations.

G. Owner Provided Utilities: The Owner shall make available the following utilities for use by the Contractor during construction.
   1. Existing electrical; coordinate with electrical company.

H. Contractor Provided Utilities: The Contractor shall provide for the following temporary service utilities during construction:
   1. Telephone
   2. Toilets
   3. Water
   4. Electrical Power

I. On-Site Storage: On-Site storage will need to be arranged with CDOT at pre-construction meeting.

J. Contractor Provided Permits and Fees: The Contractor shall provide for all permits and fees which may include, but not be limited to:
   1. State Electrical and State Plumbing permits
   2. Use Fees
   3. Fire Department Review by local jurisdiction, including fire alarm design review.

K. Contractor to provide fencing around construction area to secure job site and staging, at contractor’s risk.

L. Owner pays the following fees:
   1. State contracted code review, inspection fees
   2. Tap fees
   3. Electrical service upgrade fees
   4. Fire Line Connection fees, if needed

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01095
REFERENCE STANDARDS, CODES AND DEFINITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Documents: Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 DEFINITIONS

A. Indicated refers to graphic representations, notes, or schedules on the Drawings, paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. Location is not limited.

B. Directed, requested, authorized, selected, approved, required, and permitted mean directed by the CDOT Representative, requested by the CDOT Representative, and similar phrases.

C. Reviewed, when used in conjunction with the CDOT Representative's action on submittals, applications, and requests, is limited to the CDOT Representative’s duties and responsibilities as stated in the Conditions of the Contract.

D. Regulations include laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

E. Furnish means supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.

F. Install describes operations at the Project Site including unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

G. Provide means to furnish and install, complete and ready for the intended use.

H. Installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

I. The term experienced, when used with the term Installer, means having a minimum of 5 previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authorities having jurisdiction.

J. Project Site is the space available for performing construction activities, either exclusively or in conjunction, with others performing work as part of the Project.

K. Testing Agency is an independent entity, or Geotechnical Company of Record, engaged to perform specific inspections or tests, either at the Project Site or elsewhere, or to report on and, if required, to interpret results of those inspections or tests.

L. Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 16-Division format.

M. Abbreviated Language: Language used in Specifications is abbreviated. Implied words and meanings shall be interpreted as appropriate. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.

N. Imperative and streamlined language is used. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

1. The words "shall be" are implied where a colon (:) is used within a sentence or phrase.

O. Abbreviations and Names: Where acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

P. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments (including taxes), judgments, correspondence, records, and similar documents, established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

1.3 CODES, ORDINANCES, PERMITS AND FEES

A. Execute work per underwriters, public utility, local, state codes, ordinances, and regulations applicable. Contact city water and sewer agencies for verification of all requirements, permits, state fees and inspections prior to submitting bid. Obtain and pay for state plumbing and state electrical required permits, inspections, utility service connections, meters and certificates. Systems development fees and similar charges are not to be included in the bid, as they will be paid directly to the utility agency by the Owner upon notification. Notify CDOT Representative of items not meeting said requirements.

B. This Contractor shall include in the work, all labor, materials, services, apparatus and drawings, in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on drawings and /or specified.

C. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, and with the requirements of all governmental departments having jurisdiction. In the event of a conflict, applicable codes and ordinances shall take precedence over this specification or contract drawings.

D. All material and equipment for the electrical portion of the mechanical systems shall bear the approval label of, or shall be listed by the Underwriter's Laboratories, Incorporated, and shall be installed in compliance with the National Electric Code.

E. Comply with the latest edition and/or the adopted edition of the following codes and standards as a minimum **Approved State Building Codes:**

The following approved building codes and standards have been adopted by State Buildings Programs (SBP) as the minimum requirements to be applied to all state-owned buildings and physical facilities including capital construction and controlled maintenance construction projects:

The 2015 edition of the International Building Code (IBC)
(As adopted by the Colorado State Buildings Program as follows: Chapter 1 as amended, Chapters 2-35 and Appendices C and I)

The 2015 edition of the International Mechanical Code (IMC)
(As adopted by the Colorado State Buildings Program as follows: Chapters 2-15 and Appendix A)

The 2015 edition of the International Energy Conservation Code (IECC)
(As adopted by the Colorado State Buildings Program)
Commercial Energy Efficiency to comply with the requirements of ANSI/ASHRAE/IESNA Standard 90.1 – 2013 in accordance with Section C401.2.1 of the 2015 IECC.

The 2014 edition of the National Electrical Code (NEC)
(National Fire Protection Association Standard 70) (As adopted by the Colorado State Electrical Board)

The 2015 edition of the International Plumbing Code (IPC)
(As adopted by the Colorado Examining Board of Plumbers as follows: Chapter 1, Sections Section 101.2,102, 105, 107, Chapters 2-13 and Appendices B, D, E, F and G)

The 2015 edition of the International Fuel Gas Code (IFGC)
(As adopted by the Colorado Examining Board of Plumbers as follows: Chapter 1 Section 101, 102, 105, 107, Chapters 2-8 and Appendices A, B, and C)

The National Fire Protection Association Standards (NFPA)
(as adopted by the Department of Public Safety/Division of Fire Prevention and Control as follows with editions shown in parentheses: NFPA-1 (2006), 11 (2005), 12 (2005), 12A (2004), 13 (2002), 13D (2002), 13R (2002), 14 (2003), 15 (2001), 16 (2003), 17 (2002), 17A (2002), 20 (2003), 22 (2003), 24 (2002), 25 (2002), 72 (2002), 409 (2004), 423 (2004), 750 (2003) and 2001 (2004))

The 2010 edition of the ASME Boiler and Pressure Vessel Code
(As adopted by the Department of Labor and Employment/Boiler Inspection Section as follows: sections I, IV, VIII-Divisions 1 and 2 and 3, 1X, X including the 2011 addenda and B31.1, 2010 edition)

The 2011 edition of the National Boiler Inspection Code (NBIC)
(As adopted by the Department of Labor and Employment/Boiler Inspection Section)

The 2012 edition of the Controls and Safety Devices for Automatically Fired Boilers CSD-1
(As adopted by the Department of Labor and Employment/Boiler Inspection Section)

The 2011 edition of the Boiler and Combustion Systems Hazards Code, NFPA 85
(As adopted by the Department of Labor and Employment/Boiler Inspection Section)

The 2013 edition of ASME A17.1 Safety Code for Elevators and Escalators
(As adopted by the Department of Labor and Employment/Conveyance Section and as amended by ASME International)

The 2005 edition of ASME A17.3 Safety Code for Existing Elevators and Escalators
(As adopted by the Department of Labor and Employment/Conveyance Section and as amended by ASME International)

The 2011 edition of ASME A18.1 Safety Standard for Platform Lifts and Stairway Chairlifts
(As adopted by the Department of Labor and Employment/Conveyance Section and as amended by ASME International)

The current edition of the Rules and Regulations Governing the Sanitation of Food Service Establishments
(As adopted by the Department of Public Health and Environment/Colorado State Board of Health)

The 2009 edition of ICC/ANSI A117.1, Accessible and Usable Buildings and Facilities
(As adopted by the Colorado General Assembly as follows: CRS 9-5-101, as amended, for accessible housing)

Sheet Metal and Conditioning Contractors National Assoc. Standards (SMACNA)

American Water Works Association (A.W.W.A.)

Local Utility Company Requirements

Local Governing Fire Department Requirements

National Electrical Manufacturers Association (N.E.M.A.)

Air Movement and Control Association (A.M.C.A.)

American Concrete Institute (A.C.I.)

Note: Additional codes, standards and appendices may be adopted by the state agencies and institutions in addition to the minimum codes and standards herein adopted by State Buildings Programs.

1. The 2015 edition of the IBC became effective on July 1, 2016. Consult the state electrical and plumbing boards and the state boiler inspector and conveyance administrator and the Division of Fire Prevention and Control for adoption of current editions and amendments to their codes.

2. Projects should be designed and plans and specifications should be reviewed based upon the approved codes at the time of A/E contract execution. If an agency prefers to design to a different code such as a newer edition of a code that State Buildings Programs has not yet adopted, the agency must contact SBP for approval and then amend the A/E contract with a revised Exhibit C, Approved State Building Codes. Please note that the state plumbing and electrical boards enforce the editions of their codes that are in effect at the time of permitting not design.

3. The state's code review agents, or the State Buildings Programs approved agency building official, shall review all documents for compliance with the codes stipulated herein. Note:

The Department of Public Health and Environment, Division of Consumer Protection will review drawings for food service related projects.

4. This policy does not prohibit the application of various life safety codes as established by each agency for specific building types and funding requirements. NFPA 101 and other standards notwithstanding, approved codes will supersede where their minimum requirements are the most restrictive in specific situations. If a conflict arises, contact State Buildings Programs for resolution.

5. It is anticipated that compliance with the federal Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) and Colorado Revised Statutes Section 9-5-101 will be met by compliance with the 2015 International Building Code and ICC/ANSI A117.1. However, each project may have unique aspects that may require individual attention to these legislated mandates.

6. The 2015 edition of the International Building Code (IBC) is to be applied to factory-built nonresidential structures as established by the Division of Housing within the Department of Local Affairs.

F. Appendices

Appendices are provided to supplement the basic provisions of the codes. Approved IBC Appendices are as follows:

1. Mandatory
   IBC Appendix Chapter C - Agricultural Buildings
   IBC Appendix Chapter I - Patio Covers

2. Optional
   Any non-mandatory appendix published in the International Building Code may be utilized at the discretion of the agency. Use of an appendix shall be indicated in the project code approach.

G. Amendments

1. International Building Code, Chapter 1 as amended

H. Referenced Codes

1. While not adopted in entirety, portions of the following codes are referenced in the International Building Code (IBC), the International Mechanical Code (IMC), the International Energy Conservation Code (IECC) the International Plumbing Code (IPC), and the International Fuel Gas Code (IFGC). These following codes would be applied as reference standards.

   2015 International Fire Code (IFC)
   2015 International Existing Building Code (IEBC)

I. Referenced Standards

The IBC, IMC, IECC, IPC and IFGC standards shall be utilized to provide specific, or prescriptive, requirements on how to achieve the requirements established in the code. These standards may be unique to the code or may be derived from other established industry standards. Recognized standards may also be used to show compliance with the

standard of duty established by the code.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
   1. Preconstruction Conference
   2. Construction Progress meetings
   3. Project Closeout (Punch List) meeting
   4. Project Final Inspection

1.3 CONSTRUCTION MEETINGS

A. Preconstruction Conference: Contractor shall attend a preconstruction conference, to be held at the site of the Work, before starting construction to review responsibilities, personnel assignments, and any other pertinent construction related issues. The time of the preconstruction conference is to be determined by the CDOT Representative. CDOT Representative will provide notification to the Contractor.
   1. Attendees: Authorized representatives of the CDOT, Engineer, Engineer's Sub-Consultants (as needed); the Contractor; subcontractors; and other concerned parties shall attend. Participants shall be familiar with the Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items that could affect progress, including, but not limited to the following:
      a. Tentative construction schedule
      b. Critical work sequencing
      c. Conformance with CDOT procedures (CDOT Standard Specifications for Road and Bridge Construction, Current Edition)
      d. Submittals
      e. Development of Coordination Drawings
      f. Use of the premises
      g. Anticipated interval of subsequent construction progress meetings
      h. Location of existing easements and requirements regarding work on, near, or under existing easements

B. Construction Progress Meetings: Attend construction progress meetings at the Project Site at regular intervals as scheduled by the CDOT Representative. It is anticipated that a Construction Progress Meeting shall take place during each site observation visit that will be conducted by the CDOT Representative; contractor will notify pertinent sub-contractors.
   1. Attendees: The CDOT Representatives, the Contractor, subcontractors; and other concerned parties shall attend. All parties concerned with current progress or involved in planning, coordination, or future activities shall be represented. Participants shall be authorized to conclude matters relating to the Work.

2. Agenda: Review minutes of the previous construction progress meetings. Review items of significance that could affect progress. Include topics for discussion appropriate to Project status.

1.4 CLOSEOUT MEETINGS

A. Project Closeout (Punch List) Meeting: Attend project closeout (punch list) meeting, to be conducted at the Project Site, after issuance of notification to the CDOT Representative of substantial completion. The timing of the project closeout (punch list) meeting shall be determined by the CDOT Representative. The CDOT Representative will provide notification to the Contractor. **The Contractor shall be made aware that a Project Closeout (Punch List) Meeting shall not be scheduled by the CDOT Representative unless, in the opinion of the CDOT Representative, the total number of minor items that are anticipated to be included on the punch list shall be ten (10) or less and include no major structural, inspection or other major issues.**
   1. Attendees: The CDOT Representative, Architect, Engineer and their Sub-Consultants (as needed), CDOT State Buildings Delegee, the Contractor, subcontractors; Owner's code consultant and other concerned parties shall attend. All parties concerned with project closeout events. Participants shall be authorized to perform project closeout tasks.
   2. Agenda: Project Closeout (Punch List) Meeting is to be conducted by the CDOT Representative. Review project closeout procedures, perform Punch List walk-through of the work for the purpose of demonstrating to the Owner, Architect, Engineer, and Engineer's Sub-Consultants (as needed) and code compliance consultant that the work has been performed and completed within the guidelines set forth in the Contract Documents.
   3. Record Documents: During the project closeout meeting, the Contractor shall make arrangements to transfer the record documents to the CDOT Representative.
   4. Building Permit(s): During the project closeout meeting, the Contractor shall show evidence to the CDOT Representative that all necessary building permits have been signed off by the governing code authority on the Project's Building Inspection Report Yellow Card (State Buildings Form SBP-BIR).
   5. Contract Closeout Final Punch List is written by CDOT Representative and communicated to Contractor on State Buildings Form SBP 06 – Rev. 9/2006.

B. Project Final Inspection Meeting: Project Final Inspection written by CDOT State Buildings Delegee and communicated to Contractor.
   1. Attendees: The CDOT Representative, Architect, Engineer, Sub-Consultants (as needed), CDOT State Buildings Delegee, the Contractor, subcontractors; Owner's code consultant and other concerned parties shall attend. All parties concerned with project closeout events. Participants shall be authorized to perform remaining punch list items.
   2. Agenda: Final Inspection Meeting is to be conducted by the CDOT Representative. Review project closeout procedures, perform final walk-through of the work for the purpose of demonstrating to the Owner, Architect, Engineer, and Engineer's Sub-Consultants (as needed) and code compliance consultant that the punch list items has been performed and completed within the guidelines set forth in the Contract Documents.
   3. Contract Closeout Final Punch List is written by Owner and communicated to Contractor on State Buildings Form SBP 06 – Rev. 9/2006.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01300
SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section specifies requirements for handling submittals.

1.3 GENERAL PROCEDURES

A. Coordinate submittal preparation with performance of construction activities, and with purchasing or fabrication, delivery, other submittals and related activities. Transmit per the due dates listed per activity on the Submittal Log provided by CDOT Representative.

B. Coordinate transmittal of different submittals for related elements so processing will not be delayed by the need to review concurrently for coordination. Submit four (4) copies of paper submittals and/or an electronic copy, a minimum of one (1) stamped copy and/or an electronic copy will be returned to contractor. Electronic submittals are preferred except in the case where engineer-stamped drawings are required or color selection or material selection is required, in which case hard copy is required. The CDOT Representative reserves the right to withhold action on a submittal requiring coordination until all related submittals are received.

C. Processing: Contractor shall allow ten working days beyond the date at which the submittal arrives for initial review. Allow more time if processing must be delayed for coordination with other submittals. The CDOT Representative will advise the Contractor when a submittal must be delayed for coordination.

1. No extension of time will be authorized because of failure to transmit submittals sufficiently in advance of the Work to permit processing.

D. Substitutions: Contractor may submit “like” products for review/acceptance. Contractor must provide specific documentation evidencing that proposed product meets complete specification. CDOT Representative may reject substitution. Any substitutions must comply with agreed-upon Submittal Log Date.

E. Submittal Preparation: Place a label or title block on each submittal for identification. Include the following minimum information on the label:

1. CDOT Project Name and Project Number
2. Date (of transmittal to CDOT Representative)
3. Name, address, and telephone number of Contractor
4. Indication of review by Contractor, date, and result of review. Submittals without Contractor review stamp will not be accepted and will be returned without review.

5. Specification Section and Submittal Schedule number, the products included in the Submittal relating to Submittal clearly referenced on the submittal package.
6. Subsequent resubmittals require a suffix to the Submittal Section number identifying the resubmittal as such.
7. Meet agreed-upon Submittal Schedule

F. Submittal Transmittal: Package submittals appropriately for transmittal and handling. Transmit with a transmittal form identifying the name of the Submittal and product, the Specification Section, and the Submittal Schedule number.

G. Project-Specific Submittal Log: Owner will provide a project-specific Submittal Log to Contractor at the Project Pre-Construction Meeting. Submittals are due from Contractor to CDOT Representative on the specific dates indicated. At Pre-construction meeting, CDOT Representative will provide contractor proposed schedule of submittal due dates for review. Contractor must propose any date changes within seven (7) days of pre-construction meeting. All Submittals are due by six (6) weeks from Notice to Proceed date. The Submittal Log delineates due dates based on the Notice to Proceed date of the project. Failure to meet these submittal deadlines will have an effect on the Contractor's overall rating as part of the State's Contract Management System requirements.

H. Contractor's Construction Schedule: The Contractor shall submit a written/electronic detailed construction schedule within seven (7) calendar days of receiving the Notice to Proceed from the CDOT Representative. Provide for separation of major construction activities. Provide starting and completion dates for major construction activities.

I. Weekly Construction Reports: Contractor shall prepare a weekly construction report recording information concerning events at the site. Report shall be sent electronically every Friday by 8:00 a.m. recapping the current week's activities and projecting the next week's activities, for each work day. Weekly progress photos should be included with this report. Submit one copy to the CDOT Representative, electronic files are preferred. Reports shall include the following information:

1. Substantial completions.
2. General weather conditions, if applicable.
3. Accidents, stoppages, delays, shortages, losses. (Note: any accidents or delays/losses need to be communicated verbally to Owner at the time of incident.)
4. Change Order Bulletins, Change Order Proposals, Change Orders, Emergency Change Orders, or Field Orders received and/or implemented. Written report does not substitute for verbal telephone communication by Contractor to CDOT Representative on any pertinent issue.

J. Manufacturer's Operations and Maintenance Manuals/Instructions: See Section 01782 Operations and Maintenance Data for more detailed information.

K. Shop Drawings: Submit new information, drawn to accurate scale. Indicate deviations from Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Include the following information:

1. Dimensions, elevations, heights, etc.
2. Identification of products and materials included.
3. Notation of dimensions established by field measurement.

L. Submittal: Submit electronic drawings or correctable, translucent, reproducible print(s) and one copy made from the translucent, reproducible print(s) for review if the submittal is in the form of a drawing. Submit one electronic or four identical copies for review if the submittal is

in the form of cut sheets, written data, etc. Submit one sample or color chip of the submittal is a color selection or product sample. The reproducible print(s) (if submittal is in the form of a drawing) or one copy (if the submittal is in the form of cut sheets, written data, etc.) will be returned to the Contractor marked with action taken and corrections or modifications required after review by Architect, Owner, Engineers and Code Reviewer. The Contractor shall make all necessary copies of the returned reproducible print or copy for distribution to Sub-Contractors or affected parties. Submittals must have the stamp and signature of the Contractor, indicating the General Contractor has reviewed the Submittal prior to submission to the Architect, Owner, Engineer, and Code Reviewer. Submittals not reviewed by General Contractor will be returned un-reviewed by the CDOT Representative.

M. Do not fabricate or install any items from Shop Drawings without a final stamp from the CDOT Representative, Architect or Engineer which indicates action to be taken (if any) by the Contractor.

N. Product Data: Collect Product Data into a single submittal for each element or system. Mark each copy to show applicable choices and options. Where Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include, as applicable, the following information:

1. Manufacturer's printed recommendations.
2. Compliance with recognized testing agency standards and with the requirements of the Specifications.
3. Application of testing agency labels and seals.
4. Submittal: Submit four identical copies or an electronic copy of product data. One copy will be returned to the Contractor marked with action taken and corrections or modifications required after review by Architect, Owner, Engineers and Code Reviewer. The Contractor shall make all necessary copies of the returned submittal for distribution to Sub-Contractors or affected parties.

O. Submittal Action: CDOT Representative, Architect, or Engineers will review each submittal, mark to indicate action taken, and return. Compliance with specified characteristics is the Contractor's responsibility.

P. Action Stamp: The CDOT Representative, Architect, or Engineer will stamp each submittal with an action stamp or transmittal. The stamp or transmittal will be marked to indicate action to be taken.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

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SECTION 01700
PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 COMPLETION AND ACCEPTANCE OF THE WORK

A. The Contractor shall communicate to CDOT Representative that project is substantially complete. CDOT Representative will schedule a Project Closeout (Punch List) Meeting. The project shall be considered complete when, in the CDOT Representative's opinion, a list of incomplete work does not exceed ten (10) minor items of the Work. Should the CDOT Representative determine that the work is not complete, the CDOT Representative will immediately notify the Contractor, in writing, stating reasons why the project is not considered complete. Project is not considered complete if there are major issues outstanding or incomplete or failed inspections. Should the CDOT Representative determine that the work is complete, after the walk through; the CDOT Representative will prepare and issue a punch list of deficiencies that need to be corrected before final acceptance. After Contractor brings the project into a state of completion, a Final Inspection Meeting shall be set up by the CDOT Representative. The Contractor is made aware that all additional costs associated with re-inspection shall be paid from monies otherwise earned by the Contractor. These costs shall include the CDOT Representative's labor (time) and all associated costs of travel to the project site to attend the follow-up Project Closeout (Punch List) Meeting.

1.3 RECORD DRAWINGS

A. Maintain a clean, undamaged set of Contract Drawings. Mark-up these drawings to show the actual installation. Give particular attention to concealed elements that would be difficult to measure and record at a later date. The Record Drawings shall be kept current and shall be marked-up as necessary during the course of executing the Work. If requested by the CDOT Representative, the Contractor shall show evidence that the Record Drawings are current as a precedent to approval of Contractor Payment Applications.

1.4 RECORD SPECIFICATIONS, FINAL AS-BUILT PLANS

A. Maintain one copy of the Project Contract, including addenda. Mark to show variations in actual Work performed in comparison with the Specifications and modifications. The Record Specifications shall be kept current and shall be marked-up as necessary during the course of executing the Work. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot be readily discerned later by direct observation. If requested by the CDOT Representative, the Contractor shall show evidence that the Record Specifications are current as a precedent to approval of Contractor Payment Applications.

B. Upon completion of Project, one (1) paper copy, and two (2) electronic PDF versions on a disc, of final, accurate as-built drawings shall be delivered to the CDOT Representative. This complete submittal shall include all drawings, including architectural, mechanical, electrical

and plumbing.

1.5 COMMISSIONING

A. Prior to Project Closeout, HVAC testing and balancing and electrical commissioning in accordance with the 2015 IECC must be completed and shown to be compliant with drawings and specifications. Contractor shall submit reports to owner and code reviewer at the Project Closeout meeting.
   1. HVAC testing shall be in accordance with Section 15990 Testing and Balancing and adjusted at Contractor's cost.
   2. Electrical commissioning shall be completed at CDOT's cost by the Electrical Engineer for the project in accordance with IECC Section C408. Contractor to notify owner when project is ready for inspection. If inspection is failed, re-inspection is at Contractor's cost.

1.6 OPERATIONS AND MAINTENANCE (O & M) MANUAL

A. Refer to Section 01782, Operations & Maintenance Manual, for further information on O & M specifics.

1.7 START-UP, OPERATING AND MAINTENANCE TRAINING AND INSTRUCTION

A. Unless directed otherwise in Divisions 15 or 16, the Contractor shall arrange for training and instruction of the Owner's personnel in proper start-up, operation and maintenance procedures for all devices and equipment installed in this contract. All training and instruction is intended to be completed in one session, however, at the mutual consent of the Contractor and Owner, more than one session may take place. Schedule training with CDOT Representative, most likely to take place on the day of the Substantial Completion Walk Through. The total length of the training and instruction session(s) shall not exceed 8 hours unless mutually agreed upon by the Owner and the Contractor. Training and instruction in excess of 8 hours shall not be compensated by the Owner. Training and Instruction shall include, but not be limited to, the following topics:
   1. Start-up procedures
   2. Operating instructions
   3. Shut-down procedures
   4. Review of Operating and Maintenance manuals

1.8 FINAL CLEANING

A. Complete the following before providing notification that the work is complete:

   1. Remove labels that are not permanent labels.
   2. Clean exposed hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances.
   3. Clean the site of rubbish, litter and other foreign substances. See Special Conditions.

B. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Remove waste materials from the site and dispose of in a lawful manner.

PART 2 - PART 2 - PRODUCTS (Not Applicable)

PART 3 - PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01782
OPERATIONS AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation manuals for systems and equipment
2. Maintenance manuals for the care and maintenance of systems and equipment

B. Related Sections include the following:

1. Section 01300 "Submittals" for submitting copies of operation and maintenance manuals.
2. Section 01700 “Project Closeout” for timing of Operation and Maintenance Training for Owner.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Preliminary Submittal: Submit one (1) copy of Operations and Maintenance manual in final form a minimum of two (2) weeks prior to the Project Closeout (Punch List) Meeting. CDOT Representative will return one (1) copy with comments within 10 days of receipt.

1. Correct or modify manual to comply with CDOT Representative’s comments. Submit two (2) hard copies of corrected manual and two (2) electronic PDF copies on a disc within 10 days of receipt of Owner or Architect’s comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize the information required in the manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page
2. Table of contents
3. Manual contents

B. Title Page: Include the following information:

1. Subject matter included in manual
2. Name, address, and telephone number of Contractor

C. Table of Contents: List each product included in the manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
2. Include Specification Section Number for each product in table of contents
3. Include the final copy of the Submittal Log

D. Manual Contents: Organize into sets of manageable size. Arrange contents by specification section number and then alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, (3 inch wide maximum) sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents.
   a. Identify binder(s) on spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider.
3. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
5. Electronic Copy: Provide a disc that contains electronic PDFs of all information contained within the Operation and Maintenance Manual. Information to be organized into folders that match the divider section in the hard copy manual.

2.2 OPERATION MANUALS

A. The Contractor shall refer to Divisions 15 and 16 specifications concerning the O & M manuals for devices germane to Divisions 15 and 16. Unless otherwise indicated, organize O & M manuals into 3-ring binders.

1. Copies of Warranties
2. Index referencing Specification section number
3. Clear identification of specific product(s) or equipment used
4. Identification of equipment or products identified in the project manual that may not be typical
5. Parts list(s)
6. Start-up procedures
7. Operating Instructions
8. Wiring Diagrams
9. Piped system diagrams
10. Maintenance instructions
11. Manufacturer and/or Representative including:
    a. Name of Firm, Address, Telephone Number, Facsimile Number, Contact Name and e-mail address
12. List of Contractors, Sub-Contractors
    a. Name of Firm, Address, Telephone Number, Facsimile Number, Contact Name and e-mail address

B. Preliminary Submittal: Submit one (1) copy of each manual in final form prior to the Project Closeout (Punch List) Meeting. CDOT Representative will return copy with comments within 10 days of receipt.

1. Correct or modify manual to comply with CDOT Representative's comments. Submit two (2) hard copies of corrected manual and two (2) electronic PDF copies on a disc within 10 days of receipt of CDOT Representative's comments.

C. Manuals shall be prepared from the following materials:

1. Loose leaf, punched paper
2. Dividers with holes reinforced with plastic cloth
3. Page size, 8-1/2 inches by 11 inches
4. Foldout diagrams and illustrations
5. Reproducible by dry-copy xerography method
6. Oil-, moisture- and wear-resistant plastic covers

D. General Requirements for Manuals:

1. Manufacturer's operating manuals giving complete instructions relative to assembly, installation operation, adjustment, lubrication, maintenance, cleaning and carrying complete parts list shall be furnished by the Contractor for every item of machinery and equipment furnished by the Contractor.
2. Manuals furnished may be manufacturer's standard publications in regard to size and binding provided they comply with specified requirements relative to quantity and quality of information and data.
3. Manuals shall be bound in hard or flexible covers. Illustrations shall be clear, and printed matter, including dimensions and lettering on drawings, shall be easily legible. If reduced drawings are incorporated into manuals, original lines and letters shall be darkened as necessary to retain their legibility after reduction. Larger drawings may be folded into manuals to page size.

E. Format Manuals as follows:

1. Title page: Include the name and function of the equipment, manufacturer's identification number, and the project Specifications number and title.

2. Table of contents, in numerical order listing each section and subsection title of the O&M Manual with reference to the page on which each starts and a list of included diagrams and drawings.
3. Index, in alphabetical order.
4. Frontispiece: Recognition illustration of the equipment described in the O&M Manual.
5. Manufacturer's literature describing each piece of equipment or product, including major assemblies and subassemblies, and giving manufacturer's model number and drawing number.
6. Operation instructions including step-by-step preparation for starting, safe operation, shutdown and draining, cleaning and emergency requirements.
7. Control diagrams, as-installed by the manufacturer.
8. Sequence of operation by the control manufacturer.
9. Wiring diagrams, as-installed and color codes, of electrical motor controllers, connections and interlock connections.
10. Diagrammatic location, function and tag numbers of each valve.
11. Maintenance instructions: Include step-by-step procedures for inspection, operation checks, cleaning, lubrication, adjustments, repair, overhaul, disassembly, and reassembly of the equipment for proper safe operation of the equipment. Include list of special tools which are required for maintenance with the maintenance information.
12. Possible breakdowns and repairs.
13. Manufacturer's parts list of functional components, control diagrams and wiring diagrams, giving manufacturer's model number and manufacturer's part number.
14. "Long-Lead-Time" spare parts list for spare parts not readily available on the local open market or for which it is anticipated ordering and delivery time will exceed 10 days.
15. List of nearest local suppliers of all equipment parts.
16. Lubrication schedule indicating type and frequency of lubrication.
17. Manufacturer's warranty and guarantee data.
18. Spare parts data as follows:
    a. Complete list of parts and supplies, with current unit prices and sources of supply.
    b. List of parts and supplies that are either normally furnished at no extra cost with purchase of equipment, or specified herein to be furnished as part of Contract.
    c. List of additional items recommended by manufacturer to assure efficient operation for period of 120 days.
19. Appendix: Include safety precautions, a glossary, and, if available at time of submittal, copies of test reports, and other relevant material not specified to be submitted.
20. Delete information on material or equipment not used in the work from the O&M Manual.

F. Operating Diagrams:

1. Piping system, electrical wiring diagrams, fuel oil, lubricating oil, water capacity diagrams, and other diagrams, necessary for operation of machinery and equipment shall be furnished and installed where designated by the Engineer.
2. No single diagram shall show more than one system, or parts thereof.
3. Diagrams shall be reproduced by photographic process to a size not to exceed 18 inches by 24 inches and shall be complete and legible in all respects. Systems shall be subdivided into portions which are operable from location where diagrams are installed, and to provide intelligible information within specified size. They shall be made on white paper and vacuum-sealed in transparent plastic material impervious to moisture and oil, and resistant to abrasion. Other formats which are equal in clarity, sharpness, durability and permanence will be considered.

2.3 MAINTENANCE MANUALS

A. Content: For each system, or piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty information, as described below.

B. Source Information: List each system, or piece of equipment included in the manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions, with specific product(s) or equipment identified.
2. Drawings, diagrams, and instructions required for maintenance

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Troubleshooting guide

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service.

F. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

G. Warranties: Include copies of warranties and lists of circumstances and conditions that would affect validity of warranties.

1. Include procedures to follow and required notifications for warranty claims.
   a. Facsimile Number, Contact Name and e-mail address

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work.

END OF SECTION

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SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, mix design, placement procedures, miscellaneous items, and finishes for all concrete items.

B. Cast-in-place concrete includes the following:

1. Equipment Bases
2. Bollard Embedments
3. Form Materials
4. Concrete Materials
5. Patching of interior concrete for plumbing

1.3 SUBMITTALS

A. Product data for proprietary materials and items, including all admixtures, patching compounds, joint systems, absorptive cover, moisture-retaining cover, liquid membrane-forming curing compound, sealer, evaporation control compound, bonding agent, cleaner/stripper, preformed expansion joint filler strips, joint sealant, and others.

B. Refer to Project-Specific “Submittal Log” presented by Owner at Pre-Bid Meeting.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards (latest edition and/or version), except where more stringent requirements are shown or specified elsewhere:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 301, “Specifications for Structural Concrete.”
3. ACI 302.1R, “Guide for Concrete Floor and Slab Construction.”
4. ASTM C94, “Ready-Mixed Concrete.’
5. ASTM C150, “Portland Cement.”
6. ASTM C260, “Air Entraining Admixtures for Concrete.”
7. ASTM C309, “Liquid Membrane-Forming Compounds for Curing Concrete.”
8. ASTM C494, “Water Reducing Admixtures for Concrete.”
9. ASTM C595, “Blended Hydraulic Cements”
10. ASTM C618, “Fly Ash Mineral Admixture for Concrete.”
11. ASTM C1157, “Performance Specification for Hydraulic Cement”

12. ASTM C1602, “Mixing Water Used in the Production of Hydraulic Cement Concrete”

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Contractor shall be responsible for design, strength, and safety of formwork. Formwork shall be designed to withstand vibrator action. Design, strength, spans, details, etc. of forms shall be the Contractor’s responsibility, and shall be in full conformance with the form manufacturer’s recommendations.

B. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials complying with PS 1, A-C or B-B High Density Overlaid Concrete Form, Class I to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow of deflection.

C. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

D. Form Release Agent: Provide commercial formulation form release agent with a maximum of 210 g/L volatile organic compounds (VOCs) that will not stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

    a. Formshield WB or Formshield Pure, The Euclid Chemical Company 1-800-321-7628 www.euclidchemical.com
    b. Clean Strip Form Release (J-1EF), Dayton Superior 1 877-416-3439 www.daytonsuperior.com
    c. Duogard ® II, W.R. Meadows, Inc. 1-800-342-5976 www.wrmeadows.com

E. Inspection must occur prior to placing concrete. Forms must be inspected for cleanliness, accuracy of alignment, and reinforcing steel clearances.

F. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

1. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

2.2 REINFORCING MATERIALS

A. Welded Steel Wire Fabric: ANSI/ASTM A185 plain type; in flat sheets only; uncoated finish unless noted as hot dip galvanized on the drawings.

B. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).
2. Wood, brick or other unacceptable material is not permitted.

C. Joint Dowel Bars: Provide dowels at interior concrete patching. ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

2.3 CONCRETE MATERIALS

A. General: Refer also to "TABLE 03300 – 1" at the end of this Specification Section.

B. Hydraulic Cement:

1. ASTM C 150, Type I, II or V, ASTM C595 Type IP or ASTM C1157 Type GU, MS or HS unless otherwise noted on drawings
2. Use one brand of cement throughout the Project, unless otherwise noted on drawings.
3. Refer to Table 03300-1 at the end of this specification section for more information about the different "uses" of concrete.

C. Fly Ash: ASTM C 618, Type F. Fly ash shall not exceed 30% of total cementitious material by weight.

D. Silica Fume: ASTM C1240. Silica fume shall not exceed 7% of total cementitious material by weight

E. Normal-Weight Aggregates: ASTM C 33. Provide aggregates from a single source throughout the Project.

1. For exposed exterior surfaces, Coarse aggregates shall meet the requirements for Class 4S.
2. Fine Aggregate: Natural sand, manufactured sand or a combination thereof.
3. Coarse Aggregate: Gravel or crushed stone.
4. Maximum size of coarse aggregate shall be as follows:
   For footings…….. 1 inch
   For walls……3/4 inch
5. Any aggregate source used shall be screened for alkali-silica reactivity (ASR) using ASTM C1260. Aggregates with an expansion greater than 0.10% shall not be used or mitigative measures shall be used.
   a. Mitigative measures shall be tested using ASTM C1567 on each aggregate source to determine the minimum amount of mitigation. ASTM C1567 testing shall be run using the mix design cement and fly ash. The mitigative measure shall have an expansion less than 0.10%.

F. Ready-Mix Concrete:

1. Materials: Materials, including cement, aggregates, water, and admixtures, shall meet the requirements of ASTM C94, subject to the additional requirements of this section.
2. Quality of Concrete: Concrete shall be furnished under Alternative No. 3, ASTM C 94, whereby the manufacturer assumes full responsibility for the selection of the proportions

for the concrete mixture, with the minimum allowable cement content specified. Submit statement of composition as specified in Part 1 of this section.

3. Cement Content: As required to meet minimum strengths as indicated on the drawings.
4. Air Content: See Table 03300-1
5. Slump: See Table 03300-1
6. Maximum water-cement ratio: See Table 03300-1
7. Manufacture and Delivery:
   a. Measurement of materials, batching, mixing, transporting, and delivery shall be as specified in ASTM C 94.
   b. Hauling Time: Discharge all concrete transmitted in a truck mixer, agitator, or other transportation device no later than 1-1/2 hours.
   c. Temperature of Concrete: The temperature of the concrete prior to placement shall be less than 90 degrees Fahrenheit.
   d. Extra Water:
      (i Deliver concrete to site in exact quantities required by design mix.
      (ii Additional water is not permitted to be added to mix after leaving batch plant without prior approval of the Architect. If additional water is to be added, sets of 3 test cylinders shall be created for every truck where water has been added, taken at the point of placement. Additional water quantity shall be indicated on truck ticket and signed by person responsible.
      (iii Where extra water is added to concrete it shall be mixed thoroughly for 50 revolutions of drum before depositing.
      (iv Water may be added to the site only once for each batch.
      (v An additional slump and air content test shall be performed following the addition of any water.
   e. Redosage with High Range Water Reducing Mixture (Superplasticizer); May be done with prior acceptance of Engineer regarding dosage and time periods.

G. Water: Shall meet the requirements of ASTM C1602.

H. Admixtures: Assure that admixtures used contain zero percent calcium chloride, or admixtures containing more than 0.05 percent chloride ions or thiocyanates.

I. Air-Entraining Admixture: ASTM C 260/AASHTO M154. The Contractor is responsible for assuring that the admixture is compatible with all other admixtures, if used, as well as related materials.

   1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work are listed of CDOT's Approved Products List located at: http://apps.coloradodot.info/apl/AplSearch.cfm

J. Water-Reducing Admixture: ASTM C 494, Type A/ AASHTO M194 Type A. This admixture may be used at the Contractor's option. The Contractor is responsible for assuring that the admixture is compatible with all other admixtures, if used, as well as related materials.

   1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work are listed of CDOT's Approved Products List located at: http://apps.coloradodot.info/apl/AplSearch.cfm

K. Accelerating Admixture: ASTM C 494, Type C/ AASHTO M194 Type C. This admixture may be used at the Contractor's option. The Contractor is responsible for assuring that the admixture is compatible with all other admixtures, if used, as well as related materials.

   1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work are listed of CDOT's Approved Products List located at: http://apps.coloradodot.info/apl/AplSearch.cfm

L. Water-Reducing and Retarding Admixture: ASTM C 494, Type D/ AASHTO M194 Type D. This admixture may be used at the Contractor's option. The Contractor is responsible for assuring that the admixture is compatible with all other admixtures, if used, as well as related materials.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated in the are listed of CDOT's Approved Products List located at: http://apps.coloradodot.info/apl/AplSearch.cfm

M. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E/ AASHTO M194 Type E. This admixture may be used at the Contractor's option. The Contractor is responsible for assuring that the admixture is compatible with all other admixtures, if used, as well as related materials.

   1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work are listed of CDOT's Approved Products List located at: http://apps.coloradodot.info/apl/AplSearch.cfm

N. Water-Reducing, High Range Admixture: ASTM C 494, Type F/ AASHTO M194 Type F. This admixture may be used at the Contractor's option. The Contractor is responsible for assuring that the admixture is compatible with all other admixtures, if used, as well as related materials.

   1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work are listed of CDOT's Approved Products List located at: http://apps.coloradodot.info/apl/AplSearch.cfm

O. Water-Reducing, High Range, and Retarding Admixture: ASTM C 494, Type G/ AASHTO M194 Type G. This admixture may be used at the Contractor's option. The Contractor is responsible for assuring that the admixture is compatible with all other admixtures, if used, as well as related materials.

   1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work are listed of CDOT's Approved Products List located at: http://apps.coloradodot.info/apl/AplSearch.cfm

P. Use of admixtures will not relax cold weather placement requirements.

2.4 RELATED MATERIALS

A. Cleaner / Stripper: Biodegradable citrus-based solvent that will not etch concrete.

   1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
      a. Euco Clean & Strip, Euclid Chemical Co. 1-800-628-9900 www.euclidchemical.com
      b. Citrus Peel (J-48)™, Dayton Superior Corporation 1-866-329-8724 www.daytonsuperiorchemical.com
      c. Green Bean Clean, Dayton Superior 1-877-416-3439 www.daytonsuperior.com

B. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss. It is the responsibility of the Contractor to assure compatibility between evaporation control product and curing compound. After application of a monomolecular film-forming compound, the concrete surface shall not be re-worked.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
   a. EucoBar, Euclid Chemical Co. 1-800-321-7628 www.euclidchemical.com
   b. Sure Film (J-74)™, Dayton Superior 1-877-416-3439 www.daytonsuperior.com

C. Preformed Expansion Joint Filler. Preformed rigid sugarcane fiber board product containing durable asphalt conforming to ASTM D 1751.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
   a. Conflex ®, A Knight Company 1-800-375-0289 www.aknightcompany.com

D. Joint Sealant: Sealant over the top of the preformed expansion joint filler strip, and within the sawn shrinkage control joints in the slab on grade. Sealant shall be a one-component, high-performance, gun-grade, urethane sealant for sealing and protecting moving joints of all types and suitable for exterior joints and possessing chemical resistance to: gasoline, mineral spirits, lubricating oil, and diesel fuel. Sealant shall conform to ASTM C 920, Type S, Grade NS, Class 25.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work are listed of CDOT's Approved Products List located at: http://apps.coloradodot.info/apl/AplSearch.cfm
2. Color: Manufacturer's standard, gray (or as directed by the Architect).

2.5 PATCHING GROUT

A. Portland cement, water, and fine sand passing a No. 30 mesh sieve.

B. Sikagrout 212 or Sikadur 32 Hi-Mod as manufactured by Sika Corporation, or approved equal.

2.6 NONSHRINK GROUT

A. Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents meeting the requirements of ASTM C1107; capable of developing a minimum compressive strength of 6,000 psi in 28 days.

1. Subject to compliance with requirements, use one of the following:
   a. "Masterflow 713" - Master Builders
   b. "Five Star Grout" - U.S. Grout Corp.
   c. "Propak" – Protex
   d. 1107 Advantage Grout – Dayton Superior 1-877-416-3439 www.daytonsuperior.com

2.7 SLEEVES

A. Floor Sleeves: PVC or hot dipped galvanized schedule 40 pipe sleeves, two pipe sizes larger than carrier pipe, unless otherwise noted on the Drawings.

2.8 OTHER EMBEDDED ITEMS

A. Items encased in concrete shall not be painted. Structural steel items embedded into concrete shall be painted with finish paint coating minimum 2 inch embedment into concrete, the remainder shall not be painted. Where accessible, paint bollards 6 inch embedment.

2.9 PROPORTIONING AND DESIGNING MIXES

A. Design mixes to provide normal weight concrete with the properties as shown in TABLE 03300 - 1 which is located at the end of this specification section. Note that there are different “uses” which require different mixes, cement types, strengths, etc.

B. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted in writing by the Architect prior to placement. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Architect before using in Work.

2.10 ADMIXTURES

A. The use of water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete for placement and workability is acceptable and done at the Contractor’s option.

B. The use of accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C) is acceptable.

C. Use admixtures for water reduction, set acceleration, or retarding in strict compliance with manufacturer's directions.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, anchor rods, trench drains, sleeves, block-outs, drains and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view. Refer to Architectural drawings for control joint and tie hole patterns, as indicated.
2. Provide Class C tolerances for other concrete surfaces.

B. Forms:

1. Sufficiently tight to prevent loss of mortar.
2. Seal wood with coating material to minimize absorption of moisture from the concrete.
3. Coat textured forms with release agent and others where required. Application shall be prior to reinforcement placement.
4. Coat steel forms with a non-staining, rust preventive form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, recesses, and the like for easy removal.

D. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

3.3 PLACING REINFORCEMENT

A. Design: The reinforcement design shown on drawings shows only the necessary information for detailing the reinforcement and preparing placing and bending details.

B. Inspection: After reinforcement has been placed, it shall be inspected prior to placing the concrete.

C. Condition of Surfaces: At time concrete is placed, all metal reinforcement shall be free from rust, scale, frost, oil, dirt, or other coatings that would destroy or reduce the bond, unless otherwise noted on the drawings.

3.4 INSTALLING EMBEDDED ITEMS

A. Embedded steel pipe bollards shall be painted prior to casting in concrete, with 6 inches of the embedded portion of the steel pipe to be painted. The embedded steel pipe bollard shall be plumb and secured prior to casting. Assure that the steel pipe bollard has a 42 inch projection prior to embedding. The concrete bollard foundation shall be installed to permit removal and replacement of both bollard and concrete without damaging adjacent concrete slabs and foundations. The inner portion of the embedded steel pipe bollard is allowed to be filled either during the embedment or at a later time. The top of the inner fill portion shall be mounded 1 inch so as to allow drainage. Upon completion of the embedding and filling of the steel pipe bollard, the exposed steel portion and the mounded top concrete shall be touch up painted as specified in Section 09900 - Painting.

3.8 CONCRETE PLACEMENT

A. Preparation Before Placing:

1. Remove hardened concrete and foreign materials from inner surfaces of conveying equipment.
2. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work. Placement of concrete where reinforcing is required shall not occur until the reinforcing has been inspected and approved by the Engineer.
3. Remove ice and excess water and sprinkle semiporous subgrades sufficiently to eliminate suction.
4. Do no place concrete on frozen ground.

5. Do not place concrete during rain, sleet, or snow unless protection is provided.

B. General: Comply with ACI 304, “Guide for Measuring, Mixing, Transporting, and Placing Concrete,” and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Place concrete in final position to avoid segregation due to rehandling or flowing. Spread concrete in horizontal layers and do not drop more than 5 feet without using drop chutes. Place concrete at such a rate that the concrete remains plastic and flows readily into spaces between bars. Do not deposit concrete that has partially hardened or become contaminated by foreign material. Deposit concrete in forms in horizontal layers between 6 inches and 20 inches high and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints. Remove temporary form spreaders when concrete reaches them.

E. Consolidating:

1. Use high frequency vibrators in the placement of concrete forms. When concrete is being placed on hardened concrete or in bottom of forms, exercise care to ensure complete consolidation. After the initial lift, vibrator shall penetrate through and into top of previous lift of concrete.
2. Internal vibrators shall have a minimum frequency of 8,000 rpm. Over-vibrating and use of vibrators to transport concrete within forms shall not be allowed. Insert and withdraw vibrators at many points, from 18 to 30 inches apart, for 5 to 15-second duration. Keep a spare vibrator on the project site during all concrete placing operations.
3. Once concreting is started, it shall be carried on as a continuous operation until the placing of the panel or section is completed, preventing fresh concrete from being deposited on concrete that has hardened sufficiently to cause formation of seams and planes of weakness within the section.
4. Remove splashes or accumulations of hardened or partially hardened concrete or mortar on forms or reinforcement above general level of the concrete already in place before the work proceeds.
5. Maintain reinforcement in proper position during concrete placement operations.
6. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surfaces free of lumps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

F. Cold Weather Placement:

1. When for three successive days prior to concrete placement the average daily outdoor temperature drops below 40 deg F or when the average outdoor temperature is expected to drop below 40 deg F on the day of concrete placement, preparation, protection and curing of concrete shall comply with ACI 306.R.
2. Minimum temperature of concrete upon delivery shall conform to ACI 301 Table 7.6.1.1. Concrete temperature at time of placement shall conform to minimum values of ACI 306.R Table 1.4.1, and shall not exceed minimum values by more than 20 degrees F.
3. Subject to acceptance of Engineer an accelerating admixture may be used. Admixtures shall meet requirements of Part 2. Calcium Chloride and other chloride-type accelerating admixtures will not be allowed.

4. Comply with concrete protection temperature requirements of ACI 306.R. Record concrete temperatures during specified protection period at intervals not to exceed 16 hours and no less than twice during any 24 hour period.
5. Submittal of detailed procedures, means, and methods, for production, transportation, placement, protection, curing, and temperature monitoring of concrete during cold weather is required.
6. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

G. Hot Weather Placement:

1. When depositing concrete in hot weather, follow recommendations of ACI 305R.
2. Temperature of concrete at time of placement shall not exceed 85 deg F.
3. When air temperatures on day of placement are expected to exceed 90 deg F, mix ingredients shall be cooled before mixing. Flake ice or well-crushed ice of a size that will melt completely during mixing may be substituted for all or part of mix water.
4. Retarding admixture may be used subject to acceptance of Engineer. Admixtures shall meet requirements of Part 2.
5. Protect to prevent rapid drying. Start finishing and curing as soon as possible. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
6. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

H. Protection: Protect newly finished slabs from rain damage. Protect finished slabs from mortar leakage from pouring of concrete above. Cover masonry walls, glazing, and other finish materials with polyethylene or otherwise protect from damage due to pouring of concrete.

3.9 CONCRETE PATCHING

A. Repair and patch areas of concrete damaged or cut during construction.

B. Filling in: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction.

C. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement and two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated and at all patched areas in existing concrete slab. Drill into existing concrete slab to provide proper embedment and bonding for concrete patch.

3.10 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

3.11 SLAB FINISHES

A. Float Finish: Apply float finish to all slab surfaces and interior patch work.

B. Non-slip Broom Finish: Apply a non-slip broom finish to the equipment slabs.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Do not apply broom finish until such operations are assured of not dislodging aggregate.

3.12 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions.

B. Curing Formed Surfaces: Cure formed concrete surfaces with forms in place for the full curing period of 7 days minimum. If forms are removed prior to full curing period, continue curing after forms are removed by any of three curing methods:
1. Method that maintains the presence of mixing water in the concrete during the early hardening period. These include ponding, spraying, fogging, and saturated wet coverings.
2. Method that prevents loss of mixing water from the concrete by sealing the surface. These include impervious paper, plastic sheets, or applying membrane-forming curing compounds.
3. Method that accelerates strength gain by supplying heat and additional moisture to the concrete. This is accomplished with heating the concrete, heating the forms, or heating pads.

C. Curing Unformed Surfaces: Start initial curing as soon as free water has disappeared from concrete surface and after placing and finishing. Cure unformed surfaces, including slabs, aprons, stoops, and toppings by any of the following three curing methods:

1. Moisture curing:
   a. Keep concrete surface continuously wet by covering with water.
   b. Use continuous water-fog spray.
   c. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.
   d. Maintain moisture curing method for not less than 7 days.
2. Moisture-retaining cover curing:
   a. Cover concrete surfaces with moisture-retaining cover, placed in widest practical width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   b. Maintain moisture-retaining cover curing method for not less than 3 days.
3. Liquid membrane-forming curing compound: Use membrane curing compound that will not adversely affect surfaces to be covered with finish materials applied directly to the concrete. Furthermore, use membrane curing compound that will not adversely affect any sealer compound to be applied at a later date. If the Contractor chooses to cure the unformed slab surface with a liquid membrane-forming curing compound, then the Contractor must consider this potential for additional work in order to prepare the slab for sealing. The liquid membrane-forming curing compounds that have been specified are dissipating type products. If the dissipation has not fully taken place, then the remaining

product on the surface of the slab must be removed through the use of a cleaner/stripper product. The Contractor is reminded that there are three acceptable methods to providing for curing of unformed surfaces. Apply curing compound as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application.

D. Protection:

1. In cold weather, maintain the moisture conditions but also, by heating or covering, maintain temperature of the concrete between 50 degrees F and 70 degrees F for entire curing period.
2. In hot weather, take immediate steps to protect newly finished concrete from the drying effects of wind and sun, and maintain temperature of the air surrounding the concrete uniform within 5 degrees F in any one hour or 50 degrees F in any 24-hour period. During curing period, protect concrete from mechanical damage, loading, shock, and vibration.

E. Cleaning and/or Stripping Unformed Surfaces: If the dissipating liquid membrane-forming curing compound has not fully dissipated by the time the sealer is to be applied, then the remaining portions shall be removed through the use of a cleaner / stripper product. Surface shall be prepared in accordance with manufacturer's directions. Application may be with sprayers, automatic floor scrubbers, or other conventional methods. Apply cleaner / stripper in accordance with manufacturer's written recommendations. Thoroughly clean surface in advance of applying sealer. Cleaner / stripper need only be applied to slab-on-grade surfaces that are intended to be sealed.

3.13 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained. All supporting forms shall remain in place for a minimum of 14 days and until concrete has obtained design minimum compressive strength at 28 days. Do not remove supporting forms or shoring until members have acquired sufficient strength to support their weight and imposed loads safely.

3.14 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas of existing slab with cement mortar.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Mix the patching grout in advance and allow to stand with frequent manipulation with a trowel, without adding water, until it has reached the stiffest consistency that will permit placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. When the bonding agent begins to lose the water sheen, apply the premixed patching grout. The grout shall be thoroughly consolidated into place and struck off to leave the patch slightly

higher than the surrounding surface. To permit initial shrinkage, leave the patch undisturbed for at least 1 hour before finishing it. Keep the patched area damp for 7 days. Do not use metal tools in finishing a patch in a formed wall that will be exposed.

C. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured.
3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish so as to blend in with the adjacent finished concrete. Cure in same manner as adjacent concrete.

D. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs with prior written approval of the Architect for method and procedure.

F. Repair methods not specified above may be used, subject to prior written acceptance of the Architect.

TABLE 03300 - 1

USE	f '$_c$ [1] (ksi)	W/C RATIO (max or range)	AGGREGATE [3] TYPE	Air Content (range)	Additional Requirements
~~Foundations & grade beams (all portions)~~	~~4.5~~	~~0.45~~	~~ASTM C 33 **NW – Coarse #1**~~	~~5.0 to 8.0%~~	~~2, 4~~
Slab-on-grade (Interior) [7]	4.5	0.38 to 0.44	ASTM C 33 **NW – Coarse #2**	0.0 to 0.2%	2, 4, 5, 6
Exterior Concrete Work	3.5	0.45	ASTM C 33 **NW – Coarse #2**	0% +/- 1%	4
~~Slabs-on-grade (Exterior Apron) and Waste Oil Tank Slab~~ [7]	~~4.5~~	~~0.38 to 0.44~~	~~ASTM C 33 NW – Coarse #2~~	~~6.0% +/- 1.5%~~	~~2, 4, 5, 6~~

1 Compressive strength at 28 days.

3 NW = Normal Weight

NW-Coarse #1 – Maximum size 1 1/2", with nominal maximum size of 1", Size Numbers 5, 56 or 57 as shown in Table 2 of ASTM C33.

NW-Coarse #2 – Maximum size of 1", with nominal maximum size of ¾", Size Numbers 6 or 67 as shown in Table 2 of ASTM C 33.

4 Slump shall be at the contractor's discretion. Slump shall be sufficient to allow consolidation and not exhibit segregation potential or excessive bleeding. The slump of the delivered concrete shall be +/- 2.0 inches of the slump of the laboratory trial batch.

5 The concrete mix design shall have a permeability of less than 1500 coulombs at 28 days when tested using ASTM C1202.

6 The concrete mix design shall not exhibit cracking prior to 15 days when tested using AASHTO T334.

7 Recommend use of water reducing admixture or super plasticizer for slabs on grade to allow for adequate working time for placement and finishing without addition of water.

END OF SECTION

SECTION 05400
COLD-FORMED STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract Documents apply to this Section

1.2 SUMMARY

A. This Section includes the following:

1. Interior non-load-bearing wall framing including studs, tracks, headers over window and door openings, cripples, jack studs and bridging/straps.
2. Steel studs for load bearing walls. Provide blocking as required for plumbing fixtures and attachment to Metal Building where required.

B. Related Sections:

1. Section 07210: Building Insulation
2. Section 09260: Gypsum Board Assemblies

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads indicated on the Drawings in which deflections do not exceed the following:

1. Interior Non-Load-Bearing Wall Framing: Horizontal deflection of 1/180th of the wall height when subjected to a uniformly applied lateral load of 5 psf for the entire wall height.

B. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F.

1.4 SUBMITTALS

A. Product Data: Manufacturer's technical literature covering all products to be installed as part of the Work, including manufacturer's certification of product compliance with codes and standards. Products to be installed as part of the Work include, but are not limited to:

1. Primary elements such as joists, headers, and studs.
2. Secondary elements such as tracks, side clips, web stiffeners, flat straps, U-channel bridging, and fasteners.

B. Refer to Project-Specific "Submittal Log" provided by Owner at Pre-Bid Meeting.

C. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products.

1. Expansion anchors
2. Power-actuated anchors
3. Mechanical fasteners
4. Vertical deflection clips
5. Miscellaneous structural clips and accessories

F. Research/Evaluation Reports: Evidence of cold-formed metal framing's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. The cold-formed structural metal framing and its installation shall meet the following standards:

1. American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members" latest edition.
2. ASTM C955 Standard Specification for Load Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Applications of Gypsum Board and Metal Plaster Bases.
3. ASTM C1007 Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

B. Welding: AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code-Sheet Steel."

C. Installer Qualifications: An experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.6 DELIVERY, STORAGE & HANDLING

A. Upon delivery, the structural framing materials shall be protected from the elements by storing them in a sheltered area or using protective covers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Clark Dietrich Building Systems. 1-800-543-7140 www.clarkdietrich.com
2. Marino-Ware 1-800-627-4661 www.marinoware.com

3. Custom Stud, Inc. (952) 985-7000 www.customstud.com
4. The Steel Network, Inc. 1-888-474-48766 http://www.steelnetwork.com/

2.2 MATERIALS

A. The cold-formed structural metal framing shall be manufactured from structural quality steel having minimum yield strength of 33 ksi for all design thicknesses, or optional 50 ksi for 16 GA (0.054 inch) and heavier members, and have minimum protective coating equal to G-60 galvanized finish. The steel shall conform to one of the following ASTM Standards: ASTM A 653, A 875, A 792, or A 463.

B. Structural framing members shall conform to ASTM C955, and shall have engineering properties calculated in conformance with the AISI "Specifications For The Design of Cold-Formed Steel Structural Members" and have minimum properties as published by the manufacturer to include; Ix (in ^{4}), Sx (in ^{3}), Area (in ^{2}), Rx (in), and Resisting Moment (in.-lb.).

C. All structural framing accessories shall be formed from structural quality steel with minimum yield strength of 33 ksi and have minimum protective coating equal to G-60 galvanized finish.

D. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs, unless otherwise indicated.

E. Power Actuated Fasteners: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 4 times design load, as determined by testing per ASTM E 1190.

F. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling steel screws.

2.3 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi, unless otherwise noted.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing
2. Bracing, bridging, and solid blocking
3. Web stiffeners
4. End clips
5. Foundation clips
6. Gusset plates
7. Stud kickers, knee braces, and girts
8. Hole reinforcing plates
9. Backer plates

2.4 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A 36M, zinc coated by hot-dip process according to ASTM A123.

B. Power-Actuated Anchors: Fastener system of type suitable for application indicated,

fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

C. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

D. Welding Electrodes: Comply with AWS standards.

2.5 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Thermal Insulation: ASTM C 665, Type I, unfaced mineral-fiber blankets produced by combining glass or slag fibers with thermosetting resins.

E. Sealer Gaskets: Closed cell neoprene foam.

2.6 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding. Wire tying of framing members is not permitted. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
4. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
5. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from manufacturer's designed recommendations. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to installation of cold-formed structural metal framing, inspect work of other trades. Verify that all such work is complete and accurate to the point where the installation of the cold-formed structural metal framing may properly commence in strict accordance with the shop drawings. Report any discrepancies to the Architect. Do not proceed with installation of cold-formed structural metal framing until discrepancy has been resolved.

3.2 FASTENING

A. Cold-formed structural metal framing shall be properly spaced, plumbed, leveled, squared, fit properly against abutting members and held securely in place until permanently fastened. Wire tying of cold-formed structural metal framing is not permitted.

B. Fastening of cold-formed structural metal framing shall be accomplished by self-drilling steel screws, power actuated fasteners, welding, or a combination of methods as indicated on the architectural drawings. The type, size, and spacing of the fasteners shall be as determined by the manufacturer's structural calculations which are to be reviewed by the Architect.

C. Cold-formed structural metal framing members shall have the coating repaired, at the welds, by painting with a zinc rich primer.

D. Splices in cold-formed structural metal framing studs and joists are not permitted unless otherwise noted on the drawings.

3.3 WALL FRAMING

A. Cold-formed structural metal framing members shall be stick built in the field. The wall framing members shall be sized, spaced and erected in accordance with the Drawings and reviewed manufacturer's shop drawings.

B. The wall framing member shall have ends squarely cut by shearing or sawing, be installed plumb, square, true to line and securely fastened per the manufacturer's connection details shown on the shop drawings.

C. Fabrication, handling, and erection of wall framing members shall be done in a manner to prevent any damage or distortion of the framing.

D. Cold-formed tracks, when set to adjacent structures, shall have web contact with a uniform and level bearing surface and be securely anchored with fasteners, sized and spaced per the manufacturer's shop drawings.

E. Bracing of wall framing resisting wind (transverse) loading only, (non-axially loaded), can be accomplished by the attachment of wall sheathing to both sides of the studs.

F. Bracing of axially loaded wall framing shall be accomplished by either cold rolled U-channel, run horizontally through the stud punchouts and attached at each stud, or by minimum 2-inch wide steel straps run horizontally on both sides of the studs, and attached at each stud. Vertical spacing of bracing is limited to a maximum of 4 ft. – 0 in. throughout the height of the wall, or as per the manufacturer's recommendations.

G. Structural "C" members are not permitted to have splices or cutouts in the flanges.

H. Framing of wall openings shall include jack studs, cripples, headers and jamb studs as indicated on the drawings, or if not indicated specifically, per typical framing practices. Install deep leg track headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates as required.

I. For wall framing assemblies that will form voids which will not be accessible to the insulation sub-contractor (if utilized), then the framing sub-contractor shall be responsible for filling these voids with suitable insulation as shown on the Drawings prior to final assembly.

J. Slip connections, allowing for movement of the structure without imposing loads to the wall framing, shall be per the drawings. If not shown specifically on the drawings, provide minimum 2 inch deep leg slip track at top of wall, or deflection clip with vertically slotted holes at top of non-bearing partition wall connections.

K. Erection Tolerances: Install wall framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet.

3.4 FIELD QUALITY CONTROL

A. Remove and replace Work that does not comply with specified requirements.

B. Contractor is required to notify Owner's inspection/observation agent in a timely manner in order that they may conduct field inspection/observation visits that they deem necessary.

C. Periodic site observation visits will be made by the Architect during the course of the Work.

END OF SECTION

SECTION 05500
MISCELLANEOUS METALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Related Sections:

1. Section 03300: Cast-in-Place Concrete
2. Section 09900: Painting

1.2 SUMMARY

A. Section Includes:

1. Steel concrete-filled bollards

1.3 ACTION SUBMITTALS

A. Product Data: For Steel Pipe Bollards

1. Installation Instructions for 6 inch concrete-filled steel bollards.

B. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Pipe: ASTM A53, Type E or S, Grade B

2.2 MISCELLANEOUS MATERIALS

A. Cast-Metal Units: Cast iron, with an integral abrasive, as-cast finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of 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.
g. Or Other Approved Equal

2.3 FABRICATION, GENERAL

A. Provide complete bollard assemblies, including components necessary to support and anchor bollards on supporting structure.

1. Join components by welding unless otherwise indicated.
2. 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 connections 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. Weld exposed corners and seams continuously unless otherwise indicated.

2.4 BOLLARDS

A. Embedded Steel Pipe Bollards. Embedded steel pipe bollards shall be 6 inch nominal diameter, ASTM A53, Type E, Grade B Electric-Resistance Welded or ASTM A53, Type S, Grade B Seamless members, By = 35 KSI minimum. Bollards shall be shop primed using the system primer for high performance coating for bollards. Extend finish paint 6 inches into embedded concrete. The finish paint that is embedded into the concrete can be the urethane enamel paint specified for exterior ferrous metals in Section 09900 – Painting. Finish paint that is not embedded into the concrete shall be the high performance coating system specified for bollards.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

C. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates and adjacent construction have been properly constructed. Verify framing enclosures, weld plates, blocking and size and location of carriers, sleeves, or pockets.

B. If unsatisfactory conditions are encountered, notify CDOT Representative in writing. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install 6 inch steel bollards by details shown in drawings. Prior to pouring of concrete, Contractor to have CDOT Representative inspect all bollard locations.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication.

C. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with 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

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SECTION 06000
WOOD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 PERFORMANCE REQUIREMENTS

A. No wood framing shall be used except for blocking.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plywood backing: A-C Exposure 1 plywood, 4 foot x 4 foot x 3/4 inch sheets, for DMARC panel backer as shown on drawings and fire extinguisher panel backer. Expose “A” side. Paint white per Division 9 with 1 coat of primer and 2 coats of fire-resistant premium latex paint. Refer to Section 16121 for more information.
1. Identification/Backing Panel for Portable Fire Extinguisher: Provide an identification panel immediately above where the portable fire extinguisher shall be mounted. The panel shall be a minimum of 6 inches wide and 4 inches high. The entire identification panel shall be painted red with white block lettering which states, “EXTINGUISHER” depicted above the portable fire extinguisher device. The panel shall be securely fastened to the wall on which it is attached.

B. Provide 24 inch wide x 20 inch deep plywood shelf with metal supports mounted at 40 inches above the floor on the wall adjacent to phone panel board. Paint white per Division 9 with 1 coat of primer and 2 coats of premium latex paint.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 06400
CUSTOM CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 WORK INCLUDED

A. Provide all labor, material and equipment required for the furnishing and installation of custom casework (plastic laminate) panels as indicated in the construction documents.

1.3 DEFINITIONS

A. Custom Casework: Custom fabricated casework as indicated on drawings.

1.4 QUALITY ASSURANCE

A. Qualifications

1. Fabricator and Installer: Company specializing in the fabrication and installation of custom casework with a minimum five years satisfactory experience.
2. Submit documentation of experience.
3. Warranty: A Warranty shall be required for a period of one year for all components of work. Warranty to commence on “Substantial Completion” issued by State.

1.5 REFERENCES

A. Applicable Publications: The publications listed below form a part of the Specification to the extent referenced.

1. Architectural Woodwork Institute (AWI) "Quality Standards" revised 2003.

B. National Woodwork Manufacturer's Association (NWMA).

1.6 SUBMITTALS

A. Submit shop drawings, product data, and samples under provisions of Section 01300.

B. Shop Drawings:

1. Submit Shop Drawings showing:
   a. Location of each item
   b. Dimensioned plans and elevations

c. Mounting height in relation to finish floor elevation
d. Large scale details
e. Attachment devices
f. Countertop details shall include proposed jointing arrangements, expanded details to all specific locations

2. Submit Shop Drawings for all millwork items required.
3. Key Shop Drawings to drawing and section number as shown on the Architectural Drawings.

B. Samples:

1. When plastic laminate is indicated on the drawings, furnish two (2) 2 inch x 3 inch samples of each color, if providing a product other than that specified in the finish schedule.

C. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.7 QUALITY ASSURANCE

A. Quality Standards: For the following types of architectural wood work, comply with the indicated standards as applicable:

2. Architectural Cabinets: AWI Section 400, Custom Grade.
a. Flush overlay style

B. Provide two (2) copies of recommended finish maintenance instructions.

1.8 DELIVERY, STORAGE AND HANDLING

A. Protect countertop materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver casework, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas.

C. If, due to unforeseen circumstances, casework must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. As indicated for various products hereunder.

2.2 MATERIALS

A. Particle Board:

1. Medium density (forty-five (45) lbs./cu.ft.) minimum wood chip and phenolic resin binders, compressed board, ¾ inch thickness unless otherwise indicated.

B. Hardboard:

1. PS 58, Class 1 (tempered), smooth one side or both sides where indicated, ¼ inch thickness unless as otherwise indicated.

C. Plastic Laminate:

1. Provide plastic laminate for all cabinet work by Formica Corporation, Nevamar or Wilson Art. Re: Finish schedule for laminate types.
2. Countertop Vertical Edge: Provide continuous plastic laminate with demi full bull nose 1 1/2 inch width.
3. Finishes:
    a. Plastic laminate for horizontal surfaces: Type 2, 0.050 inch thick, General-Purpose Type (high pressure) solid color.
    b. Plastic laminate for external vertical surfaces: Type 4, 0.028 inch thick, General-Purpose Type (high pressure).
    c. Plastic laminate for concealed panel backing: 0.020 inch thick, Backer-Type (High Pressure).
    d. White Melamine for inside cabinet faces and shelves.
    e. Colors shall be as indicated on finish schedule.

2.3 MISCELLANEOUS ACCESSORIES

A. Nails:

1. Face nailing not permitted.
2. Do not use nails for gluing pressure.
3. Nails may be used only for temporary, concealed anchorage.

B. Adhesives:

1. Adhesive for plastic laminate shall conform to AWI 100-S-5, Resorcinol-Formaldehyde Resins, CS-35, Type 1; mechanically pressed under heat.
2. All adhesives required for field application of plastic laminate shall conform to AWI 100-S-5, Contact Cement, CS-35, Type II, non-flammable.

2.4 MOISTURE CONTENT

A. At the time lumber and other materials are delivered and when installed in the work, their moisture content shall be 19 percent maximum for treated and untreated lumber 2 inches or less in thickness.

2.5 CUSTOM CASEWORK (PLASTIC LAMINATE)

A. Custom Mill Built Casework: AWI Sections 400, 400B, 1600, and 1600A, B & C “Custom” grade, flush overlay construction.

2.6 CABINET HARDWARE

A. ¾ inch Doors: concealed hinge – Blum ‘COMPACT’ or equal.

B. Adjustable Shelf Standards: Knape and Vogt No. 255 with No. 256 or 32mm hole system.

C. Door and Drawer Pulls: Base: Hafele 4 inch Wire Pull, satin chrome finish, part no. 116.39.464; Optional: Berenson 4" wire pull, satin chrome part #6130-2sc-p
1. Provide attic stock of (2) additional pulls.

D. Drawer Slides:
1. Typical Drawer Slide: Blum Drawer Runner No. BS230E for side mounting.

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to starting work, examine and determine conditions of preceding work for suitability and adequacy of performance to insure compliance with quality of workmanship of this Section.

B. Notify Contractor, Owner and Architect in writing if any surfaces are not in a suitable condition to receive this work.

3.2 PREPARATION

A. Verify all dimensions in the field and take particular care to align with all joints and recesses, where required, with the building module lines.

B. Coordinate the work with that of other trades affected by installation of wood ground, nailers and blocking to avoid delay in job progress.

C. Treat all blocking and grounds in accordance with AWPA. Brush coat surfaces that have been cut after treatment. Air season all lumber for not less than 30 days before covering with finishing materials.

3.3 FABRICATION

A. Workmanship shall equal in all respect to the standards of custom quality furniture work as described by AWI. Perform all work by qualified and fully competent workmen.

B. Fabricate and finish all millwork work at the shop and assemble in single and complete units, insofar as the dimensions thereof will permit shipment to and installation at the building. Construct large pieces requiring sectional construction so their several parts are accurately fitted and aligned with each other, using fasteners that will be concealed in the finished work.

C. Provide ample screws, glue and bolt blocks, tongues, grooves and splines, dowels, mortises and tenons, screws bolts, clip angles, braces, anchors, or suitable means rigid and permanently secured in proper position to each related section.

D. Allow sufficient additional material to permit:

1. Accurate scribing to walls, floors, and related work.
2. Provide for shrinkage that may develop after installation.

E. Provide all single and sectional units with adequate cleating, blocking, crating and other forms of protection as required to preclude damages thereto during shipping and handling.

F. Assemble framing and blocking members with concealed bolted and screwed connections, and secure to the structural backings with cinch, expansion screws, or toggle bolts, as required, so spaced and installed as to insure ample strength and rigidity.

G. Accurately construct all members plumb, square, level and permanently secured in precise position as indicated. Construct moldings true to detail, cleanly cut and sharp.

H. All screws shall be driven snugly into lead holes. No screws shall be hammer driven. Any member with a split or crack of any description caused by fastener application or other cause shall be replaced. If dowels are used only spirally grooved non-compressed dowels shall be used.

I. Return plastic laminate to exposed ends of casework.

3.4 CASEWORK INSTALLATION

A. Custom grade per AWI standards.

B. Assemble all units on job without face nails or screws. Accurately set all trim plumb, square, level and permanently secured in precise position as indicated.

C. Exercise extreme care to avoid damaging finished surfaces during the handling and erecting of all members. All damaged surfaces or blemishes arising from such operation, or other causes, shall be replaced.

3.6 CLEANING

A. Remove soil, stains, paint, prints and adhered matter from exposed parts of hardware and wood surfaces. Remove foreign matter that could affect operation of hardware.

B. Clean adjacent surfaces for soiling incurred during installation of hardware. Repair or replace defective materials.

C. Repair or replace damage to adjacent surfaces caused by installation of casework.

END OF SECTION

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SECTION 07210
BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Concealed building insulation
2. Sound-attenuating insulation

B. Related Sections

1. Section 05400 – Cold-Formed Structural Metal Framing
2. Section 08110 – Steel Doors, Windows and Frames
3. Section 09260 – Gypsum Board Assemblies

C. Thermal and Moisture Protection

1. Minimum R-values for Insulation and air filtration must comply with the building envelope requirements for metal buildings set forth in the Building Envelope Comcheck and the drawing details and in accordance with ANSI/ASHRAE/IES Standard 90.1 (2013) “Energy Standard for Buildings.”
2. Provide vapor retarder at inside face of all walls and roof.
3. Provide air barrier at exterior envelope. Air barrier shall be caulked and sealed at all edges and may consist of interior metal panel, plastic panel or gypsum board.

1.3 SUBMITTALS

A. Product Data for each type of insulation product used.

B. Product Data for Roof and Wall Insulation Assemblies or Systems

C. U-factor Compliance Report for Compliance with Wall and Roof Insulation Requirements

E. Product test reports from and based on tests performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, water absorption, and other properties, based on comprehensive testing of current products. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this Section

as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering insulation products that may be incorporated in the work include, but are not limited to, the following:

1. Extruded-Polystyrene Board (XPS) Insulation:
   a. DiversiFoam Products www.diversifoam.com 1-763-477-5854
   b. Dow Chemical Co. www.dow.com 1-866-583-2583
   c. Owens Corning www.owenscorning.com 1-800-438-7465
   d. UC Industries, Inc.; OwensCorning www.owenscorning.com 1-800-438-7465

2. Glass-Fiber Insulation:
   a. Guardian Building Products www.guardianbp.com 1-800-569-4262
   b. Owens-Corning Fiberglas Corporation www.owenscorning.com 1-800-438-7465
   c. CertainTeed Corporation www.certainteed.com 1-800-233-8990
   d. Knauf Fiber Glass GmbH www.knaufusa.com 1-317-398-4434
   e. Johns Manville www.jm.com 1.800.654.3103

3. Mineral-Wool Blanket Insulation:
   a. Fibrex Insulations Inc.
   b. Owens Corning
   c. Roxul Inc.
   d. Thermafiber

4. Vapor Retarder
   a. Raven Industries
   b. Reef Industries
   c. Or Approved Equal

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded-Polystyrene Board Insulation: Rigid, cellular polystyrene thermal insulation formed from polystyrene base resin by an extrusion process using hydrochlorofluorocarbons as blowing agent to comply with ASTM C 578 for type and with other requirements indicated below:

1. Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density, unless otherwise indicated. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 75 and 450, respectively

C. Un-faced Glass-Fiber Blanket Insulation: To be used with vapor retarder: Thermal insulation combining fibers to comply with ASTM C 665, Type I; with maximum flame-spread and smoke developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. For exterior metal building applications, use fiber insulation specifically designed for metal building application.

D. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.3 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

B. Protection Board: Pre-molded, semi rigid asphalt/fiber composition board, 1/4 inch (6 mm) thick, formed under heat and pressure, standard sizes.

2.4 VAPOR RETARDERS

A. Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft. (12 kg/100 sq. m), with maximum permeance rating of 0.0507 perm (2.9 ng/Pa x s x sq. m).

B. Products: Subject to compliance with requirements, provide one of the following:

1. Raven Industries Inc.; DURA-SKRIM 6WW.
2. Reef Industries, Inc.; Griffolyn T-65.

2.5 INSULATION ACCESSORIES

A. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to

hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

1. Where spindles will be exposed to human contact after installation, protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.

B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

C. Products: Subject to compliance with requirements, provide one of the following:

1. Adhesively Attached, Spindle-Type Anchors:
   a. TACTOO Insul-Hangers; AGM Industries, Inc.
   b. Spindle Type Gemco Hangers; Gemco.

D. Insulation Hangers;

1. Spindle Hanger: Gemco

2. Hanger for supporting insulation between girts: Insul-Hold

3. Insulation-Retaining Washers:
   a. RC150; AGM Industries, Inc.
   b. Dome-Cap; Gemco
   c. R-150; Gemco

4. Anchor Adhesives:
   a. TACTOO Adhesive; AGM Industries, Inc.
   b. Tuff Bond Hanger Adhesive; Gemco

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

B. Close off openings in cavities receiving poured-in-place insulation to prevent escape of insulation. Provide bronze or stainless-steel screens (inside) where openings must be maintained for drainage or ventilation.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Apply single layer of insulation to meet required R-value as indicated in drawings, unless multiple layers are otherwise shown or required to meet the required R-value.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
   5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
   6. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

B. Glass Fiber Metal Building Blanket Insulation: Install in accordance with ASHRAE 90.1 standards, and as described in the details and building Com Check.

   1. At walls install the insulation such that it is compressed between the metal wall panel and the metal structure as a single layer installation.

C. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

   1. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3.5 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
   1. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.

2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.6 PROTECTION

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07400
METAL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Related Sections:
   1. Section 07920: Joint Sealants

1.2 SUMMARY

A. Section includes
   1. Metal wall panels
   2. Flashing and Trim

1.3 SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples for Initial Color Selection: For each type of metal panel indicated with factory-applied color finishes.

D. Sample Warranties: For Special Warranties

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.6 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.7 WARRANTY

A. Provide manufacturer's standard written warranty for twenty (20) years against perforation of metal wall panels due to corrosion under normal weather and atmospheric conditions. Warranty shall be signed by manufacturer. Warranty shall duplicate terms of the manufacturer.

B. Siding Panel Finish Warranty: Provide manufacturer's standard written warranty for 25 years for siding panel finish, covering failure of the factory-applied exterior finish on metal wall panels within the warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

1. Painted Wall Panels:
   a. Will not chalk more than a #8 during years 1-25 when measured per ASTM D4214.
   b. Will not change color more than 5 Hunter Units during years 1-25 per ASTMD2244
   c. Will not noticeable peel, blister, chip, crack or check in finish for a period of 25 years

PART 2 - PRODUCTS

2.1 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal ribs and a flat space spaced between ribs.
1. Basis-of-Design Product: Subject to compliance with requirements, 'PBR' or 'R' Panel or comparable product by one of the following:

a. Architectural Metal Systems; a Nucor company.
b. Berridge Manufacturing Company.
Butler Manufacturing Company; a BlueScope Steel company.
c. Chief Building Systems.
d. Englert, Inc.
e. Fabral.
f. Firestone Metal Products, LLC.
g. Flexospan Steel Buildings, Inc.
h. MBCI; a division of NCI Building Systems, L.P.
i. McElroy Metal, Inc.
j. Metal Sales Manufacturing Corporation.
k. Morin; a Kingspan Group company.
l. Petersen Aluminum Corporation.
m. Union Corrugating Company.
n. United Steel Deck, Inc.; Subsidiary of Bouras Industries Inc.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

a. Nominal Thickness: 24 gauge
b. Exterior Finish: Two-coat fluoropolymer.

3. Major-Rib Spacing: 12 inches (152 mm) o.c.
4. Panel Coverage: 36 inches (914 mm)
5. Panel Height: 0.75 inch with a maximum of 1.25 inch
6. Color: To be selected by Architect from manufacturer's full range.

2.2 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
1. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, valleys, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.3 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.4 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color: To be selected by Architect from manufacturer’s standard colors.

PART 3 - EXECUTION

3.1 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Lap-Seam Metal Wall Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.
6. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
7. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
8. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturers; or, if not indicated, types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.2 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07920
JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Related Sections:

1. Section 03300: Cast-in-Place Concrete
2. Section 08100: Steel Doors and Frames
3. Section 09260: Gypsum Board Assemblies

1.2 SUMMARY

A. This Section includes sealants for the following applications, including those specified by reference to this Section.

B. This Section includes sealants for the following applications:

1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
   a. Joints between different materials and around frames of doors and windows.
   b. Joints around frames of doors and windows between frame and metal building
   c. Other joints as indicated.

2. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints of exterior openings.
   c. Tile control and expansion joints.
   d. Joints between interior wall surfaces and frames of interior doors and windows.
   e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   f. Other joints as indicated.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

D. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F (4.4 deg C).
2. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than or greater than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by CDOT Architect from manufacturer's full range for this characteristic.

2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

2.3 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable

C. Backer rod to be closed-cell type.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
   a. Unglazed surfaces of ceramic tile.

3. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
   a. Metal
   b. Glass
   c. Porcelain enamel
   d. Glazed surfaces of ceramic tile

B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

A. One-Part Nonacid-Curing Silicone Sealant: At all exterior joints, provide products complying with the following:

1. Products:
   a. Dow Corning 790; Dow Corning
   b. Silpruf SCS 2000; GE Silicones
   c. 890 FTS; Pecora Corporation
   d. Spectrem 2; Tremco
   e. SikaSil WS 605-S; Sika Corporation
2. Type and Grade: S (single component) and NS (nonsag)
3. Class: 50
4. Use Related to Exposure: NT (nontraffic).

B. Mildew-Resistant Silicone Sealant: At interior joints exposed to water, kitchen, toilets, showers, etc., provide products formulated with fungicide that are intended for sealing and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes, and that comply with the following:

1. Products:
   a. Dow Corning 786 Mildew Resistant; Dow Corning
   b. Sanitary SCS 1702; GE Silicones
   c. 898NST Silicone Sanitary Sealant; Pecora Corporation

d. PSI-611; Polymeric Systems, Inc.
e. Proglaze White; Tremco

2. Type and Grade: S (single component) and NS (nonsag)
3. Class: 25
4. Use Related to Exposure: NT (nontraffic)

C. Multicomponent Nonsag Urethane Sealant: At interior joints not otherwise indicated, provide products complying with the following:

1. Products:
   a. Chem-Calk 505; Bostik Inc.
   b. Dymerik 24 OFC; Tremco
   c. Dynatrol II; Pecora Corporation
   d. PSI-275; Polymeric Systems, Inc.
   e. Sonolaastic NP2; BASF Construction
   f. Sikaflex 2C NS; Sika Corporation
2. Type and Grade: M (multicomponent) and NS (nonsag)
3. Class: 25
4. Use Related to Exposure: NT (nontraffic)

END OF SECTION

SECTION 08110
STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel doors
2. Steel door frames
3. Hollow metal doors
4. Hollow metal frames
5. Hollow metal borrowed lights
6. Other hollow metal items
7. Glazing for doors

B. Related Sections include the following:

1. Section 07920: Joint Sealants
2. Section 08710: Door Hardware
3. Section 09260: Gypsum Board Assemblies
4. Section 09900: Painting

1.3 SYSTEM DESCRIPTION

A. Design Requirements: Exterior hollow metal frames shall be designed by a professional engineer registered in the State of Colorado, to resist a wind load of 27.5 psf with a maximum deflection not to exceed L/180. Provide internal reinforcing as required to meet these requirements. Design calculations shall be submitted to the CDOT Architect on request.

1.4 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B. Shop Drawings: Show the following:

1. Elevations of each door design
2. Details of doors including vertical and horizontal edge details
3. Frame details for each frame type including dimensioned profiles
4. Details and locations of reinforcement and preparations for hardware
5. Details of each different wall opening condition
6. Details of anchorages, accessories, joints, and connections

C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

D. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.5 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to CDOT Architect. Remove and replace damaged items that cannot be repaired as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch-(100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Doors and Frames:
    a. Curries Manufacturing
    b. Elco Metal Products
    c. Gateway Metal Products
    d. McKinney Door and Hardware
    e. North Central Supply
    f. Southwestern Hollow Metals
    g. State Door, Inc.
    h. SteelCraft
    i. Transit Mix Doors Shop
    j. Or approved equal

2.2 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.3 DOORS

A. General: Provide doors of sizes, thicknesses, and designs indicated.

B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 2 and Physical Performance Level C, (Standard Duty), Model 1 (Full Flush)
2. Door closers as specified
3. Lever lock sets
4. Kick plates as specified
5. Paint doors and frames as scheduled
6. Sound insulated
7. Other hardware as specified

C. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level.

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush), with 16 gauge galvanized steel faces.
2. Door closers
3. Paint doors and frames as scheduled
4. Kick plate
5. Card access lock on the outside of exterior door
6. Weather stripping
7. Aluminum threshold and sweep
8. Thermal-rated assembly: Provide u-factor of .091 or less
9. Other hardware as specified

D. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated. Size of lite shall not interfere with door hardware and/or exit devices.

2.4 FRAMES

A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, windows and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Frames of 18 gauge thick steel sheet for interior doors and window frames.

C. Frames of 16 gauge thick galvanized steel sheet for exterior doors.

D. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers

on strike jambs of single-door frames and two silencers on heads of double-door frames.

E. Supports and Anchors: Fabricated from not less than 16 gauge thick, electrolytic zinc-coated or metallic-coated steel sheet.

F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

B. Door Construction: For locations as indicated, fabricate doors, panels, and frames from cold-rolled steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 16 gauge metallic-coated steel channels with channel webs placed even with top and bottom edges.

C. Interior Door Faces: Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from the following material:

1. Cold-rolled steel sheet, minimum 18 gauge for interior doors
2. Galvannealed steel sheet, minimum 16 gauge for exterior doors

D. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI Standards.

E. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames".

F. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

G. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

I. Frame Construction: Fabricate frame with mitered or coped and continuously welded corners to shape required to accommodate specified door and adjacent wall construction.

J. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

K. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

L. Glazing Stops: Manufacturer's standard, formed from 20 gauge thick steel sheet.

1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

2.6 FINISHES

A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

2.7 GLAZING AT DOOR

A. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Insulating-Glass Schedule at the end of Part 3.
   1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.

B. Glazing Type:
   1. GL-1: Uncoated Clear Insulating Safety Glass: Where glass of this designation is indicated, primarily for exterior doors, provide uncoated insulating-glass units complying with the following:
      a. Overall Unit Thickness: 3/4 inch
      b. Thickness of each Glass Lite: 1/4 inch
      c. Class 1, Clear, Fully Tempered Glass
      d. Interspace Content: Air
      e. Tinting: None
   2. GL-2: Uncoated Clear Safety Glass: Where glass of this designation is indicated, primarily for interior doors, provide uncoated tempered glass units complying with the following:
      a. Class 1, Kind FT (Fully Tempered), clear float glass.
      b. Overall thickness: 1/4 inch.
      c. Tinting: None

C. Sealing System: Dual seal, with manufacturer’s standard primary and secondary sealants

D. Spacer Specifications: Manufacturer's standard spacer material and construction

E. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; 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; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install pre-hung steel doors, frames, and accessories manufactured specifically for metal buildings (no knock down frames permitted) according to Shop Drawings, manufacturer's data, and as specified

B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
   1. Provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
   2. Install fire-rated frames according to NFPA 80.

C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

3.2 GLAZING INSTALLATION

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. 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.

C. 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.

D. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

E. 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.

F. 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

3.3 ADJUSTING AND CLEANING

A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

SECTION 08305
ACCESS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this section.

1.2 SUMMARY

A. The extent, location, type and size of each access door required shall be determined by the individual trade contractor, i.e.: mechanical, electrical, fire protection, etc.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 07920: Joint Sealants
2. Section 08110: Steel Doors and Frames
3. Section 09260: "Gypsum Board Assemblies" for gypsum board walls and ceilings.
4. Section 09310: "Ceramic Tile" for ceramic tile walls.
5. Section 09511: "Acoustical Panel Ceilings" for access tile in suspended or furred acoustical tile ceilings.
6. Section 15050: Basic Mechanical Materials and Methods

1.3 SUBMITTALS

A. Product data for each type of access door assembly specified, including details of construction relative to materials, individual components, profiles, finishes, and fire-protection ratings (if required).

1. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, latching or locking provisions, and other data pertinent to installation.

B. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain access doors for entire Project from one source and by a single manufacturer.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per test method as indicated below, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Size Variations: Obtain Architect’s acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acudor Products Inc.
2. Bar-Co, Inc. Div., Alfab, Inc.
3. J.L. Industries
4. Karp Associates, Inc.
5. Larsen's Manufacturing Co.
6. Meadowcraft, Inc.
7. Milcor, Inc.
8. Nystrom, Inc.
9. Smith (Jay R.) Mfg Co.
10. Zurn Industries Inc; Hydromechanics Div.

2.2 MATERIALS

A. Steel Sheet: ASTM A 366 commercial-quality, cold-rolled steel sheet with baked-on, rust-inhibitive primer.

2.3 ACCESS DOORS

A. Non-Insulated, Access Doors: Self-latching units consisting of frame, trim, door, and hardware, complying with the following requirements:

1. Frame with Exposed Trim: 16 gauge sheet steel with 1 inch trim flange overlapping surfaces surrounding door frame.
2. Door: 14 gauge sheet, welded pan type, flush panel door.
3. Hinges: Concealed Continuous spring hinges
4. Latches: Flush Screwdriver cam latch with key operated cylinder.
5. Fire-Protection Rating for walls and ceilings: As applicable.
6. Factory applied rust inhibitive prime coat paint finish.

B. Gasketed Construction: Where indicated as "Sealed", furnish manufacturer's gasketed-type door, with built-in protected cushion-type neoprene gasket, intended for reduction of noise, air and moisture penetration.

C. Drained Construction: Where indicated as "Drained", or where drainage pipe connection is shown, furnish manufacturer's gutter-type or watertight-type unit, complete with drainage slots or ports at floor surface, and with encompassing gutter with one, or more drain pipe connections.

D. Double-Leaf Construction: Where opening width exceeds 3 feet, furnish manufacturer's standard double-leaf unit construction.

E. Removable Access Plates

2.4 FABRICATION

A. General: Manufacture each access door assembly as an integral unit ready for installation.

B. Steel Access Doors and Frames: Continuous welded construction. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flange: Nominal 1 inch wide around perimeter of frame.
2. For gypsum board assemblies or gypsum veneer plaster, furnish frames with edge trim for gypsum board or gypsum base.
3. For installation in masonry construction, furnish frames with adjustable metal masonry anchors.

C. Locking Devices: Furnish number required to hold door in flush, smooth plane when closed.

1. Cylinder lock, furnish 2 keys per lock and key all locks alike.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's instructions for installing access doors.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces.

C. Install concealed-frame access doors flush with adjacent finish surfaces.

3.2 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION

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SECTION 08710
DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:
   a. Swinging doors

B. Related Sections include the following:

1. Section 08110: "Steel Doors and Frames"

1.3 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of the supplier's Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
   a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.
3. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item
   b. Manufacturer of each item
   c. Fastenings and other pertinent information
   d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule
   e. Explanation of abbreviations, symbols, and codes contained in schedule
   f. Mounting locations for door hardware
   g. Door and frame sizes and materials

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data,

Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared by or under the supervision of supplier's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

D. Maintenance Data: For each type of door hardware.

E. Refer to Project-Specific "Submittal Log" provided by Owner at Pre-Bid Meeting.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and 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.

D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

E. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)", ICC A117.1 and NFPA 101.

F. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section 01200 "Project Meetings." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion
2. Preliminary key system schematic diagram
3. Requirements for key control system
4. Address for delivery of keys

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to Owner either in person or by registered mail or overnight package service.

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3.

2.2 HINGES AND PIVOTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hinges
   a. Ives (IVE)
   b. McKinney
   c. Stanley

B. Standards: Comply with the following:

1. Butts and Hinges: ANSI/BHMA A156.1.
2. Template Hinge Dimensions: ANSI/BHMA A156.7.

C. Quantity: As scheduled.

D. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

E. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

F. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight ball bearing hinges.
2. Doors with Closers: Ball-bearing hinges.
3. Interior Doors: Ball-bearing hinges.

G. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Stainless steel, with stainless-steel pin.
2. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
   a. Out-swinging doors with locksets.
3. Corners: Square.

H. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.

2.3 LOCKS AND LATCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Card Reader Lock
   a. Alarm Lock Trilogy PDL3000 Card Reader Lock (with interior lever handle) – no substitutions (ALA).
2. Mechanical Locks and Latches:
   a. Best Lock Corporation (BLC)
   b. Sargent Manufacturing; An ASSA ABLOY Group Company (SGT)
   c. Schlage Lock Company; an Ingersoll-Rand Company

B. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

C. Card Reader Lock Accessories:

1. At each exterior card reader lock provide a Key Pad Cover sized to match lock.
   a. Manufacturer: Safety Technology International
      (1 Product: STI-6516 Mini Bopper Stopper with Spring Loaded Hinge - Clear

2.4 CYLINDERS AND KEYING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cylinders: Same manufacturer as for locks and latches.

B. Standards: Comply with the following:

1. Cylinders: ANSI/BHMA A156.5.

C. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Six
2. Bored-Lock Type: Cylinders with tailpieces to suit locks

D. Construction Keying: Comply with the following:

1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

E. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:

1. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.

F. Keys: Provide nickel-silver keys complying with the following:

1. Quantity: In addition to one extra blank key for each lock, provide the following:
   a. Cylinder Change Keys: Five
   b. Master Keys: Five
   c. Grand Master Keys: Five

2.5 CLOSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Surface-Mounted Closers:
   a. LCN Closers; and Ingersoll-Rand Company (LCN)
   b. Norton Door Controls; Div. of Yale Security Inc.; An ASSA ABLOY Group Company (NDC)
   c. Sargent Manufacturing Company; An ASSA ABLOY Group Company (SGT)

B. Standards: Comply with the following:

1. Closers: ANSI/BHMA A156.4.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide non-sized closers, adjustable to meet field conditions and requirements for opening force.

2.6 PROTECTIVE TRIM UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Protective Trim Units:
   a. Hager Companies (HA)
   b. Ives; an Ingersoll-Rand Company (IVS)
   c. Rockwood Manufacturing; An ASSA ABLOY Group Company (RO)
   d. Trimco (TR)

B. Standard: Comply with ANSI/BHMA A156.6.

C. Materials: Fabricate protection plates from the following:

1. Stainless Steel: 0.050 inch thick; beveled top and 2 sides.

D. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

E. Furnish protection plates sized 2 inches less than door width by height specified in Door

Hardware Schedule.

2.7 STOPS AND HOLDERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ives; an Ingersoll-Rand Company (IVS)
   b. Rockwood Manufacturing; An ASSA ABLOY Group Company (RO)
   c. Trimco (TR)

B. Standards: Comply with the following:

   1. Stops and Bumpers: ANSI/BHMA A156.16

C. Wall Stops: For doors, unless wall or other type stops are scheduled or indicated.

   1. Where wall stops are not appropriate, provide overhead holders.

D. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

2.8 DOOR GASKETING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Door Gasketing:
      a. National Guard Products, Inc. (NG)
      b. Pemko Manufacturing Co., Inc. (PK)
      c. Zero International (ZI)

C. Standard: Comply with ANSI/BHMA A156.22.

D. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

   1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
   2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

E. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

F. Gasketing Materials: Comply with ASTM D 2000 and AAMA 701/702.

2.9 THRESHOLDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. National Guard Products, Inc. (NG)
2. Pemko Manufacturing Co., Inc. (PEM)
3. Zero International (ZI)

B. Standard: Comply with ANSI/BHMA A156.21.

2.10 FABRICATION

A. Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and ANSI/BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Steel Machine or Wood Screws: For the following fire-rated applications:
   a. Mortise hinges to doors
   b. Strike plates to frames
   c. Closers to doors and frames
3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:
   a. Surface hinges to doors.
   b. Closers to doors and frames.
4. Spacers or Sex Bolts: For through bolting of hollow metal doors.

2.11 FINISHES

A. Standard: Comply with ANSI/BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. BHMA Designations: Comply with base material and finish requirements indicated by the following:

1. BHMA 630: Satin stainless steel, over stainless-steel base metal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section 07920 "Joint Sealants."

3.4 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 so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

3.5 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.

3.6 DOOR HARDWARE SCHEDULE

Manufacturer:	**Approved Substitution:**
(ALA) Alarm Lock	no substitutions
(IVE) Ives	McKinney, Stanley
(LCN) LCN	Sargent
(NGP) National Guard Products	Pemko, Zero
(SCH) Schlage	Sargent
(VON) Von Duprin	Precision
(STI) Safety Technology International	no substitutions

HARDWARE GROUP NO. 01: EXTERIOR DOOR AT VESTIBULE
DOOR NUMBER: 01

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CARD READER	PDL3000 IC/26D	26D	ALA
1	EA	KEY PAD COVER	STI-6516	CLR	STI
1	EA	LATCH GUARD	LGO	630	VON
1	EA	MORTISE CYLINDER	20-001 114 XQ11-947	626	SCH
1	EA	RIM CYLINDER	20-022	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH SRI TBSRT - ST-1595 - INSTALL PARALLEL ARM	689	LCN
2	EA	KICK PLATE	8400 12" X 34” LDW B4E	630	IVE
1	EA	DRIP CAP	16A X FRAME WIDTH	CL	NGP
1	EA	HEAD SEAL	700SA - INSTALL BEFORE DOOR CLOSER	AL	NGP
2	EA	JAMB SEAL	700ES	AL	NGP
1	EA	DOOR SWEEP	198NA	AL	NGP
1	EA	THRESHOLD	613 SIA - OR AS SHOWN AT SILL DETAIL	AL	NGP

HARDWARE GROUP NO. 02: VESTIBULE DOOR
DOOR NUMBER: 02

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PASSAGE SET	L9010 07A	630	SCH
1	EA	SURFACE CLOSER	4040XP EDA SRI TBSRT - INSTALL PARALLEL ARM	689	LCN
2	EA	KICK PLATE	8400 12" X 34” LDW B4E	630	IVE
1	EA	WALL STOP	WS407CVX	630	IVE
1	SET	SEALS	5050B - HEAD AND JAMBS	BRN	NGP
1	EA	DOOR SWEEP	198NA	AL	NGP
1	EA	THRESHOLD	613 SIA - OR AS SHOWN AT SILL DETAIL	AL	NGP

HARDWARE GROUP NO. 03: MECH ROOM DOOR
DOOR NUMBER: 03

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080P 07A	630	SCH
1	EA	SURFACE CLOSER	4040XP CUSH SRI TBSRT - INSTALL PARALLEL ARM	689	LCN
1	EA	WALL STOP	WS407CVX	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE

HARDWARE GROUP NO. 04: WOMEN’S RESTROOM DOOR
DOOR NUMBER: 04

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	PRIVACY LOCK	L9040 07A L583-363	630	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA SRI TBSRT - INSTALL REGULAR ARM	689	LCN
2	EA	KICK PLATE	8400 12" X 34” LDW B4E	630	IVE
1	EA	WALL STOP	WS407CVX	630	IVE
1	SET	SEALS	5050B - HEAD AND JAMBS	BRN	NGP

HARDWARE GROUP NO. 05: MEN’S RESTROOM DOOR
DOOR NUMBER: 05

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	PUSH/PULL SET	8103 E2 DOOR PULL 1” ROUND 12” 8300 PULL PLATE 3.5” X 15” 8200 PUSH PLATE 3.5” X 15”	630	IVE
1	EA	SURFACE CLOSER	4040XP RW/PA SRI TBSRT - INSTALL REGULAR ARM	689	LCN
2	EA	KICK PLATE	8400 12" X 34” LDW B4E	630	IVE
1	EA	WALL STOP	WS407CVX	630	IVE
1	SET	SEALS	5050B - HEAD AND JAMBS	BRN	NGP

HARDWARE GROUP NO. 06: CLASSROOM DOOR
DOOR NUMBER: 06

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	EXIT DEVICE	98/99E	630	VON
1	EA	SURFACE CLOSER	4040XP RW/PA SRI TBSRT - INSTALL PARALLEL ARM	689	LCN
1	EA	WALL STOP	WS407CVX	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE

HARDWARE GROUP NO. 07: EXTERIOR DOOR AT CLASSROOM – DOUBLE DOOR W/ INACTIVE LEAF
DOOR NUMBER: 07

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	EXIT DEVICE WITH SURFACE MOUNTED VERTICAL ROD	9827/9927	630	VON
1	EA	CARD READER	PDL3000 IC/26D	26D	ALA
1	EA	KEY PAD COVER	STI-6516	CLR	STI
1	EA	LATCH GUARD	LGO	630	VON
1	EA	MORTISE CYLINDER	20-001 114 XQ11-947	626	SCH
1	EA	RIM CYLINDER	20-022	626	SCH
2	EA	OVERHEAD STOP	900S	630	GJ
4	EA	KICK PLATE	8400 12" X 34” LDW B4E	630	IVE
1	SET	SEALS	5050B - HEAD AND JAMBS	BRN	NGP
1	EA	DRIP CAP	16A X FRAME WIDTH	CL	NGP
1	EA	THRESHOLD	613 - OR AS SHOWN AT SILL DETAIL	AL	NGP

END OF SECTION

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SECTION 09260
GYPSUM BOARD ASSEMBLIES AND FRP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum wallboard
2. Cementitious Tile Backer Board
3. Non-load-bearing steel framing

B. Related Sections include the following:

1. Section 05400: Cold-Formed Structural Metal Framing
2. Section 07210: Building Insulation
3. Section 07920: Joint Sealants
4. Section 08110: Steel Doors and Frames
5. Section 08305: Access Doors
6. Section 09310: Ceramic Tile
7. Section 09511: Acoustical Panel Ceilings
8. Section 09900: Painting
9. Section 10800: Toilet and Bath Accessories

1.3 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Framing and Furring:
   a. Clark-Dietrich Steel Framing Systems
   b. Consolidated Systems, Inc.
   c. Dale Industries, Inc. - Dale/Incor
   d. MarinoWare; Division of Ware Ind.
   e. National Gypsum Company
   f. Scafco Corporation
   g. Unimast, Inc.

2. Gypsum Board and Related Products:
   a. American Gypsum Co.
   b. G-P Gypsum Corp.
   c. National Gypsum Company
   d. United States Gypsum Co.

3. Cementitious/Fiberglass Tile Backer Board:
   a. Custom Building Products
   b. Domtar Gypsum
   c. FinPan, Inc.
   d. United States Gypsum Co.
   e. Georgia Pacific

2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Components, General: Comply with ASTM C 754 for conditions indicated.

B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

C. Hangers: As follows:

1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
2. Rod Hangers: ASTM A 510, mild carbon steel.
3. Flat Hangers: Commercial-steel sheet, ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch- wide flange, with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.

E. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

1. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.

F. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Armstrong World Industries, Inc.
   b. Chicago Metallic Corporation
   c. USG Interiors, Inc.

2.3 STEEL PARTITION AND SOFFIT FRAMING

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base Metal Thickness: 0.035, / 20 gauge with 50 ksi strength.
2. Depth: 3-5/8 inches unless otherwise indicated on the Drawings.
3. Depth: 2 1/2 inches at perimeter insulated walls and high, insulated curb in administrative area

B. King Studs at Doors: ASTM C 645

1. Minimum Base Metal Thickness: 0.053 / 16 gauge
2. Depth: 3-5/8 inches unless otherwise indicated on the Drawings.

C. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- deep flanges.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base Metal Thickness: 0.035 inch / 20 gauge
2. Minimum Width: 4 inches

E. Cold-Rolled Channel Bridging: 0.0538-inch bare steel thickness, with minimum 1/2-inch-wide flange.

1. Depth: 1-1/2 inches.
2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.035 inch / 20 gauge.
2. Depth: 7/8 inch.

G. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

H. Cold-Rolled Furring Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch-wide flange.

1. Depth: 3/4 inch.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

I. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

J. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 1396/C 1396/M.

1. 5/8 inch thick, Type X

2.5 TILE BACKER BOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Tile Backer: ANSI A118.9 and ASTMC1288 or 1325 with manufacturer’s standard edges.
1. Thickness: 5/8 inch, unless otherwise indicated
2. Width: Manufacturer’s standard width, but not less than 32 inches

C. Products: Subject to compliance with requirements, provide one of the following products:
1. Wonderboard Multi+Board; Custom Building Products
2. DomCrete Cementitious Tile-Backer Board; Domtar Gypsum
3. Util-A-Crete Concrete Backer Board; FinPan, Inc.
4. DUROCK Cement Board; United States Gypsum Co.
5. DensShield Tile Backer; Georgia Pacific

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet.
2. Shapes:
   a. Cornerbead: Use at all outside corners.
   b. LC-Bead (J-Bead): Use at exposed panel edges and where gypsum board panels abut other materials.
   c. Expansion (Control) Joint: Where indicated or at 20 feet o.c. max in continuous gypsum wall board, vertical application, evenly distributed.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper
2. Tile Backing Panels: As recommended by panel manufacturer

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Fastening Adhesive:

1. Steel: Adhesive recommended for attaching panels to steel framing.

D. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

E. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), non-perforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

2.9 SURFACE FINISHES

A. Sand joints and screw holes to provide smooth finish.

1. Texture: Spatter knock-down.

2.10 FRP -1 – GLASS-FIBER-REINFORCED PLASTIC PANELING

A. General: Gelcoat-finished, composite glass-fiber reinforced plastic panels.

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. Crane Composites, Inc., (formerly Kemlite Company Inc.)
   b. Creative Panel Solutions
   c. Glasteel, (a subsidy of Stabilit America)
   d. Marlite, Inc.
   e. Newcourt, Inc.
   f. Nudo Products, Inc.
   g. Parkland Performance Panels, Inc.
2. Basis-of-Design Product: Subject to compliance with requirements, provide Nudo Products, Inc FiberLite Wall Panels or equal.
3. Nominal Thickness: Not less than 0.090 inch
4. Substrate: Gypsum Wall Board
5. Surface Finish: Molded pebble texture
6. Fire Rating: Class C : non-structural
7. Width: 4 foot-0 inches
8. Length: 4 foot-0 inches
9. Color: White

2.11 FRP-1 ACCESSORIES

A. General: Manufacturer's accessories designed and specifically sized to secure, retain and cover edges of composite panels. Provide division bars, inside corners, outside corners, caps and fasteners as needed to secure and conceal all exposed edges. All edges of Composite panels to be covered with manufactures standard trim set in full bed of sealant. Accessories to be utilized that provide complete seal of all edges and concealing all non-vinyl fasteners.

1. Color: Match panels
2. Trim: Manufacturer’s standard vinyl extrusions design to retain and cover edges of panels.
3. Adhesive: Provide adhesive as recommended by the manufacturer to adhere to gypsum board substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support

ceilings and that hangers will develop their full strength.

1. Furnish concrete inserts and other devises indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLING STEEL FRAMING, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.

1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.

    a. Use deep-leg deflection track where indicated.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Suspend ceiling hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counters playing, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.

8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.

C. Sway-brace suspended steel framing with hangers used for support.

D. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.

1. Where studs are installed directly against exterior walls, install foam-gasket isolation strip between studs and wall.

B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing 4 inches above highest adjacent ceiling. Brace top of framed wall every 6 feet in two directions to structural supports or substrates above suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

D. Install steel studs and furring at the following spacing:

1. Single-Layer Construction: 16 inches on center, unless otherwise indicated.
2. Multilayer Construction: 16 inches on center, unless otherwise indicated.
3. At Column Cladding in administrative, 12 inches on center, maximum, or three studs per clad face, minimum.

E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install two studs at each jamb, unless otherwise indicated.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

H. Polyethylene Vapor Retarder: Install to comply with requirements specified in Section 07210 "Building Insulation".

3.6 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.

I. Form control and expansion joints with space between edges of adjoining gypsum panels.

J. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments and perpendicular walls of dissimilar materials. Provide 1/4 inch wide spaces at these locations, and trim edges with J-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces and perpendicular walls with acoustical sealant.

L. Sound Insulated Partitions: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings. Provide minimum 3 inches, un-faced batt

insulation, minimum R-11, for inside wall cavity.

M. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

1. Space screws a maximum of 12 inches o.c. for vertical applications.

N. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

3.7 PANEL APPLICATION METHODS

A. Single-Layer Application:

1. On restroom ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.

2. On partitions/walls, apply gypsum panels horizontally, perpendicular to framing, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   a. Stagger abutting end joints not less than one framing member in alternate courses of board. At stairwells and other high walls or where framing is more suitable, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly. Panels may not be installed in both horizontal and vertical directions on the same wall.

B. Multilayer Application on Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

C. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

D. Z-Furring Members: Apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

E. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

F. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.

G. Tile Backing Panels:

1. Cement Tile Backing Board: Install at showers, tubs, sinks, behind tile and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

3.8 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces. Refer to room finish legend on plans for gypsum board finish level.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

1. Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges.

3.10 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Architect will conduct an above-ceiling observation before installing gypsum board ceilings and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
   a. Installation of 80 percent of lighting fixtures, powered for operation
   b. Installation, insulation, and leak and pressure testing of water piping systems
   c. Installation of air-duct systems
   d. Installation of air devices
   e. Installation of mechanical system control-air tubing
   f. Installation of ceiling support framing

3.11 FRP-1 INSTALLATION

A. Preparation: Verify substrate conditions, which have been previously installed per this section, are acceptable for product installation in accordance with manufacturer’s instructions. Verify that site conditions are acceptable for installation of wall panels. Examine back-up surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails are countersunk and joints and cracks are filled flush and smooth

with the adjoining surface. Do not proceed with installation of wall panels until unacceptable conditions are corrected.

B. Installation:

1. Inspect panels Inspect panels for any defects immediately. Do not install panels of unacceptable quality. Field cutting of all wall systems should be accomplished using a circular saw with fine tooth carbide blade.
2. Position panel so that the saw blade enters the finished HPL side first to avoid chipping or damage. Protect decorative laminate face of panel by covering work area, do not remove protective will until after installation.
3. Follow adhesive manufacturer's recommendations for appropriate height of adhesive bead left by trowel and do not allow adhesive to skin over.

C. Trim Installation:

1. Start in the corner. Mark plumb line 48 1/8 inches from corner.
2. Apply adhesive directly to entire back of composite wall panel using correct trowel with 100% adhesive coverage using crosshatch pattern. Apply adhesive to within 1/2 inch of all edges of panel.
3. Slide panel into molding and withdraw 1/8 inch for moldings to provide appropriate gap. Align with plumb line.
4. Begin in top corner nearest molding with laminate roller, rolling down and out toward the edge without molding.
5. Continue rolling down and out working across panel away from previously installed panel or initial molding. Remove all trapped air.
6. Install one-piece division bar and caps or next molding by sliding onto panel.
7. Repeat process, working in one direction around room.
8. Immediately remove all adhesive residue. To remove, clean with nonabrasive cotton cloth and warm water. If necessary, use a mild nonabrasive detergent. For cleanup with solvent based adhesives, use mineral spirits or acetone to remove residue.

END OF SECTION

SECTION 09310
CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. 4-1/4 x 8-1/2 inch scheduled glazed wall tile

B. Related Sections include the following:

1. Section 09260: "Gypsum Board Assemblies" for water resistant cement backer board installed in gypsum wallboard assemblies.
2. Section 07920: “Joint Sealants”

1.3 SUBMITTALS

A. Product Data: For each type of tile, mortar, grout, sealant and other products specified.

B. Tile Samples: Furnish two (2) actual tiles or sections of tiles showing the color, texture and pattern for each scheduled tile type and color indicated. Include samples of accessories involving color selection.

C. Grout Samples: Furnish two (2) sections of grout showing the color for each scheduled grout type and color indicated.

D. Mortar Samples: Furnish two (2) sections of mortar showing the color for each scheduled mortar type and color indicated

E. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.

F. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for

each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.7 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide products indicated in the ceramic tile installation schedules at the end of this Section.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Tile Products:
   a. American Olean Tile Company
   b. Dal-Tile Corporation
   c. Florida Tile Industries, Inc.
   d. Mannington Ceramic Tile
   e. Monarch Tile, Inc.

f. Summitville Tiles, Inc.
g. United States Ceramic Tile Company

2. Tile-Setting and -Grouting Materials:
   a. American Olean Tile Company
   b. Bostik
   c. Dal-Tile Corporation
   d. DAP, Inc.
   e. Laticrete International, Inc.
   f. Mapei Corporation
   g. Summitville Tiles, Inc.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Provide CDOT Representative selections from manufacturer's typical full range of colors, textures, and patterns for products of type indicated.
2. Provide tile trim and accessories that match color and finish of adjoining flat tile.

D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.

1. Where tile is indicated for installation in swimming pools, on exteriors, or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for these kinds of installations and has a record of successful in-service performance.

2.3 TILE PRODUCTS

A. Glazed Wall Tile: Provide flat tile complying with the following requirements:

1. Module Size: 4-1/4 by 8-1/2 inches.
2. Thickness: 5/16 inch.
3. Face: Plain with modified square edges or cushion edges.
4. Mounting: Factory back-mounted.

B. Basis of Design: Daltile Modern Dimensions Glazed Ceramic Wall Tile

C. Trim Units: Provide tile trim units (bullnose, cove) to match characteristics of adjoining flat tile and to comply with the following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes:
   a. Base for Thin-Set Mortar Installations: 4 1/4 inch high cove base
   b. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.
   c. External Corners for Thin-Set Mortar Installations: Surface bullnose.
   d. Internal Corners: Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

2.4 SETTING MATERIALS

A. Latex-Portland Cement Mortar: ANSI A118.4, composed as follows:

1. Mixture of Dry-Mortar Mix and Latex Additive: Mixture of prepackaged dry-mortar mix and liquid-latex additive complying with the following requirements:
   a. Latex Additive: Acrylic resin.
   b. For wall applications, provide no sagging, latex-Portland cement mortar complying with ANSI A118.4 for mortar of this type defined in Section F-2.1.2.

2.5 GROUTING MATERIALS

A. Latex-Portland Cement Grout: ANSI A118.6 for materials described in Section H-2.4, composed as follows:

1. Mixture of Dry-Grout Mix and Latex Additive: Mixture of factory-prepared, dry-grout mix and latex additive complying with the following requirements:
   a. Unsanded Dry-Grout Mix (for walls): Dry-set grout complying with ANSI A118.6 for materials described in Section H-2.3, for joints 1/8 inch and narrower.
   b. Sanded Dry-Grout Mix (for floor): Commercial Portland cement grout complying with ANSI A118.6 for materials described in Section H-2.1, for joints 1/8 inch and wider.
   c. Latex Additive: Acrylic resin.

2.6 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section 07920 "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.7 CEMENTITIOUS TILE BACKER BOARDS

A. Provide cementitious backer units or fiberglass mat-faced backer board complying with ANSI A118.9, of thickness and width indicated below, and in maximum lengths available to minimize end-to-end butt joints. Refer to Section 09260 for more detailed requirements.

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: White-zinc-alloy terrazzo strips, 1/8 inch (3.2 mm) wide at top edge with integral provision for anchorage to mortar bed or substrate, unless otherwise indicated.Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with the CDOT Representative.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.

1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:

1. Petroleum paraffin wax, applied hot.
2. Grout release.
3. Petroleum paraffin wax or grout release.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."

H. Grout tile to comply with the requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.
2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.
3. For chemical-resistant furan grouts, comply with ANSI A108.8.

I. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:

1. Wall Tile: 1/8 inch. (minimum 1/16 inch)

C. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards

3.6 CLEANING, PROTECTING and SEALING TILE

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection (sealing) and maintain conditions, in a manner acceptable to manufacturer and Installer that ensures tile is without damage or deterioration at the time of Substantial Completion.

1. When recommended by tile manufacturer, apply a protective coat of sealer (Miracle Sealants 511 Impregnator. (Company info: Miracle Sealants Company (800) 350-1901)

to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

SECTION 09511
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this section

B. Related Sections

1. Section 09260: Gypsum Board Assemblies
2. Section 16511: Lighting

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for acoustical tile ceilings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated

B. Samples: For each exposed finish

C. Product test reports

D. Research/evaluation reports

E. Maintenance data

1.4 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory.

B. Fire-Test-Response Characteristics:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   a. Identify materials with appropriate markings of applicable testing and inspecting agency.
2. Surface-Burning Characteristics: Acoustical panels complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.
   a. Smoke-Developed Index: 450 or less.

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 5 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 5 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANEL CEILINGS, GENERAL

A. Acoustical Panel Standard: Comply with ASTM E 1264.

1. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.

B. Metal Suspension System Standard: Comply with ASTM C 635.

1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Seismic perimeter stabilizer bars, seismic struts, and seismic clips.

F. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING – ACT-1

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industies, Inc.; Cortega 703 24 inch by 48 inch or a comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. BPB USA
3. Chicago Metallic Corporation
4. Ecophon CertainTeed, Inc.
5. Tectum Inc.

6. USG Interiors, Inc.

B. Classification: Provide panels complying with ASTM E 1264 for type and form as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted

C. Color: White.

D. LR: Not less than .82

E. NRC: Not less than .55, Type E-400 mounting per ASTM E 795.

F. CAC: Not less than 40.

G. Edge/Joint Detail: Angled Tegular; for 15/16 grid

H. Thickness: 3/4 inch (19 mm)

I. Modular Size: 24x48 inch

2.3 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING ACT-1

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc product compatible with selected ACT ceiling panel or a comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. BPB USA
3. Chicago Metallic Corporation
4. Ecophon CertainTeed, Inc.
5. USG Interiors, Inc.

B. Double-Web Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch-(24-mm-) wide metal caps on flanges and 7/8 inch x 7/8 inch wall angle.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Cap Material: Steel or aluminum cold-rolled sheet.
4. Cap Finish: Painted white.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders.

C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
2. Do not attach hangers to steel deck tabs or to steel roof deck.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

END OF SECTION

SECTION 09650
RESILIENT FLOOR, BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Resilient floor tile
2. Resilient wall base and accessories

1.3 SUBMITTALS

A. Product Data: For each type of product specified.

B. Samples for Initial Selection: When submitting a different product than the basis of design, provide Manufacturer's color charts consisting of units or sections of units showing the full range of colors and patterns available for each type of product indicated.

D. Samples for Verification: Provide two (2) product samples of selected color and style. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F.

C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F nor more than 95 deg F in spaces to receive products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After post-installation period, maintain a temperature of not less than 55 deg F nor more than 95 deg F.

B. Install accessories after other finishing operations, including painting, have been completed.

C. Do not install base over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Floor: Furnish not less than 10 square feet for each 500 square feet or fraction thereof, of each type, color, pattern, and size of resilient accessory installed.
2. Base: Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient accessory installed.
3. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated for each designation.

2.2 LUXURY VINYL TILE (LVT)

A. Basis of Design: Knight Tile Luxury Vinyl Tile
1. Size: 4 inch x 36 inch
2. Thickness: 2 millimeters
3. Wear Layer: 0.3 millimeters
4. Pattern: Wood effect planks laid at 90 degrees
5. Other approved manufacturers include: Mannington, Armstrong, Terkett and Mohawk

2.3 RESILIENT ACCESSORIES

A. Rubber Wall Base: Basis of Design: Roppe Pinnacle 4 inch Rubber Wall Base – Standard Toe
   1. Style B- Cove
   2. Alternate Manufacturers: Armstrong and Johnsonite
   3. Product to comply with ASTM F1861 Type TP-Rubber Thermoplastic and with requirements specified in the Finish Schedule.

2.4 INSTALLATION ACCESSORIES

A. Pre-molded outside and inside corners

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 LVT INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer’s instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminated, and where indicated.

H. Scribe flooring to walls, columns, floor outlets, and other appurtenances to produce tight joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. General: Install resilient accessories according to manufacturer's written installation instructions.

B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
3. Do not stretch base during installation.
4. On irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
5. Install pre-molded outside and inside corners before installing straight pieces or score or miter continuous base to maintain continuous contact on inside and outside corners.

C. Place resilient accessories so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

3.5 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
2. Sweep or vacuum floor thoroughly.

END OF SECTION

SECTION 09900
PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

B. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

C. Related Sections

1. Section 03300: Cast-in-Place Concrete
2. Section 08110: Steel Doors and Frames
3. Division 15 and 16: Painting of Mechanical and Electrical work is specified in Divisions 15 and 16, respectively

1.2 SUMMARY

B. This Section includes surface preparation and field painting of the following, colors as scheduled:

1. Exposed exterior items and surfaces
2. Exposed interior items and surfaces
3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
4. Steel Bollards
5. Hollow Metal Door and Frames
6. Exposed Steel trim

C. Paint: As Specified or Architect approved equal. One coat primer on all surfaces and 2 finish coats.

1. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, Architect will select from standard colors and finishes available.

a. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, primed steel structure, concrete building curb, and primed metal surfaces of mechanical and electrical equipment.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:
   a. Pre-engineered metal building wall panels and trim (Fluoropolymer Finish)
   b. Finished mechanical and electrical equipment
   c. Light fixtures
   d. Louvers and Vents (Flouropolymer Finish)

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
   a. Foundation spaces
   b. Furred areas
   c. Ceiling plenums

3. Finished metal surfaces include the following:
   a. Anodized aluminum
   b. Stainless steel
   c. Chromium plate
   d. Copper
   e. Bronze and brass
   f. Galvanized Metal

4. Operating parts include moving parts of operating equipment and the following:
   a. Valve and damper operators
   b. Linkages
   c. Sensing devices
   d. Motor and fan shafts

5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.3 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Samples for Initial Selection: Submit 2 samples of each color and each type of finish – coat material indicated.

C. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Construction Meeting.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material
2. Product description (generic classification or binder type)
3. Manufacturer's stock number and date of manufacture
4. Contents by volume, for pigment and vehicle constituents
5. Thinning instructions
6. Application instructions
7. Color name and number
8. VOC content

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

2. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.7 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.

B. Manufacturer’s Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:

1. Benjamin Moore & Co. (Moore).
2. ~~Comex Industrial Paint, a division of Kwal-Howell Paints (Comex)~~
3. Deidrich Technologies, Inc. (Diedrich)
4. Diamond Vogel (DV)
5. Devoe Coatings from Akzo Nobel. (Devoe).
6. Glidden Professional and Devoe Coatings from Akzo Nobel (Glidden)
7. Kwal Paint, a division of Sherwin Williams
8. PPG Industries, Inc. (PPG).
9. Pratt & Lambert, Inc. (P & L).
10. Sherwin-Williams Co. (S-W).

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Provide color selections as scheduled. If not scheduled, provide full range of Manufacturer’s Standard Color Samples to Architect for selection.

2.3 MIXING AND TINTING

A. Except where specifically noted in this section, all paint shall be ready-mixed and pre-tinted. Agitate all paint prior to and during application to ensure uniform color, gloss, and consistency.

B. Thinner addition shall not exceed manufacturer's printed recommendations. Do not use kerosene or other organic solvents to thin water-based paints.

C. Where paint is to be sprayed, thin according to manufacturer's current guidelines.

2.4 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish system over exterior ferrous metal. Primer is not required on shop-primed items, however confirm shop the primer on shop primed items is compatible with the finish coat specified.

1. Urethane High Performance Coating: Provide 2 finish coats over a rust-inhibitive primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm) or as recommended by the manufacturer. Acceptable products include:
(1 Moore: Super Spec HP Alkyd Metal Primer P06

(2 DV: DVP Pinnacle Protective Coatings CoteAll Multi-Purpose Alkyd Primer
(3 Devoe: Devran 203 Waterborne Epoxy Primer
(4 PPG: 95-245 Series Pitt-Guard Rapid Coat DTR Polyamide Epoxy Mastic Coating
(5 S-W: Kem Bond HS Primer B50N23

b. Finish Coats: Two coats of urethane high performance exterior enamel applied at spreading rate to achieve a total dry film thickness of not less than 3.4 mils (0.086 mm) or as recommended by the manufacturer. Acceptable products include:
(1 Moore: Super Spec HP Urethane Alkyd Gloss Enamel P22.
(2 DV: DVP Pinnacle Protective Coatings CoteAll Multi-Purpose Alkyd Enamel
(3 Devoe: Devthane 379 Acrylic Urethane Gloss
(4 PPG: 95-8800 Series Pitthane High Build Semi-Gloss Urethane Enamel
(5 S-W: Pro Industrial Urethane Alkyd Enamel B54-150 Series

2.5 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Semigloss, 100 % Acrylic Latex: 2 finish coats over a primer.

a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm). Acceptable products include:
(1 Moore: Ultra Spec 500 Interior Latex Primer N534
(2 DV: DVP Health-Kote Interior Zero VOC Primer
(3 Glidden: Lifemaster No VOC Interior Primer 9116-1200.
(4 PPG: Speedhide Zero Interior Zero VOC Primer 6-4900.
(5 P & L: ProHide Green Interior Latex Primer Z9160/F9160
(6 S-W: ProMar 200 Zero VOC Latex Primer B28W2600.

b. First and Second Coats: Low Odor, Low VOC 100% Acrylic Interior Latex Semi-Gloss applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm). Acceptable products include:
(1 Moore: Ultra Spec 500 Interior Semi-Gloss N539
(2 DV: DVP Zero Plus Zero VOC Interior Latex Semi Gloss
(3 Glidden: Ultra-Hide No VOC Interior Semi-Gloss Paint 1415-XXXX
(4 PPG: Speedhide Zero Interior Zero VOC Latex Semi-Gloss 6-4510.
(5 P & L: ProHide Green Interior Semi-Gloss Latex Z9300/F9300 Series
(6 S-W: ProMar 200 Latex Zero VOC Semi-Gloss B31-2600 Series.

B. Ferrous Metal: Provide the following finish systems over ferrous metal. Ferrous metal items to be painted include but are not limited to hollow metal doors, metal door frames and exposed structural steel:

1. Semigloss, Latex Finish: Two finish coats over an alkyd based primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or latex-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm) or as recommended by the manufacturer. Acceptable products include:
(1 Moore: Super Spec HP Alkyd Metal Primer P06
(2 DV: DVP Pinnacle Protective Coatings Vers-Acryl 200 Acyrlic Maintenance Primer/Finish
(3 Devoe: 4160 Devguard Alkyd Primer

(4 PPG: 6-208 Speedhide Int/Ext Rust Inhibitive Steel Primer.
(5 P & L: Interior/Exterior Metal Waterborne Primer P2305.
(6 S-W: Pro Industrial Pro-Cryl Universal Primer, B66N310

b. Finish Coat: Low Odor, Quick Drying, Rust Inhibitive Waterborne Acrylic or Alkyd Semi-Gloss applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.036 mm) or as recommended by the manufacturer. Acceptable products include:
(1 Moore: Super Spec HP DTM Acrylic Semi-Gloss P29.
(2 DV: DVP Pinnacle Protective Coatings Finium DTM-AT Semi Gloss
(3 Devoe: 4216 Devflex Acrylic Enamel Semi-Gloss
(4 PPG: 90-1210 Pitt-Tech Int/Ext Semi-Gloss DTM Industrial Enamel
(5 P & L: Acrylic Waterborne DTM Enamel – Semi-Gloss Z6700 Series
(6 S-W: Pro Industrial Zero VOC Acrylic B66-650 Series

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the CDOT Representative about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Verify compatibility of primer or coating with paint system. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

    a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
    c. Clean surfaces to be painted to manufacturer’s specifications for surface preparation.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

    a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

~~4. Zinc Coated Metal (Galvanized Surfaces): Solvent clean with mineral spirits or other acceptable solvent in accordance with SSPC-SP1 to remove all residue oil, grease or other contamination. Prime as specified.~~

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
8. Finish interior of unfinished casework to match exterior.
9. At the request of CDOT or Architect, provide field test of any high performance coating system.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Exposed piping, pipe hangers, and supports.
2. Ductwork.

G. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

H. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

B. Extra Stock

1. Extra Paint: At the completion of painting, deliver to the Owner any excess paint of each paint color and type used along with the color number or formula for each type.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

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SECTION 10200
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on drawings and/or herein specified, including all labor, materials, equipment, and incidentals necessary and required for their completion.

1.2 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward.

B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Samples for Initial Selection: Submit manufacturer’s standard color line for units with factory-applied color finishes.

1.6 QUALITY ASSURANCE

A. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.

D. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

2.2 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel unless otherwise indicated.

C. Include supports, anchorages, and accessories required for complete assembly.

D. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.

E. Provide subsills made of same material as louvers and extended sills for recessed louvers.

F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable Blade Louver:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Air Balance Inc.; a Mestek company.
b. American Warming and Ventilating, Inc.; a Mestek company.
c. Arrow United Industries; a division of Mestek, Inc.
d. Construction Specialties, Inc.
e. Greenheck Fan Corporation.
f. Ruskin Company; Tomkins PLC.

2. Louver Depth: 4 inches
3. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location: Interior face.
2. Screening Type: Bird screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
2. Finish: Same finish as louver frames to which louver screens are attached

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.6 ALUMINUM FINISHES

A. Finish louvers in factory after assembly.

B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

C. Color and Gloss: As selected by Architect from manufacturer's standard range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.

B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

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SECTION 10425
SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Related Sections:

1. Division 1 “Temporary Facilities” for temporary project identification signs.
2. Section 15010: General Mechanical Requirements
3. Section 16075: Electrical Identification
4. Section 16511: Lighting

1.2 SUMMARY

A. This Section includes the following types of signs:

1. Restroom Signage
2. Exit Signs
3. Occupancy Signage

1.3 SUBMITTALS

A. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. ADA signage: Color chart identifying approved color combinations.

C. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.4 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

C. ADA Accessibility Guidelines, Latest Edition

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Manufacturers of Panel Signs:

a. Allenite
b. Andco Industries Corp.
c. ASI Sign Systems, Inc.
d. Best Manufacturing Company
e. Compliance Signs
f. Kroy Sign Systems
g. Romark
h. Seton Identification Products
i. Spanjer Brothers, Inc.
j. Vomar Products, Inc.

2.2 MATERIALS

A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following general types:

1. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

B. Plastic Laminate: Provide high-pressure plastic laminate engraving stock with face and core plies in contrasting colors, in finishes and color combinations indicated or, if not indicated, as selected from the manufacturer's standards.

C. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

D. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.3 SIGNAGE

A. Unframed Panel Signs: Fabricate signs of plastic laminate, vinyl or acrylic sheets, with edges mechanically and smoothly finished to conform with the following requirements:

1. Edge Condition: Square cut.

2. Edge Color for Plastic Laminate: Edge color same as copy.

3. Corner Condition: Corners rounded to radius indicated.

B. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

C. Engraved Copy –for signs not required to be ADA Compliant: Machine-engrave letters, numbers, symbols, and other graphic devices into sign panel on the face indicated to produce

precisely formed copy, incised to uniform depth. Use high-speed cutters mechanically linked to master templates in a pantographic system or equivalent process capable of producing characters of the style indicated with sharply formed edges.

1. Engraved Plastic Laminate: Engrave through the exposed face ply of the plastic laminate sheet to expose the contrasting core ply.

2. Engraved Opaque Acrylic Sheet: Fill engraved copy with enamel.

D. Interior Identification signs shall be as follows:

1. Restrooms:
   a. Provide one 8 inch x 8 inch ADA compliant identification sign at each restroom
   b. Women's: Compliance Signs Item #RRE-130-99 or approved equal
   c. Men's: Compliance Signs Item #RRE-150-99 or approved equal
   d. Sign Material: Acrylic
   e. Color: Blue

2. Exit Sign:
   a. Provide one sign stating EXIT in raised characters and Braille at each accessible exit door
   b. Seton No. 31935 or approved equal
   c. Sign Material: Acrylic
   d. Color: Blue

3. Occupancy Sign
   a. At Classroom provide one sign stating "Maximum Occupancy Not to Exceed 55 Persons"
   b. Color: Black Letters on White Field
   c. Size: 8 1/2 inches x 11 inches

4. Other Identification Graphics: Provide signs with written name, raised braille lettering, graphic symbol, and contrasting color that is compliant with ADA requirements

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

C. Handicapped Accessible Signage:

1. Sign Mounting Height: Braille shall be 48 inches minimum and 60 inches maximum above floor, measured to the baseline of braille cells.

2. When a sign containing braille or raised characters is provided at a door, the sign shall be alongside the door at the latch side. Where the sign is provided at double doors where both leaves are active, the sign shall be to the right of the right hand door.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION

SECTION 10520
FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section. Note: Fire Alarm System is part of Section 16721.

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers
2. Identification
3. Smoke Detectors

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes (including color) for fire-protection specialties.

1. Fire Extinguishers: Include rating and classification
2. Brackets: Include wall brackets
3. Smoke Detectors

B. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.4 QUALITY ASSURANCE

A. Model number indicated is to establish a minimum standard of quality only.

B. Source Limitations: Obtain fire extinguishers through one source from a single manufacturer.

C. ANSI/UL Compliance: Comply with ANSI/UL 299 and 711.

PART 2 - PRODUCTS

2.1 PORTABLE FIRE EXTINGUISHER

A. Acceptable Manufacturers:

1. Products of the following manufacturers are specified herein as the standard of quality for the portable fire extinguishers:

a. Badger Fire Protection
944 Glenwood Station Lane
Charlottesville, VA 22901

Telephone: (800) 446-3857
www.badgerfire.com

b. Pyro-Chem
One Stanton Street
Marionette, WI 84143
Telephone: (800) 526-1079
www.pyrochem.com

c. Ansul/Tyco Fire Protection Products
One Stanton Street
Marinette, WI 54143-2542
Telephone: 1-(715) 735-7411
www.ansul.com

B. Features:

1. Extinguisher Type: Dry chemical
2. Shell Type: Steel
3. Hose Length: 26.6 in.
4. Capacity: 10 lb.
5. Discharge Time: no more than 19 sec.
6. Flow Rate: minimum 0.59 lb./sec.
7. Effective Range: 16 ft or greater
8. Charged Weight: 17 lbs.
9. UL Rating: 60-B:C / 40-B:C

C. Dimensions:

1. Height: 16.1 inches
2. Width: 8.3 inches
3. Depth: 5.3 inches

D. MODELS

1. Badger Fire Protection Model B10BC
2. Pyro-Chem PC10BC-1
3. Ansul/Tyco Sentry Model C10S

E. ACCESSORIES

1. Mounting Bracket: Manufacturer's standard steel, multipurpose bracket designed to secure extinguisher.

2. Identification/Backing Panel: Provide an identification panel immediately above where the portable fire extinguisher shall be mounted. The panel shall be a minimum of 6 inches wide and 4 inches high. The entire identification panel shall be painted red with white block lettering which states, “EXTINGUISHER” depicted above the portable fire extinguisher device. The panel shall be securely fastened to the wall on which it is attached.

2.2 SMOKE DETECTOR

A. Provide hard-wired combination smoke and carbon monoxide detector with photoelectric sensor.

B. Acceptable Product for Smoke Detector: Kidde 900-0114A with battery back-up or approved equal.

C. Provide ceiling mounted fire strobe Kidde SL177i or equal. Interlock fire strobes to smoke/carbon monoxide detectors. See specification section 16721 “Fire Alarm and Detection System” for more information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable anchoring of identification/backing panel and subsequent portable fire extinguisher unit.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.
2. Proceed with installation only after unsatisfactory conditions, if any, have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing portable fire extinguisher and smoke detector device.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Fasten painted, plywood identification/backing panel to wall, square and level.
2. Fasten mounting bracket(s) to plywood identification/backing panel.
3. Fasten portable fire extinguisher device to mounting bracket(s).

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure that smoke detector and portable fire extinguisher devices are without damage or deterioration at the time of Substantial Completion.

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SECTION 10800
TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Related Sections

1. Section 15450 : Plumbing Fixtures and Trim

1.2 SUMMARY

A. This Section includes the following:

1. Toilet and bath accessories.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

D. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect or Owner.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering accessories that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:

1. Toilet and Bath Accessories:

a. American Specialties, Inc. (ASI)
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.
d. McKinney/Parker Washroom Accessories Corp.
e. Tork and SCA Brand.

C. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Toilet and Bath Accessory Schedule at the end of Part 3.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.

C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

G. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.

1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.

E. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

F. Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

D. Provide grab bars per ICC/ANSI A117.1-2009 requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET AND BATH ACCESSORIES

Provide the following accessories where indicated on the drawings.

A. Paper Towel Dispenser (PTD): Provide metal/plastic paper towel dispenser, one per Toilet Room and one at janitor sink, and one at kitchen sink complying with the following:

1. Surface-Mounted Type: Sized for Tork H1 Roll Towel without using special adapters; with hinged front equipped with tumbler lockset; battery powered and with refill indicators window on front.
2. Mounting Height: Mount dispenser such that access to the paper towels is between 44 inches – 48 inches AFF and mount outside of required ADA clear floor space of plumbing fixtures
3. Model: Tork Matic Hand Towel Roll Dispenser – with Intuition Sensor, Product 5511282

B. Toilet Tissue Dispenser (TD): Provide toilet tissue dispenser, one per water closet, complying with the following:

1. Type: Roll-in-reserve dispenser with hinged front secured with tumbler lockset, Double-roll dispenser
2. Mounting: Surface mounted with concealed anchorage.
3. Mounting Height: Install top of unit 2 inches below bottom of grab bar and per ANSI requirements for height and distance from water closet.
4. Material: Stainless steel
5. Model: ASI No. 0030 or approved equal

C. Soap Dispenser (SD): Provide soap dispenser, one per lavatory hand sink at VSF, at janitor sink, and at kitchen sink, complying with the following:

1. Liquid Soap Dispenser, Vertical-Tank Type: Surface-mounted type, minimum 40-oz. capacity tank with stainless-steel piston, springs, and internal parts designed to dispense soap in measured quantity by pump action; and stainless-steel cover with unbreakable window-type refill indicator.
2. Mounting Height: Mount over or adjacent to sink such that the soap valve or push button is 8 inches above sink or 42 inches AFF.
3. Model: ASI NO. 0343 or approved equal.

D. Grab Bars: Provide stainless-steel grab bars, two horizontal and one vertical per water closet, complying with the following:

1. Stainless-Steel Nominal Thickness: Minimum 0.05 inch
2. Mounting: Concealed with manufacturer's standard flanges and anchors.
3. Mounting height: Mount horizontal grab bars 33 inch minimum or 36 inch maximum AFF and vertical bar at 40 inches AFF (bottom of bar) and with centerline of bar 40 inches from rear wall and as required per ANSI /A-117-2003 Chapter 6
4. Gripping Surfaces: Manufacturer's standard slip-resistant texture (not peened)
5. Outside Diameter: 1-1/2 inches
6. Size and Location: Provide as indicated on drawings

7. Model: ASI No. 3200 series

E. Mirror Unit: Provide mirror unit, one per lavatory, complying with the following:

1. Stainless Steel, Framed Mirror: Fabricate frame from minimum nominal 0.05 inch thick stainless steel angles, with square corners mitered, welded, and ground smooth. Size: 18 inch x 36 inch
2. Mounting Height: Mount mirror a minimum of such that the bottom of the reflective surface of the mirror is no more than 40 inches AFF and the frame is a minimum of 3 inches above the sink.
3. Model: ASI No. 0600 or approved equal

F. Toilet partitions, overhead braced, complying with the following:

1. Door, Panel, and Pilaster Construction, General: Form edges with interlock to provide watertight fit without crown molding. Braze corners and finish smooth.
2. Provide exposed surfaces free of pitting, visible seams and fabrication marks, stains, telegraphing of core material, or other imperfections.
3. Core Material: Manufacturer's standard sound-deadening, water resistant honeycomb in thickness required to provide finished thickness for doors, panels and pilasters.
4. Door Construction: 1 inch (25 mm) thick, constructed from 0.0313 inch/22 ga (0.794 mm) galvannealed steel.
5. Provide each door with internal 0.0625 inch/16 ga (1.59 mm) and 0.0781 inch/14 ga (1.98 mm) welded reinforcements at top and bottom hinge locations, with factory installed concealed true gravity cam hinges.
6. Panel Construction: 1 inch (25 mm) thick, constructed from 0.0313 inch/22 ga (0.794 mm) galvannealed steel.
7. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
8. Pilaster Construction: 1 1/4 inch (32 mm) thick, constructed from 0.0375 inch/20 gauge (0.953 mm) galvannealed steel.
9. Provide pilaster with internally welded bracket suitable to accept minimum 3 inch (76 mm) long, 5/16 inch (7.9 mm) stainless steel hex bolt for leveling.
10. Headrail: Extruded anodized aluminum headrail with anti-grip profile. Provide fasteners for attachment to pilaster and stainless steel brackets to secure to wall.
11. Shoes: 4 inches (102 mm) high minimum, Type 304 stainless steel with No. 4 satin brushed finish. Secured to the floor with tamper-resistant screws.
12. Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
13. Urinal-Screen Construction: Matching toilet compartment panel construction.
14. Hardware, Standard Duty: Manufacturer's standard chrome-plated zamac castings, including corrosion-resistant, tamper-resistant fasteners:
    a. Hinges: Self-closing wrap-around gravity-type adjustable to hold doors open at any angle up to 90 degrees, with emergency access by lifting door.
    b. Latch and Keeper: Surface-mounted slide latch with wrap-around rubber-faced combination door strike and keeper, with provision for emergency access, meeting requirements for accessibility at accessible compartments.
    c. Coat Hook: Combination hook and rubber-tipped stop, sized to prevent door from hitting compartment-mounted accessories. Provide wall bumper where door abuts wall. Provide formed L-shaped hook without stop at outswing doors.
    d. Door Pull: Standard unit on outside of inswing doors. Provide pulls on both sides of outswing doors.
15. Manufacturer's standard powder coat finish, color as selected by Architect from manufacturer's full range.
16. Basis of Design Product: Bradley, Mills Partitions, Sentinel, Series 400, or approved equal.

17. Other approved manufacturers include: Global Industrial and Manning Materials Inc.

END OF SECTION

SECTION 15010
GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. In case of disagreement between drawings and specifications, or within either document itself obtain written clarification from the Mechanical Engineer through the CDOT Representative. Failure to obtain clarification prior to bid will result in the better quality and greater quantity being required during the construction phase, without additional reimbursement.

1.2 SUMMARY OF WORK

A. Work Included: Unless specified otherwise, provide all supervision, labor, materials, transportation, equipment, hauling, and services necessary for completely finished and operational mechanical systems. Provide all minor incidental items such as offsets, fittings, etc. required as part of the work even though not specifically shown on contract drawings or specifications. All work included by virtue of these specifications shall be free from all defects which may be caused by computerized date features.

B. The Contractor shall provide and install the number of items of equipment as indicated on the drawings, and as required for code-compliant systems.

C. Description of Systems: The work of Division 15 includes but is not limited to:

1. Heating, Cooling and Ventilating
2. Plumbing Systems
3. Temperature Control and Instrumentation
4. Testing, Adjusting & Balancing

D. Related Requirements:

1. General Requirements: Division 1 - All Sections
2. Mechanical: Division 15 - All Sections

E. Work Under Other Divisions:

1. Fixed Concrete Bases and/or pads for Mechanical Equipment: Division 3 Concrete, Base size and other required information furnished under Division 15, or as required by applicable code or ordinance.

2. Concrete for Inertia Bases for Mechanical Equipment: Division 3 - Concrete. Steel forms provided under Division 15.

3. Wall Openings and Chases: Under applicable Division according to information furnished under Division 15.

4. Painting (except Mechanical Identification System): Division 9 - Finishes.

5. Power Wiring: Division 16 - Electrical.

6. Disconnect switches which are not furnished as an integral part of mechanical equipment: Division 16 - Electrical.

F. Inspection: GC to inspect work preceding or interfacing with work of Division 15 sections prior to construction and report all known or observed defects that affect the mechanical design to the CDOT Representative. Do not proceed with the construction work until defects are corrected.

1.3 EXAMINATION OF CONTRACT DRAWINGS AND SPECIFICATIONS

A. Material and equipment has been carefully selected for this project, and the Contractor is expected to provide all items as closely as possible to the specifications.

B. The mechanical drawings show the general arrangement of all piping, ductwork, mechanical equipment, and appurtenances, and shall be followed as closely as actual building construction and the work of their trades will permit.

C. The architectural drawings shall be considered part of the mechanical work insofar as these drawings furnish this Division with information relating to design and construction of the building.

D. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. Investigate the structural and finish conditions affecting the work and provide such fittings, valves and accessories as may be required to meet such conditions.

1. Verify dimensions governing mechanical work at the building. Do not scale the mechanical drawings for dimensions. Take dimensions, measurements, locations, levels, etc. from the architectural drawings and the approved shop drawings submitted on the actual equipment to be furnished.

2. No extra compensation shall be claimed or allowed on account of differences between the actual dimensions and those indicated on the drawings.

3. Examine all adjoining work on which the mechanical work is dependent for maximum efficiency and report all design conflict which must be corrected prior to submitting bid. No waiver of responsibility shall be claimed or allowed due to failure to report unfavorable conditions affecting the mechanical work.

E. Submission of a bid constitutes acceptance of Drawings and Specifications as sufficiently detailed and complete to provide a complete, properly-functioning installation in conformance with applicable codes, standards and ordinances.

F. Omission of words or phrases such as "the Contractor shall", "in conformity therewith", "shall be", "as noted on the drawings", "a", "an", "the", "all", etc. are intentional. Omitted words and phrases shall be supplied by inference in the same manner as they are when a "note" appears on the Drawings. "Provide" is intended to mean furnish and install.

G. Order of Precedence: The precedence of mechanical construction documents is as follows:

1. Addenda and modifications to the Drawings and Specifications take precedence over the original Drawings and Specifications.

2. Should there be a conflict within the Specifications or within the Drawings of the same scale, the more stringent or higher quality requirements shall apply.

3. In the Drawings, the precedence shall be Drawings of larger scale over those of smaller scale, figured dimensions over scaled dimensions and noted materials over graphic indications.

4. Should a conflict arise between the Drawings and the Specifications for products indicated on the Drawings and the Specifications, the Specifications shall have precedence.

1.4 EXAMINATION OF PROJECT SITE

A. Examine site carefully to determine conditions to be encountered, work to be performed, equipment, and materials to be transported, stored, furnished, other features applicable to completion of the work.

B. Study drawings and specifications, report inconsistencies, errors, omissions, conflicts with codes and ordinances.

C. Submittal of bid will indicate satisfactory field examinations made, applicable allowances included in the bid.

1.5 COORDINATION

A. The Contractor shall plan all of his work in advance, and shall inform the CDOT Representative of the proposed construction schedule and anticipated completion date upon request. Contractor shall complete the entire installation as soon as the condition of the remaining building construction will permit.

B. Location of pipes, ducts, switches, panels, equipment, and fixtures, shall be adjusted to accommodate the work or interferences anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication.

1. Right of way: Lines which pitch shall have the right-of-way over those which do not pitch. Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.

2. Offsets, Transitions, and Changes in Direction: Offsets, transitions and changes in direction of pipes and ducts shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings.

3. Furnish and install all traps, air vents, sanitary vent, and devices as required to affect these offsets, transitions, and changes in direction.

C. Where major conflicts occur, contractor shall rely upon the CDOT Representative to make final decision regarding priority of right of way. Contractor shall request written clarification from the CDOT Representative prior to conflict reaching critical stage requiring removal of previously installed equipment or system components either by himself or by other trades involved.

D. When directed by the CDOT Representative, submit shop drawings showing interrelationship of various portions of work and work of other trades. Failure to properly coordinate may result in removal and relocation at no expense to the Owner.

E. Locations of existing utilities are based on the best information available. Contractor to hire independent locating company to verify exact locations of all utilities prior to fabrication and erection of work to avoid all interferences. Verification shall be by site inspection, excavation, or whatever means necessary to determine exact location of utilities. Interferences shall be avoided at no extra cost. If hidden utilities are encountered after Contractor's locating company's investigation, it is at the Contractor's cost to rectify hidden utility issues in a code-compliant manner. Contractor must notify Owner when a hidden utility is encountered. Utilities (including services) shall mean items such as pipes, and associated items such as valves, coating, and coverings. An item shall not be considered hidden if accessible, e.g. if above lay-in ceilings, if behind access panels, or if in other similar locations.

1.6 FUTURE SERVICE AND MAINTENANCE ACCESSIBILITY

A. Install all mechanical equipment so as to allow proper service access to equipment as recommended by equipment manufacturer. Do not install any portion of the mechanical system in such a manner as to eliminate or inhibit service access required on equipment installed by another trade on the project.

B. Install mechanical work to permit removal of heat exchanger bundles, filters, belt guards, sheaves, drives, and other parts requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure. All mechanical equipment shall be replaceable (dismantled) without requiring the removal of permanent building components. Alert Engineer if such conditions do not exist.

C. Arrange pipes, ducts, and equipment to permit ready access to valves, cocks, traps, starters, motors, control components, and to clear the openings of swinging doors and access panels.

D. If required for better accessibility, furnish access doors for the purpose. All changes shall be approved by the CDOT Representative prior to making the change.

E. This Contractor shall provide the General Contractor with the exact locations of access panels for each concealed valve, control, damper or other device requiring service. Locations of these panels shall be submitted for approval in sufficient time to be installed in the normal course of work.

1.7 UTILITY INTERRUPTIONS

A. Coordinate mechanical utility interruptions with the Owner and the Utility Company. Plan work so that duration of the interruption is kept to a minimum. This contractor shall be responsible for informing all adjacent tenants or building owners of a pending utility interruption. Contractor shall coordinate the utility interruption in a practical manner which is most convenient to all outside parties so affected.

1.8 OPENINGS THROUGH BUILDING CONSTRUCTION

A. This contractor shall cooperate with the General Contractor and all other Contractors whose work is the same space, and shall advise General Contractor of his requirements. Such spaces and clearances shall, however, be kept to the minimum size required.

B. This Contractor shall see that all slots and openings through floors, walls, ceilings and roofs are properly located and shall do all cutting and patching caused by neglecting to do so.

1. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as the work proceeds.

2. It is the responsibility of this contractor to locate these items and see that they are properly installed.

1.9 CODES, ORDINANCES, PERMITS AND FEES

A. Execute work per underwriters, public utility, local, state codes, ordinances, and regulations applicable. Contact city water and sewer agencies for verification of all requirements, permits, state fees and inspections prior to submitting bid. Obtain and pay for required permits, inspections, utility service connections, meters and certificates. Systems development fees and similar charges are not to be included in the bid, as they will be paid directly to the utility agency by the Owner upon notification. Notify CDOT Representative of items not meeting said requirements.

B. This Contractor shall include in the work, all labor, materials, services, apparatus and drawings, in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on drawings and /or specified.

C. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, and with the requirements of all governmental departments having jurisdiction. In the event of a conflict, applicable codes and ordinances shall take precedence over this specification or contract drawings.

D. All material and equipment for the electrical portion of the mechanical systems shall bear the approval label of, or shall be listed by the Underwriter's Laboratories, Incorporated, and shall be installed in compliance with the National Electric Code.

E. Comply with all applicable codes and standards referenced in Section 01095.

1.10 SUBMITTALS

A. Within thirty days after award of the Contract submit to CDOT Representative complete catalog data and/or shop drawings for each item of material and for every manufactured item of equipment to be used in the work. Such data shall include specific performance data, material description, rating, capacity, dimensions, and type for each item of material, each manufactured item, and all component parts utilized in final operating mechanical system. Applicable data shall be underlined and each applicable item identified in each catalog by the same identification acronyms used on the Drawings.

B. This Contractor shall submit to the CDOT Representative the number of copies required by the Division 1 General Requirements.

C. Each item submitted shall bear the Contractor's stamp, be dated and signed certifying that they have reviewed and approved the submittal.

D. The review comments of the CDOT Representative, the Architect, and/or code reviewer shall not relieve the Contractor from responsibility for deviations or errors from the Drawings or Specifications.

1.11 REQUESTS FOR SUBSTITUTION

A. Contractors desiring to use alternate equipment or materials and manufacturers or suppliers desiring to furnish alternate materials or equipment in lieu of those specified, shall submit requests for approval to the CDOT Representative not less than the due date of questions for the Second Addenda, which date will be delineated in Addendum # 1, so that answers can be included in Addendum #2.

B. Requests for approval shall be made in writing and shall include complete data sheets, and catalogue cuts and shall identify all maintenance procedures deviating from that of the specified equipment.

C. Contractor shall be responsible for proper installation, complete in all respects, and operation of all equipment or materials substituted as a result of approval of requests to substitute, including all required modifications in work to be accomplished by the other trades involved.

D. This contractor shall be responsible for the proper location, capacity, and quantity of all rough-ins and connections to substituted equipment by members of other trades involved.

1.12 ELECTRIC WIRING AND SAFETY DEVICE WORK AND MATERIAL RESPONSIBILITIES

A. Furnish equipment requiring electrical connection to operate properly, deliver full capacity at electrical service available.

B. All control wiring to be in accord with manufacturer's recommendations, and all wiring shall be color coded to facilitate checking.

C. Unless otherwise indicated, all mechanical equipment motors and controls shall be furnished, set in place, and wired in accordance with the following schedule: (MD = Mechanical Division; ED = Electrical Division)

ITEM	FURNISHED UNDER	SET IN PLACE OR MOUNTED UNDER	POWER WIRED & CONNECTED UNDER	CONTROL WIRED & CONNECTED UNDER
Equipment Motors	MD	MD	ED	--
Magnetic Motor Starters: a. Automatically controlled with or without HOA switches	MD	MD	ED	MD
b. Manually controlled	MD	MD	ED	MD
c. Manually controlled and furnished as part of factory wired equipment	MD	MD	ED	MD

ITEM	FURNISHED UNDER	SET IN PLACE OR MOUNTED UNDER	POWER WIRED & CONNECTED UNDER	CONTROL WIRED & CONNECTED UNDER
Line voltage thermo-stats, etc. not connected to control panel systems	MD	ED	ED	ED
Temperature control panels and time switches mounted on temperature control panels	MD	MD	ED	MD
Motorized damper motors	MD	MD	ED	MD
Control circuit feeders	ED	ED	ED	ED
Low voltage controls, thermostats, etc.	MD	MD	ED	ED
Water heater controls, panels, internally wired	MD	MD	ED	MD
Fused and unfused disconnect switches, thermal overload switches, manual operating switches	ED	ED	ED	--
Multi-speed switches	MD	ED	ED	ED
Contactors	ED	ED	ED	ED
Control relays, transformers	MD	ED	ED	ED

D. Make Connections to controls directly attached to ducts, piping and mechanical equipment with flexible connections.

E. All temperature control conduit and wiring will be furnished and installed under electrical contract. All motorized damper wiring will be furnished and installed under temperature control subcontract. In the event that temperature control is not under separate contract, Mechanical Contractor shall assume all temperature control subcontract responsibilities.

F. Division 16 shall furnish and install all conduit required for power wiring to all mechanical equipment.

G. Mechanical Contractor shall provide Electrical Contractor with a complete summary list of all mechanical equipment requiring electric power within 30 days after award of contract. This list

shall summarize equipment power loads, quantities, and locations of equipment and connection points.

1.13 QUALITY ASSURANCE

A. Preparation: Base final installation of materials and equipment on actual dimensions and conditions at the project site. Field measure for materials or equipment requiring exact fit.

B. Workmanship: Perform work in a workmanlike manner. The good appearance of the finished work shall be important.

C. Supervision: Be responsible for and coordinate the work of all sub-contractors working under Division 15.

D. Installation Procedures: Confer and cooperate with other trades and coordinate the work in proper relation with theirs. Coordinate wall/ceiling cavity space carefully with other trades, prior to commencing installation of mechanical equipment.

E. Properly locate anchors, chases, recesses and openings required for the proper installation of the work. Arrange with the proper Contractors for the building of anchors, etc. and for the leaving of the required chases, recesses and openings.

F. Install equipment and materials in accordance with manufacturers; recommendations unless specifically indicated otherwise, or where local codes or regulations take precedence.

G. Protection:

1. Close ends of pipe and ductwork during construction to prevent entry of foreign material. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation (prior to owner acceptance of jobs). Protect fixtures and equipment against damage during mechanical work. Protect filters and coils from construction debris at air handling equipment, including terminal units by wrapping equipment with plastic.

2. Pay for damage, injury or loss caused by negligence or errors of Division 15 Contractors. Post effective danger signs warning against hazards created by work.

1.14 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Division 1 General and Special Requirements.

B. Protection: Make provisions for coordination with Owner and other Contractors for safe storage of materials and equipment.

1. Store materials and equipment off the ground and under cover, protected from damage.

C. Large Items: Schedule delivery of large equipment requiring special openings, as required for installation without delaying the work of other project trades.

D. Acceptance: Check and sign for materials to be furnished by Division 15 and other trades for installation under Division 15 upon delivery. Assume responsibility for the storage and safekeeping of such materials from time of delivery until final acceptance.

1.15 SCAFFOLDING, RIGGING AND HOISTING

A. This Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of all equipment and apparatus furnished. Remove same from premises when no longer required.

1.16 QUIET OPERATION AND VIBRATION

A. All work shall operate under all conditions of load without sound or vibration which is objectionable in opinion of the Owner. In case of moving machinery, sound, or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, will be considered objectionable by the Architect and Owner, and shall be corrected in an approved manner by this Contractor at his expense. Vibration control shall be by means of approved vibration isolation devices as specified in Section 15160 - Vibration Isolation.

1.17 CLEANING

A. Clean exposed surfaces of piping, hangers, ducts, and other exposed items of grease, dirt or other foreign material. At the completion of the work, remove rubbish and debris resulting from the construction operations and leave equipment and building spaces clean and ready for use.

B. Provide and install new filters to all equipment utilizing throwaway filters prior to and at completion of test and balancing of all air handling equipment. Clean all permanent filters.

1.18 TESTS AND SCHEDULE OF TESTING

A. Demonstrate the proper operation of equipment installed under this project

B. Equipment shall not be tested, or operated for any purpose until fully lubricated in accordance with manufacturer's instructions and until connections to fully operative systems have been accomplished.

C. A schedule of testing shall be drawn up by the Mechanical Contractor in such a manner that it will show areas tested, test pressure, length of test, date, time, ambient or surrounding air temperature at beginning and conclusion of test, and signature of testing personnel.

D. All testing must be performed in the presence of the General Contractor or authorized agent, and his signature for verification of the test must appear on the schedule.

1.19 PROJECT RECORD DOCUMENTS

A. One set of contract drawings shall be kept current by the Contractor during construction to indicate all deviations from the plans in the actual installation.

B. Job site Documents: Maintain at the job site, one record copy of the following:

1. Drawings
2. Specifications
3. Addenda
4. Reviewed Shop Drawings
5. Field Test Records

C. Do not use record documents for construction purposes. Maintain documents in clean legible condition, apart from documents used for construction.

D. Record Information: Label each document "Record Document". Mark information with contrasting color using ink. Keep each record current. Do not permanently conceal any work until required information is recorded.

1. Record following information on Record Drawings:

a. Horizontal and vertical location of underground utilities
b. Location of internal utilities and appurtenances concealed in construction
c. Field changes of dimension and detail
d. Changes by change order or field order
e. Details not on original contract drawings
f. Record following information on Specifications
g. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed
h. Changes by change order or field order
i. Other matters not originally specified

E. Shop Drawings: Maintain Shop Drawings as record documents recording changes made after review as specified for drawings above.

1.20 OPERATION AND MAINTENANCE DATA

A. See Section 01782 Operations & Maintenance Manuals for specific directions on preparing Manuals.

1. Completed Test, Adjust, and Balance Report.

2. Copy of original mechanical specification complete with all applicable addendums.

B. Completed and corrected Operation and Maintenance manuals shall be delivered to General Contractor prior to final payment to Mechanical Contractor.

1.21 WARRANTIES

A. In accordance with Division 1, provide a written warranty to the Owner covering the entire mechanical work to be free from defective materials, equipment and workmanship for a period of one year after Date of Acceptance. During this period provide labor and materials as required to repair or replace defects at no additional cost to the Owner. Provide certificates for such items of equipment which have warranties in excess of one year. Submit to the General Contractor.

All compressorized equipment, including but not limited to condensing units shall be provided with minimum 5 year compressor warranty.

1.22 CERTIFICATES AND KEYS

A. Certificates: Upon completion of the work, submit one copy of Certificate of Final Inspection to CDOT Representative as part of the Yellow Card Inspection Report.

B. Keys: Upon completion of work, submit two (2) keys for mechanical equipment, panels, etc. to the CDOT Representative. Clearly label key to equipment type.

1.23 SITE OBSERVATIONS

A. From time to time, the Architect, CDOT Representative and/or Engineer shall make observations of the construction progress and general quality of the construction.

B. Engineer shall not be responsible for continuous or excessively detailed site observations to verify the quality or quantity of construction work accomplished.

C. Engineer shall not be responsible for Contractor's failure to carry out construction work in accordance with the Contract documents, and/or failure to maintain sound and safe construction procedures or practices.

D. Engineer shall provide CDOT Representative with a typed list of site observation comments or "Punch List". It shall remain the responsibility of the General Contractor to see that all items incorporated within the typewritten list of comments are accomplished by the Mechanical Contractor.

E. The failure of the Engineer to identify all construction procedures conflicting with the intent of the Mechanical Construction Documents shall not relieve the Contractor of his responsibility to provide a complete, operable and efficiently installed mechanical system.

PART 2 - PRODUCTS

A. Not used

PART 3 - EXECUTION

A. Not used

END OF SECTION

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SECTION 15050
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section

B. Work Included in This Section:

1. Pipe Hangers and supports
2. Sleeves
3. Dielectric Fittings
4. Plates and Escutcheons
5. Flashings and Seals
6. Expansion Compensation
7. Motors and Starters
8. Belt Drives
9. Belt Guards
10. Valves
11. Dielectric Connections
12. Copper Water Piping Joints
13. Welding
14. Access Doors
15. Freeze Protection Systems for Piping and Equipment
16. Excavating for Mechanical Work
17. Backfilling
18. Cutting and Patching
19. Heating System Used for Temporary Heat During Construction
20. Concrete Bases
21. Drip Pans
22. Piping Installation
23. Tests
24. Identification Materials for Piping and Equipment

C. Related Sections
1. Section 08305: Access Doors
2. Division 15 Sections
3. Section 16050: Electrical Material and Methods

D. Furnish only:
1. Motor Starters: For installation by Division 16, Electrical

1.2 QUALITY ASSURANCE

A. Welder Qualifications: Welders shall be certified by the National Certified Pipe Welding Bureau (NCPWB) for the type of work being performed. Operators' certificates shall be on file at the site and shall be available for examination.

B. Superintendent: This Contractor shall furnish the services of an experienced superintendent. Said superintendent shall have successfully completed a minimum of four (4) projects of similar size and scope previous to the commencement of all work on this project. He shall be in constant charge of all skilled workman, fitters, metal workers, welders, helpers, and labor required to unload, transfer, erect, connect-up, adjust, start, operate, and test for each system specified within this mechanical specification.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards:

1. Air Movement and Control Association (AMCA)
2. Canadian Gas Association (CGA)
3. American Water Works Association (AWWA)
4. ANSI B31 Code for Pressure Piping
5. National Certified Pipe Welding Bureau (NCPWB)
6. National Electric Code (NEC)
7. National Electrical Manufacturers Association (NEMA)
8. National Fire Protection Association (NFPA)
9. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
10. Underwriters Laboratories (UL)

1.4 SUBMITTALS

A. Shop Drawings and Product Data: Submit for the following in accordance with Section 01300 and 15010.

1. Valves
2. Pipe Hangers and Supports
3. Motors
4. Starters

B. Operating Instructions and Maintenance Data: Submit for the following in accordance with section 01300 and 15010.

1. Valves
2. Motors
3. Starters

1.5 EQUIPMENT AND MATERIALS

A. Materials and apparatus required for the work is to be new, of first class quality, and is to be furnished, delivered, erected, connected, and to be so selected and arranged so as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first class standard article shall be furnished, as approved by CDOT Representative.

B. All materials shall bear the Manufacturer's name and trade name. Equipment and materials of the same general type shall, as much as is feasible, be of the same make throughout the work to provide uniform appearance, operation, and maintenance.

C. Unless otherwise specifically indicated, equipment and materials shall be installed in accordance with the recommendations of the manufacturer. This includes the performance of such operational tests as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 PIPE HANGERS, INSERTS AND SUPPORTS

A. General:

1. Study thoroughly all architectural, mechanical, and electrical drawings, shop drawings, and catalog data to determine how piping systems are to be supported, mounted, or suspended. Provide extra steel bolts, inserts, pipe stands, steel angles, brackets and accessories for proper support whether or not shown on drawings.

2. All work installed under Division 15 shall be supported plumb, rigid, and true to line.

3. Adjustable pipe hangers shall be used on suspended pipe. Hangers shall be vertically adjustable minimum (+/-) 1-1/2 inches after piping is erected.

4. Chain or perforated strap hangers will not be permitted.

5. Water Supply piping, where practical, shall be placed at the same elevation and suspended with trapeze type hangers.

6. Provide copper plated hangers and supports for copper piping or tubing.

7. Isolate hangers of dissimilar metals from coming in contact with bare piping with plastic sheet lead or other suitable dielectric material securely held between hanger and pipe.

8. Hangers and supports shall impede disengagement by movement of supported pipe.

B. Each Contractor shall be responsible for all drilling required for the installation of his hangers.

C. Concrete Inserts: Galvanized malleable iron shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods and lugs for attaching to forms or machine bolt expansion anchors. Size inserts to match size of threaded hanger rods.

D. Hanger Rods: Continuous threaded steel, sizes as specified in table below.

1. Hangers:
   a. Hot Pipes:
      1) ½ inch through 1-1/2 inch: Adjustable Wrought Steel Ring
   b. Cold Pipes:
      1) ½ inch through 1-1/2 inch: Adjustable Wrought Steel Ring

E. Hanger Sizes and Spacing: Provide hangers with maximum spacing and hanger rods with minimum sizes as follows:

Pipe Type	Pipe Size	Maximum Spacing	Minimum Hanger Rod Size
Steel Pipe	1/2" and under	6'-0"	3/8"
	3/4" through 1-1/4"	8'-0"	3/8"
	1-1/2" and 2"	10'-0"	3/8"

Copper Pipe	1-1/2" and smaller	6'-0"	3/8"
	2" and larger	8'-0"	3/8"
Plastic Pipe	1-1/2" and under	4'-0"	3/8"
	2" and above	4'-0"	1/2"
Cast Iron	2"	See Below	3/8"
	3"	See Below	1/2"
	4" and 5"	See Below	5/8"

F. Cast Iron Soil Pipe: Support within 1 foot of every hub, maximum 5 foot intervals.

G. Buried Piping: Shall be laid on firm bed free of rocks and debris for its entire length.

H. No Hub Cast Iron: Support within 1 foot of each side of couplings for piping lengths feet or longer; one hanger at each coupling for piping lengths less than 4 feet; one hanger at each fitting.

I. Insulated Piping Supports: All insulated piping shall have insulation continuous through hangers, and shall be protected at points of support with thermal hanger shields. Thermal hanger shields shall consist of a 360^{o} insert of high density, waterproofed calcium silicate, encased in a 360^{o} sheet metal shield. Insert shall be same size of adjoining pipe insulation. See table below for shield length and minimum sheet metal gauge. Calcium silicate insert shall extend minimum one inch beyond sheet metal shield. If pipe hanger spacing exceeds 10 feet, utilize double layer of sheet metal, gauge as shown below, on all bearing surfaces.

Pipe Size	Shield Length	Minimum Gauge
1/2" through 1-1/2"	4"	26
2" through 6"	6"	20

J. Vertical Piping Support:

1. Provide friction riser clamps, supported and braced.

2. Isolate supports of dissimilar metals from coming in contact with bare piping with plastic sheet or other suitable dielectric material securely held between support and pipe.

3. Provide vertical piping support with maximum spacing as follows:

Pipe Type	Pipe Size	Maximum Spacing
Steel Pipe	1-1/2" and under	8'-0"
	2" and over	10'-0"
Copper Pipe	1-1/2" and under	6'-0"
	2" and over	8'-0"

K. Cast Iron Soil Pipe: Minimum one support per story height and at its base. Where practical, support vertical riser piping independently of connected horizontal piping.

L. Plastic Pipe: Minimum one (1) support per story height and at its base. Provide intermediate pipe guides at mid-story. Compensate for expansion at minimum 30 foot intervals.

M. Floor support for pipe sizes to 4 Inches and all cold water pipe sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier or steel support. ANSI/MSS-SP-69 Type 38.

N. Acceptable Manufacturers: B-Line, Elcen, Fee and Mason, Grinnell, Michigan Inc., PHD Manufacturing, Superstrut, Unistrut.

2.2 SLEEVES

A. Sleeves shall be constructed of 24 gauge galvanized sheet steel with lock seam joints for all sleeves set in concrete floor slabs terminating flush with the floor. All other sleeves shall be constructed of galvanized steel pipe unless otherwise indicted on the drawings. "Crete Sleeve" plastic type sleeves are acceptable for concrete construction, as manufactured by Sperzel Division, Shamrock Industries.

B. Provide all cutting, patching of holes, opening, notches. Obtain written approval before notching, boring, chipping, burning, drilling, and welding to structural members.

C. This subcontractor shall provide and locate all sleeves and inserts required before the floors and walls are built, or shall be responsible for the cost of cutting and patching required for pipes where sleeves and inserts were not installed, or where incorrectly located.

D. Sleeves shall be provided for all mechanical piping passing through concrete floor slabs and concrete, masonry, tile, and gypsum wall construction.

E. Terminate sleeves flush with walls, partitions and ceiling.

F. In areas where pipes are concealed, as in chases, terminate sleeves flush with floor.

G. In all areas where pipes are exposed, extend sleeves ¼ inch above finished floor, except in rooms having floor drains, where sleeves shall be extended 1 inch above floor.

H. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials getting forced into the space between pipe and sleeve during construction.

I. Sleeve Sizing:

1. Where pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe.

2. Oversized sleeves shall be provided where pipes penetrate exterior walls below grade to prevent breakage.

3. Insulated Piping Requiring Vapor Barrier: Insulated piping which shall normally or periodically be subject to operating temperatures less than the surrounding dew point shall have sleeves which are large enough to pass both piping and the continuous insulation, and shall allow free movement of pipe and insulation.

4. Insulated Piping Not Requiring Vapor Barrier: Insulated piping which shall normally be subject to operating temperatures above the surrounding dew point shall have sleeves large enough to pass the piping only, allowing for free movement of pipe. Insulation shall be made to butt up on both sides of sleeve.

2.3 PLATES AND ESCUTCHEONS

A. Provide tight fitting cover plates on cleanout openings in walls, ceilings, and floors, chrome plated in finished areas, galvanized cast iron in unfinished areas and mechanical rooms.

B. Provide duct collars for ducts passing through walls, floors and ceilings, chrome plated in finished areas, galvanized sheet metal in unfinished areas and mechanical rooms.

C. Provide one piece type escutcheons on pipes passing through walls, floors and ceilings. Escutcheons shall be chrome plated brass or chrome plated steel, one piece type with set screw for fastening to pipes or sleeve in finished areas. Escutcheons shall be galvanized cast iron in unfinished areas and mechanical rooms. Coordinate piping with flat part of all metal wall panels whenever possible. Holes for penetrations are not to exceed 1/4 inch larger than the pipe.

1. Size: Use escutcheons that fit tight around pipes and insulation, cover openings around pipes, and cover the entire pipe sleeve projection. Where pipe sleeve projects from wall further than permissible with one piece type escutcheon, provide telescoping two piece type escutcheon of size sufficient to cover wall opening, pipe and pipe sleeve.

2. Minimum thickness:

a. Floor escutcheons: 0.094 inches (3/32 inch)

b. Wall and ceiling escutcheons:

Pipe Size	Thickness
2-1/2" and under	0.025"
3" and over	0.035"

2.4 FLASHING AND SEALS

A. Steel Flashing: 26 gauge galvanized sheet metal, to match roof contour.

B. Flexible Neoprene Pipe Flashing: One piece, cone shaped, seamless, molded, 0.060 inch thick uncured neoprene, water absorption maximum one percent (1%) by weight, tensile strength minimum 1800 psi, elasticity minimum three hundred percent (300%) with full recovery without set, match color of surrounding roofing.

C. Sleeve Seal in Exterior Wall Below Grade: Pack annular space between pipe or conduit and sleeve with oakum and lead and make completely watertight.

D. Modular Mechanical Type Waterproof Seal: Interlocking synthetic rubber links, sized to fill annulus between pipe or conduit and wall opening. Rubber links expanded to form watertight seal with zinc coated bolts.

E. Fire Barrier Sealant: Firestop type putty such as "Flameseal" manufactured by Nelson Co. shall be packed within annular space surrounding pipe or duct by Mechanical Contractors on both sides of wall or floor. UL classified as "Wall Opening Protective Device," non-toxic, non-allergenic before and after cure. Material must meet requirements of NEC (NFPA), Article 300-21. Material must seal watertight, be of sufficient viscosity to withstand direct fire hose impact, less than flame spread 25, fuel contributed 25, and ASTM E 814 shall not be exceeded. Other

acceptable manufacturers are 3M (Fire Barrier), IPC (Flamesafe) and Dow Corning (System 2000). Fire barrier sealant shall meet requirements of UL Standard 1479.

2.5 EXPANSION COMPENSATION

A. Flexible Connections:

1. 3/4 inch through 1-1/2 inch: Wire and fabric reinforced flexible duty hose rated for 150 psi at 240° F. Fittings shall be brass screw type attached by expansion or swedging method. Overall lengths shall not exceed the following: 9 inches for 3/4 inch; 10 inches for 1 inch; 13 inches for 1-1/2 inches; 15 inches for 1-1/2 inches; hoses shall be Mason Industries Type RMM.

2.6 MOTORS

1. General:

a. Furnish motors necessary to operate mechanical equipment. Verify motor characteristics shown on mechanical drawings with those shown on electric drawings before ordering equipment. Have conflicts clarified by CDOT Representative.

b. Requirements for horizontal and vertical alternating current induction motors for general purpose application shall conform to the following requirements unless otherwise noted or required for a particular application.

c. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

d. Each direct-connected motor shall be securely mounted and accurately aligned. The drive must be free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures. Belt drives and flexible coupled direct drives shall be aligned after final installation.

e. The horsepower of motors specified or indicated on the drawings are those estimated to be required, and have been used to determine the electric feeder sizes. If the actual horsepower required for all equipment to be furnished differs from that specified, or shown on the drawings, the matter must be referred to the Engineer for adjustment before installation in accordance with the requirements of Division 16.

f. Each motor shall have capacity to start and operate the machine it drives adequately for the duty to be performed without exceeding its full rated load or safe operating temperature when the driven equipment is operating at specified capacities with ambient temperatures and altitude compensation for actual job conditions or at all speeds and loads which may be obtained by the driver actually furnished.

g. Dry Areas: NEMA design B with Class B insulation for three phase motors where normal starting torque is adequate. NEMA design C motors with Class F insulation for high starting torque loads.

h. Wet Areas: NEMA 4 rated with Class F insulation for high starting torque loads.

2. Motor Characteristics:

   a. Altitude Deration: Motors to be furnished to maintain specified rated service factor at the altitude of the project.

   b. NEMA Temperature Rating: Rated for 40° C environment for continuous duty at full load.

   c. Starting Characteristics: Each motor provided with automatic control shall also be capable of making as frequent starts as the control device may demand. Motors not provided with automatic control shall be capable of making not less than 4 starts per hour.

   d. Phases and Current Characteristics: Provide energy efficient squirrel-cage induction polyphase motors for 1/2 horsepower and larger, and provide capacitor-start single-phase motors for 1/3 horsepower and smaller, except 1/6 horsepower and smaller may at equipment manufacturer's option be split-phase type, unless otherwise noted.
      1) Note: This excludes special applications of motors in 1/2 to one horsepower range where voltage limitations exist or motors which are an integral part of an assembly powered at different voltage.
      2) Coordinate current characteristics with power specified in Division 16 and with individual equipment requirements specified in other sections of Division 15, or shown on the drawings.

   e. Service Factor: Maximum 1.15 for 3-phase motors and maximum 1.35 for single-phase motors.

   f. Motor Frames: Motor frames and end bells NEMA Standard. Frames larger than 256 shall have cast iron or fabricated steel end bells and frames.

   g. Factory Furnished Motors: Motors smaller than 1/2 horsepower furnished as part of packaged equipment having a 460 volt main drive motor, shall include all necessary transformers and other accessories required to properly operate from the main power source with no other external connections required.

   h. Energy Efficiency: All motors, one horsepower or 0.75 kw and larger shall have efficiencies and power factors at full load not less than as shown in the Motor Efficiency Schedule. Efficiencies shall be determined and published in accord with NEMA MG1-12.53a and NEMA MG1-12.53b, respectively. Where local and state building codes and required or recommended energy codes exact more stringent requirements for motor efficiency and power factor, the local and state code requirements shall be adhered to.

B. Where commercially available, motors rated greater than 5 HP shall have a power factor of not less than 90 percent under rated load conditions. Where not commercially available, power factors shall be capacitor corrected by equipment manufacturer to at least 90 percent under rated load calculations. Motors shall have 1.15 service factor at altitude.

NOMINAL FULL-LOAD EFFICIENCY
EPACT 92 (NEMA STD.MG1, TABLE 12-6C)

Horsepower Rating	ODP			TEFC		
HP/RPM	1200	1800	3600	1200	1800	3600
1	80.0	82.5	X	80.0	82.5	75.5
1.5	84.0	84.0	82.5	85.5	84.0	82.5
2	85.5	84.0	84.0	86.5	84.0	84.0
3	86.5	86.5	84.0	87.5	87.5	85.5
5	87.5	87.5	85.5	87.5	87.5	87.5
7.5	88.5	88.5	87.5	89.5	89.5	88.5

C. Motor Construction:

1. Bearings and Shafts: All belt-connected motors, regardless of size, shall be equipped with shafts and bearings that will withstand both the normal belt pull of the drive furnished and the momentary or continuous overloads due to acceleration or incorrect belt tension.

2. Bearings shall be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is normally inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in the motor, provide bearings designed to resist the thrust loading.

3. Slide Base: All belt-connected motors, regardless of size, shall be mounted using appropriately sized adjustable slide bases with dual adjusting screws to facilitate alignment and motor belt tension adjustment.

4. Enclosure Type:

   a. Indoor where atmosphere is not excessively dirty and/or corrosive, and where satisfactorily housed or remotely located during operation: open dripproof.

   b. Indoor, same as above except where exposed to contact by building occupants or employees: guarded dripproof.

   c. Outdoor, or indoor when atmosphere is dirty and/or corrosive: Totally enclosed fan cooled (TEFC) or total enclosed non-ventilated (TENV). Where TEFC and TENV size, price, and efficiency is equal, TENV is preferred. Provide NEMA 4 rates motor and enclosure in wet environments (wash bay).

5. Overload Protection: Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping the motor at the starter.

6. Noise Rating: Provide "Quiet" rating on motors at full load, rated speed individually specified.

7. Name Plate: Provide metal nameplate on each motor, indicating full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

8. Motor Connections: Provide conduit connection boxes, and flexible power connections.

2.7 STARTERS

A. General: Furnish starters necessary to operate mechanical equipment for installation under Division 16.

1. Motor Starter Characteristics: Comply with NEMA standards and National Electrical Code. Furnish Type I general purpose enclosures with padlock ears, and with frames and supports for mounting on wall, floor or panel as indicated. Furnish the type and size of starter recommended by the motor manufacturer and equipment manufacturer for the applicable protection and start-up condition; refer to mechanical schedules on drawings for basis load requirements.

2. Manual Control:

a. Furnish maintained-contact push buttons and pilot lights, properly arranged for single-speed or multi-speed operation as indicated.

b. Furnish manual switch and pilot light for motors 1/3 horsepower and smaller, except where interlock or automatic operation is indicated.

3. Automatic Control:

a. Furnish magnetic starters for motors 1 horsepower and larger, and for smaller motors where interlock or automatic operation is indicated. Include the following:

1) Maximum number of auxiliary contacts available, 3 or more.

2) "Hand-Off-Automatic" switches in starter cover.

3) Interlocks and similar devices as required for coordination with the control requirements specified in Section 15900 - Temperature Controls.

4) Built-in 120 volt control circuit transformer, fused from line side, where service exceeds 240 volts.

a) Control circuit conductors to be protected in accord with Article 250-5, Exception 5, of the National Electrical Code.

5) Trip-free thermal overload relays, one for each phase.

6) Externally operated manual reset.

7) Undervoltage release or protection.

4. Weather Protection: Provide weatherproof mounting of magnetic starters for equipment installations outside of the building.

2.8 BELT DRIVES

A. Each motor driven machine (which is not direct connected) including those provided with factory-assembled equipment shall be equipped with a v-belt drive, as specified herein.

B. Belts shall be endless, of reinforced cord and rubber or synthetic rubber construction. Cords shall be of long staple cotton, rayon, dacron or other suitable textile fibers. Belts shall be of

correct cross section to fit properly in the sheave grooves. Belts for each drive shall be carefully matched by measuring on belt-matching machine (not be comparison of "code numbers," or "match numbers"). Matched sets shall be sealed together, preferably with tape, to prevent missing or partial loss of sets.

C. Sheaves shall be fixed-pitch type unless otherwise specified of cast-iron or steel, of bushing type only with bushing bored to fit properly on the shafts and secured with keys of proper size. The use of set screws alone will not be permitted. Pitch diameters of fixed-pitch sheaves shall be not less than those shown in the table below. Pitch diameters of adjustable and variable pitch sheaves, when adjusted as specified below, shall also be not less than those shown.

MINIMUM PITCH DIAMETERS
OF V-BELT SHEAVES

Standard		Fractional Horsepower	
Belt Size	Min. P.D.	Belt Size	Min. P.D.
3L	1.25	A	3.0
4L	1.8	B	5.4
5L	2.2	C	9.0
		D	13.0

D. Unless otherwise specified, each adjustable or variable pitch sheave shall be selected to provide the required r.p.m. with the sheave set within 10 percent, plus or minus, of the midpoint of its adjustment range. However, the horsepower rating of the drive shall be based on the maximum pitch diameter to which the sheave may be adjusted.

E. The horsepower rating of each belt drive shall be equal to the motor nameplate horsepower multiplied by a service factor. Unless otherwise specified, the service factor shall not be less than 2.0 in addition to the proper allowances for pitch diameter, center distance, and arc of contact.

F. For each fixed-pitch drive, the groove spacing of driving and driven sheave shall be the same. For adjustable and variable-pitch drives, all companion sheaves shall have wide groove spacing to match the driving sheaves, except that standard groove spacing may be used for all two-groove drives and for all three-groove drives having center distance equaling or exceeding the following:

A and B Belts	-20 inches
C Belts	-28 inches
D Belts	-36 inches

G. Driving and driven shafts shall be set parallel, and sheaves shall be located so that corresponding grooves will be in the same plane.

2.9 BELT GUARDS

A. Each belt shall be equipped with a guard. Guards, including those furnished as part of factory assembled equipment shall be as shown on drawings and shall be constructed of No. 12 M.S.G. 3/4 inch diamond mesh wire screen, or equivalent, welded to 1 inch steel angle frames and shall enclose (both sides) all belts and sheaves. Tops and bottoms of guards shall be of substantial sheet metal of not less than No. 12 M.S.G.. Guards shall each be provided with hinges so that the entire guard may swing or shall be sectionalized to swing 180 degrees or sufficiently to conveniently change belts, and drive. Back portion of guard shall remain in place while main portion swings out. (Back portion of guard may be omitted where projected outline

of guard falls within the limits of the casing of driven equipment and where such casing forms back portion of guard.

B. Guards shall be designed with adequate provision for movement of the motor required to adjust belt tension.

C. Guards shall be secured to the driven machines or to the foundations or floors by heavy angle supports and anchor bolts. Braces or supports secured to motors will not be permitted and braces or supports must not "bridge" the sound and vibration isolators.

2.10 VALVES

A. General:

1. Provide valves where necessary for isolation of equipment and for proper operation and maintenance. Locate valves for easy access and operation. When installed in concealed location, provide access panels to insure required maintenance accessibility to all valves.

2. All valves of a given type shall be of one manufacturer and shall be listed with the Manufacturers Standardization Society of the Valve and Fittings Industry.

3. Ball valves, butterfly valves or eccentric valves shall be used in lieu of gate valves wherever the pressure and temperature ratings are satisfactory for the intended service.

B. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.

C. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves, 6 inches and smaller, other than plug valves. Provide one wrench for every 10 plug valves. Provide chain-operated sheaves and chains for overhead valves as indicated.

1. GLOBE VALVES

a. Comply with the following standards:

1) Cast-Iron Valves: MSS SP-85
2) Bronze Valves: MSS SP-80
3) Steel Valves: ANSI B16.34

b. Acceptable Manufacturers

1) Crane Co.
2) Hammond Valve Corp.
3) Jenkins Bros.
4) Milwaukee Valve Co., Inc.
5) Nibco, Inc.
6) Powell (Wm.) Co.
7) Stockham Valves
8) Walworth Co.

2. DRAIN VALVES

a. Comply with the following standards:

1) Water Heater Drain Valves: ASSE 1005

b. Acceptable Manufacturers:

1) Conbraco
2) Hammond Valve Corp.
3) Nibco Inc.
4) Prier Brass Mfg. Co.
5) Red-White

3. PLUG VALVES

a. Acceptable Manufacturers:

1) Powell (The Wm.) Co.
2) Rockwell International; Flow Control Div. (Nordstrom)
3) Walworth Co.

4. BALL VALVES

a. Comply with the following standards:

1) Cast-Iron Valves: MSS SP-72
2) Steel Valves: ANSI B16.34
3) Bronze Valves: MSS SP-80

b. Acceptable Manufacturers:

1) Apollo
2) Hammond Valve Corp.
3) Jamesbury Corp.
4) Jenkins Bros.
5) Jomar International
6) Nibco, Inc.
7) Powell (The Wm.) Co.
8) Stockham Valves and Fittings, Inc.
9) Walworth Co.

D. VALVE FEATURES

1. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.

2. Bypass: Comply with MSS SP-45, and except as otherwise indicated, provide manufacturer's standard bypass piping and valving.

3. Drain: Comply with MSS SP-45, and provide threaded pipe plugs.

4. Flanged: Valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5. (steel), or ANSI B16.24 (bronze).

5. Threaded: Valve ends complying with ANSI B2.1.

6. Butt-Welding: Valve ends complying with ANSI B16.25.

7. Socket-Welding: Valve ends complying with ANSI B16.11.

8. Solder-Joint: Valve ends complying with ANSI B16.18.

9. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron, ANSI B16.5 (steel), or ANSI B16.24 (bronze).

10. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:

11. Tube Size 2 inch and Smaller: Soldered-joint valves.

12. Pipe Size 2 inch and Smaller: One of the following, at Installer's option:

    a. Threaded valves
    b. Grooved-end valves
    c. Butt-welding valves
    d. Socket-welding valves
    e. Flanged valves
    f. Flangeless valves
    g. Single flanged valves

13. Valve Stem: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

14. Non-Metallic Disc: Limit selection and installation of valves with non-metallic discs to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.

15. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

16. Fluid Control: Except as otherwise indicated, install ball valves to comply with ANSI B31.9. Where throttling is indicated or recognized as principal reason for valve, install globe or butterfly valves.

E. Provide the following valves for various valve types listed in Division 15 piping sections.

1. GLOBE VALVES

    a. 2 inch and Smaller: Class 125, bronze body, screw-in bonnet, integral seat, renewable disc.

	Threaded Ends	Solder Ends
Nibco:	T-235	S-235

    b. 2 inch and Smaller: Class 125, bronze angle body, screw-in bonnet, integral seat, renewable disc.

	Threaded Ends	Solder Ends
Nibco:	T-311	S-311

2. DRAIN VALVES

a. Class 125: Bronze body, screw-in bonnet, rising stem, composition disc, ¾ inch hose outlet.

	Threaded Ends	Solder Ends
Nibco:	73	72

3. PLUG VALVES

a. 2 inch and Smaller: 150 psi, bronze body, straightaway pattern, square head, threaded ends.

1) Homestead: 611

b. 2-1/2 inch and Larger: 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends.

1) Nordstrom: 143
2) Powell: 2201
3) Walworth: 1718F

4. BALL VALVES

a. 1 inch and Smaller: 150 psi, bronze body, full port, bronze trim, 2-piece construction, TFE seats and seals.

	Threaded Ends	Solder Ends
Nibco:	T-585	S-585

b. 1-1/4 inch to 2 inches: 150 psi, bronze body, full port, 3-piece body, TFE seats with bronze trim.

	Threaded Ends	Solder Ends
Apollo:	82-100	82-200
Nibco:	T-595-Y	S-959-Y
Powell:	4201-R	4201-R
Watts:	B-6800	B-6801

c. Hose End: 3/4 inch Apollo 78-100 or 78-200 (or equal). bronze body, chrome plated 2 piece construction, TFE seats & seals, 3/4 inch hose outlet with dust cap.

2.11 ACCESS TO MECHANICAL WORK

A. Access Units Fire-Resistance Ratings: Where fire-resistance rating is indicated for construction penetrated by access units, provide UL listed-and-labeled units, except for units which are smaller than minimum size requiring ratings as recognized by governing authority.

B. Provide access doors required for access to mechanical equipment, whether shown or not.

C. Access Doors

1. General: Where floors, walls and ceilings must be penetrated for access to mechanical work, furnish types of access doors indicated, including floor doors if any. Furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware. Access doors to comply with Section 08305- Access Doors.

D. Where valves, control devices, cleanouts and similar elements of mechanical work are located within or behind wall, ceiling or floor construction or finishes, or below grade, and are not (cannot be) provided with integral removable access plates as specified in other Division 15 sections, provide removable access plates of types and sizes needed for access requirements, as indicated. Provide manufacturer's complete units with anchorages, fasteners and standard factory-applied finishes.

1. Wall/Ceiling Unit Construction: Except as other wise indicated, and where adaptable to substrate, provide manufacturer's standard frameless round formed stainless steel or chrome-plated brass low profile plate cover, with single exposed flush screw anchor, with bright polished finish.

2. Painted Finish: Where substrate is indicated for painted finish, provide steel units with prime-coat paint finish.

2.12 CONCRETE BASES

A. Special inertia bases as detailed on the Mechanical Drawings shall be provided by Division 15 Mechanical with concrete work complying with provisions of Division 03 Concrete.

B. Provide minimum 4 inch concrete pad (base) under base mounted pumps, boilers, water heaters, air handling units, floor mounted expansion tanks, glycol tanks and other floor mounted equipment.

C. Establish the size and location of the various concrete bases required.

1. Water heaters, air compressors and other floor mounted equipment shall have a concrete base at least 4 inches high which shall project 4 inches on all sides beyond the associated equipment.

D. Furnish necessary anchor bolts and templates to Division 03 for locating and casting into concrete bases.

2.13 DRIP PANS

A. Provide aluminum sheet metal drip pans with 3/4 inch drain lines below all piping crossing over all electric equipment or control devices. 3/4 inch drain lines should be run to indirect waste at nearest floor drain or plumbing receptacle.

2.14 IDENTIFICATION MATERIALS FOR PIPING AND EQUIPMENT

A. Materials for identification shall be as follows:

1. Metal Tags: Round brass discs, minimum 1-1/2 inch diameter with edges ground smooth. Each tag shall be punched and provided with brass chains for installation.

2. Engraved Nameplates: Fabricate from plastic sheet stock of sufficient thickness to allow engraved lettering in contrasting color.

3. Painted Stencils: Of size and color per ANSI A13.1 using clean cut letters and oil base paint. Paint materials shall be standard exterior type stenciling enamel, brush on or spray can form.

4. Aluminum Tape: 1/2 inch wide aluminum tape, such as DYMO, banded in place around pipe. Imprint only one side of tab.

   a. Acceptable Manufacturers:

      1) Allen Systems, Inc.
      2) Brady (W.H.) Co., Signmark Div.
      3) Industrial Safety Supply Co., Inc.
      4) Seton Name Plate Corp.

PART 3 - EXECUTION

3.1 INSTALLATION OF VALVES

A. General: Except as otherwise indicated, comply with the following requirements:

1. Install valves where required for proper operating of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

3. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

4. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

C. Mechanical Actuators: Install mechanical actuators with chain operators where indicated. Extend chains to about 5 feet above floor and hook to clips to clear aisle passage.

D. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

E. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

F. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

G. Examine threads on valve and mating pipe for form and cleanliness.

H. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

I. Do not attempt to repair defective valves; replace with new valves.

3.2 FREEZE PROTECTION

A. Do not run lines in outside walls, ventilated attic or ceiling spaces, or locations where freezing may occur. Piping next to outside walls shall be in furred spaces with insulation between the piping and the outside wall. In attic or ceiling spaces, piping shall be on the warm side of insulation batts. Insulation of piping shall not be considered freeze protection.

3.3 DIELECTRIC CONNECTIONS

A. Wherever steel and copper pipe are joined in the plumbing or fire protection systems, provide dielectric insulating type unions or flanges as manufactured by Epco Sales Co., or approved equal.

3.4 COPPER WATER PIPING JOINTS

A. Cut pipe square, remove burrs, and ream. Clean with medium grit emery cloth, flux pipe, fitting with nokorode paste. Use only 95% tin - 5% silver solder.

3.5 WELDING

A. Use only ASME certified experienced welders with current certificate. Joints between sections of pipe, and between pipe and fittings, shall be fusion welded. Strength of finished welded joints equal to strength of pipe. Width of finished weld shall be at least 2-1/2 times the thickness of the part jointed. Thickness of weld at least 25% greater than the thickness of pipe or fittings. All finished welded joints shall present a neat and workmanlike appearance.

B. Make no direct welded connections to valves, strainers, apparatus, or related equipment. Make connections to flanged valves or flanged connections with welded flanges.

C. Radii of weld ells shall be 1-1/2 times nominal diameter of fittings. Fittings used for all branch connections, whether full size or reducing shall be with interior surfaces smoothly contoured. Wall thickness of welding fittings shall be equal to adjacent piping.

D. Joints between sections of pipe and between pipe fittings, to be fusion welded. Strength of finished weld joints equal to strength of pipe. Width of finished weld at least 2-1/2 times the thickness of the part jointed. Thickness of weld at least 25 percent greater than the thickness of pipe or fittings. Finished welded joints to present neat and workmanlike appearance.

3.6 EXCAVATING FOR MECHANICAL WORK

A. General: Do not excavate for mechanical work until work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum.

B. Piping run parallel to foundation wall shall be run above 45^{o} plane downward from lowest exterior point of building foundation.

C. Excavation for Trenches: Dig trenches to uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6 inches to 9 inches of clearance on both sides of piping.

1. Excavate trenches to depth required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.

2. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with 6 inch layer of crushed stone or gravel prior to installation of pipe.

3. For piping 5 inches or less in nominal size, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support piping on undisturbed soil.

4. For piping 6 inches and larger in nominal size, tanks, and other mechanical work indicated to receive sub-base, excavate to sub-base depth indicated, or if not otherwise indicated, to 6 inches below bottom of work to be supported.

5. Grade bottoms of trenches as indicated, notching under piping couplings to provide solid bearing for entire body of piping.

D. Shape sub-bases and bottoms of excavations with recesses to receive pipe bells, flanged connections, valves and similar enlargements in piping systems.

E. Concrete Encasement: Where piping under roadways is less than 2 foot-6 inches below surface of roadway, provide 4 inch base slab of concrete to support piping. After piping is installed and tested, provide 4 inch thick encasement (sides and top) of concrete before backfilling. Provide Class 2500 concrete for encasement and slab.

3.7 BACKFILLING

A. Do not backfill until installed mechanical work has been tested and accepted, wherever testing is indicated.

3.8 CUTTING AND PATCHING

A. Openings in New Construction:

1. The Division 15 contractor shall verify all openings required in the new construction in connection with the work under Division 15 with the Architectural and Structural Drawings and shall then meet with and verify same with the General Contractor who will assign the work to the appropriate contractor to provide all openings in the new construction of the correct size and location in walls, floors or through roofs required for the installation of the mechanical work.

B. Cutting in New Construction:

1. Failure on the part of the Division 15 Contractor to make the above arrangements for required openings shall cause the cost of cutting and patching for the necessary openings or the installation of his work to be borne by him, either by having the cutting

done by the appropriate contractor as assigned by the General Contractor or in the form of performing the required cutting himself. In either case, all patching shall be done by the appropriate finishing contractor as determined by the General Contractor; no cutting or drilling of holes shall be done without approval of the engineer.

C. Patching in New Construction:

1. The appropriate finishing contractor as determined by the General Contractor shall patch all openings in the new structure. All openings made in fire-rated walls, floors, or ceilings, shall be patched and made tight to conform to the fire rating for the enclosure. All materials used in patching shall match the materials specified in the Architectural Specifications and all patched areas shall be restored to the specified finish surface to the satisfaction of the engineer.

D. The Division 15 Contractor shall pay the appropriate Finishing Contractor as determined by the General Contractor for all patching resulting from cutting to accommodate mechanical work.

3.9 HEATING SYSTEM USED FOR TEMPORARY HEAT DURING CONSTRUCTION

A. Permanent heating system shall not be used.

B. If for any reason the heating system has been placed into operation, it shall not be shut down except for moderate weather, and all heated areas shall be maintained at a minimum temperature of 50^{o}F 24 hours a day. Building must be totally enclosed (No temporary barriers).

C. When air-handling equipment is used for temporary heat, the filters shall be installed and maintained. Before building acceptance by Owner, these units shall be thoroughly cleaned (including coils, heat exchangers and duct systems) and new or cleaned filters shall be installed. This is over and above the set of filters to be provided the Owner as called for in the specifications. Coils shall be cleaned if necessary, as determined by the Structural Engineer.

D. All systems being used for temporary heat shall become the Contractor's responsibility to maintain, and be put into first class working order before acceptance by the Owner.

E. All guarantees that start with the use of equipment for temporary heat shall be personally extended by the contracting firm holding the prime contract for construction, so that the Owner will have his one-year guarantee from date of acceptance.

3.10 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Materials and methods shall be per applicable portions of ASM, ASTM, ASA, AWS, and applicable Plumbing Code.

C. Provide proper grades, slopes, elevations with readily accessible drainage connections at low points so entire systems may be completely drained. Allow for expansion and contraction to avoid distortion, damage, improper operation. Make certain piping above and below grade is not inadvertently anchored; if questionable, obtain clarification.

D. Arrange, install piping approximately as indicated. Install straight, plumb, and as direct as possible. Form right angles or parallel lines with building walls. Keep pipes as close to walls,

partitions, ceilings as possible. All piping to be concealed in building construction unless noted or shown otherwise. Keep fixture branches concealed except for final connection.

E. Interference with Other Trades: Before installing piping, check mechanical drawings with all other drawings and arrive at mutual agreement with other trades where interferences may occur. Obtain approval of proposed changes.

F. Protect Open Piping: Keep piping free from scale and dirt. Protect open pipe ends whenever work is suspended during construction.

G. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

H. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

K. Install piping to permit valve servicing.

L. Install piping at indicated slopes.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install piping to allow application of insulation.

P. Select system components with pressure rating equal to or greater than system operating pressure.

Q. Verify final equipment locations for roughing-in.

3.11 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 inches and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.12 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.13 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.

1. Construct concrete bases of dimensions indicated, but not less than 6 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

6. Use 4000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Sections.

3.14 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.15 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion

joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

C. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

D. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," are not exceeded.

I. All Insulated Piping: Comply with the following:

1. Install MSS SP-58, Type 40 protective shields on cold and hot piping with vapor barrier. Shields shall span arc of 180 degrees.

2. Apply insulation continuously through hangers.

a. Piping 1-1/2 inches and below and operating below Ambient Air Temperature: Apply insulation continuously through hangers. Protect insulated horizontal pipe at point of support with 180 degree, 12 inch long sheet metal thermal-hanger shield. No hanger shall penetrate or crush insulating material.

b. Piping 1-1/2 inches and below and operating above Ambient Air Temperature: Apply insulation continuously through hangers. Protect insulated horizontal pipe at point of support with 180 degree, 12 inch long sheet metal thermal-hanger shield. No hanger shall penetrate or crush insulating material.

1) At contractor’s option: Wrap pipe and hanger. Hangers sized for piping. Clamp may project through insulation.

c. Do not exceed pipe stress limits according to ASME B31.9.

3. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

3.16 TESTS

A. General: Provide test pump, gauge, meters, other instruments, materials, labor, in connection with tests.

B. Pressure Tests: Before testing piping systems, remove or otherwise protect from damage, control devices, air vents, and other parts, which are not designed to stand pressures used in testing piping.

3.17 PIPE IDENTIFICATION

A. General Installation Requirements

1. All piping identification system shall be in full compliance with ASTM Standards.

2. All piping is to be identified with initials and flow arrows. Labels are to be stenciled; stick-on labels are not acceptable.

B. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

C. Piping System Identification

1. Aluminum Tape: Shall be utilized on piping systems ½ inch diameter and less. Imprinting shall be applied to one side of tape only, with lettering 3/16 inch high.

2. Painted Stencils: Stenciled marking shall be neatly performed with no overspray, drips, or other imperfections. Pipes and equipment to be stenciled shall first be wiped clean of dirt, dust, rust, grease and moisture. Comply with Painting Specifications Section 09900.

D. Size of Legend and Letters for Stencils:

Insulation or Pipe Diameter	Length of Color Field	Size of Letters
3/4" to 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
Equipment	NA	2-1/2"

E. All pipe identification systems shall be visible from a normal observation position.

F. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations as follows:.

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and non-accessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.
8. Provide a directional flow arrow adjacent to all pipe identification.

G. Legend:

Type	Medium	Symbol	Field Color	Letter Color
Gas	Natural Gas	NG	Yellow	Black
Waste	Sanitary Sewer	SAN	Green	White
Waste	Sanitary Vent	V	Green	White
Water	Domestic Cold Water	DCW	Green	White
Water	Domestic Hot Water	DHW	Yellow	Black
Water	Heating Water Supply with Glycol (Util. & Air Cond.)	HWS/G	Yellow	Black
Refrigerant	Refrigerant Liquid	RL	Blue	White
Refrigerant	Refrigerant Suction	RS	Blue	White
Air	Compressed Air	CA	Blue	Blue

H. Valve Identification

1. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

I. Equipment Identification

1. Provide equipment identification for each piece of motor driven mechanical equipment. Identification shall indicate equipment tag and area served.

3.18 MOTOR INSTALLATION

A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.

B. ADJUSTING

1. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

C. CLEANING

1. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

2. Clean motors, on completion of installation, according to manufacturer's written instructions.

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SECTION 15060
PIPE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Related Sections:
1. Section 15010: General Mechanical Requirements
2. Section 15050: Basic Mechanical Materials and Methods
3. Section 15400: Plumbing

1.2 GENERAL

A. Pipe Workmanship: Piping shown on drawings shall be installed complete, and shall be of the size shown on the drawings.

B. When a size is not indicated, the subcontractor shall request the pipe size from the Engineer or CDOT Representative through the General Contractor. All piping shall be installed parallel or perpendicular to the building construction. All piping shall be installed so as to allow for expansion.

C. Piping Joints: All pipe shall be reamed to full pipe diameter before joining. Soldered joints shall be made with 95%-5% tin-silver solder metal per ASTM B32-89, alloy Grade 95TS, Canfield 100% Watersafe (or approved equal). Screwed joints shall be made with standard pipe thread, and an approved compound applied to the male thread only. Welded joints shall be made in accord with the procedure outlined in the U.S.A. Piping Code, and each welder shall be certified by the National Certified Pipe Welding Bureau, or by other reputable testing laboratory or agency. Subcontractor shall use only "Threadolet" or "Weldolet" fittings for intersection welding of branches to mains. Valves and specialties shall have screwed or flanged joints.

D. Piping Supports: All pipe shall be supported from building structure in a neat and workmanlike manner. Wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze type hangers. Vertical risers shall be supported at each floor line with steel pipe clamps. The use of wire or perforated metal to support pipes will not be permitted.

1.3 SUBMITTALS

A. Shop Drawings and Product Data: Submit for the following in accordance with Section 01300 and 15010.

1. Cast Iron Pipe
2. No Hub Couplings
3. Copper Pipe
4. Solder
5. Steel Pipe
6. PEX Pipe
7. PVC

8. CPVC

PART 2 - PRODUCTS

2.1 STRAINERS

A. Strainers in steel piping systems, 2 inches and smaller shall be McAlear style SG, semi-steel body, screwed, Y-pattern ASTM A126-84, Class B, with a 20 mesh screen.

B. Strainers in copper piping systems 2 inches and smaller shall be McAlear No. 539S, cast bronze base stainless steel screen.

2.2 BALANCE COCKS

A. All balance cocks to be eccentric type, suitable for 250 degF continuous service and dead shut-off, DeZurik Fig. 425 with adjustable balance stop, or equal by A.C.F. Industries, Bell & Gossett, or Illinois Valve Co.

2.3 UNIONS

A. (Screwed Piping) Malleable iron, ground joint, brass to iron seat, Grinnell Fig. 463 or Grabler.

B. (Copper Tubing) Brass with soldered joints.

2.4 PIPE AND FITTINGS

A. Shall be of material, weight, ASTM and ANSI Designation, and pressure ratings as follows unless specifically excepted otherwise. All pipe shall be new, clean and free of all rust.

2.5 SANITARY WASTE AND VENT UNDERGROUND INSIDE BUILDING

A. Include 10 foot – 0 inch plus or minus outside building wall.

B. Pipe: Service weight cast iron soil pipe, Class B ASTM A74-87.

C. Fittings: Cast iron soil pipe fittings shall correspond to pipe in material, class and ASTM Designation.

D. Joints: Elastomeric cast iron soil pipe joints conforming to ASTM C 564-88.

2.6 SANITARY SOIL, WASTE AND VENT, ABOVE GROUND INSIDE BUILDING

A. Pipe: ASA Group 022 Type SV no hub cast iron pipe conforming to CISPI Standard 301, latest edition, or standard weight galvanized steel pipe per ASTM A53-90b.

B. Fittings: Cast iron no hub fittings shall be ASA Group 022 conforming to CISPI Standard 301, latest edition. Galvanized pipe fittings shall be tar coated iron recessed drainage type, ANSI B 16.12-91.

C. Joints: Hubless type using fittings, gaskets, clamp assembly complying with CISPI Standard 301, latest edition.

D. Galvanized steel pipe shall have screwed type joints using ribbon type joint compound.

2.7 DOMESTIC WATER SERVICE OUTSIDE OF BUILDING

A. 3 inch and larger shall be Class 250, cement lined, cast iron mechanical joint or American "Fastite" or equal joint.

B. 2-1/2 inch and smaller shall be Type "K" soft drawn copper, all joints to be silver soldered.

2.8 DOMESTIC HOT AND COLD WATER UNDERGROUND INSIDE BUILDING

A. Include 5 feet -0 inch plus or minus outside of building wall.

B. 2-1/2 inch and Under:

1. Pipe: Copper water tube, heavy wall thickness, annealed temper; ASTM B 88-92, Type K

2. No fittings or joints allowed underground, below floor slabs.

2.9 DOMESTIC COLD WATER AND HOT WATER ABOVE GROUND INSIDE BUILDING

A. 2-1/2 inch and Under:

1. Pipe: Type L, seamless copper tubing ASTM B88-92 (hard drawn for all horizontal and all vertical lines) or Code approved PEX piping

2. Fittings: Wrought copper or bronze solder joint pressure type fittings per ANSI B16.22-1989

3. Joints: 95%-5% tin-silver solder metal per ASTM B32-89, alloy Grade 95TS, Canfield 100% Watersafe (or approved equal).

2.10 PEX TUBE AND FITTINGS

A. PEX Distribution System: ASTM F 877, SDR 9 tubing.

1. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.

2. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.

2.11 PEX-AL-PEX TUBE AND FITTINGS

A. PEX-AL-PEX Distribution System: ASTM F 1281 tubing.

1. Fittings for PEX-AL-PEX Tube: ASTM F 1281, metal-insert type with copper or stainless-steel crimp rings and matching PEX-AL-PEX tube dimensions.

2.12 PEX-AL-HDPE TUBE AND FITTINGS

A. PEX-AL-HPDE Distribution System: ASTM F 1986 tubing.

B. Fittings for PEX-AL-HDPE Tube: ASTM F 1986, metal-insert type with copper or stainless-steel crimp ring and matching PEX-AL-HDPE tube dimensions

2.13 NATURAL GAS PIPING

A. Above ground, inside or outside in building:

1. Pipe: Schedule 80 for pipe sizes 1/2 inch and under; Schedule 40 for pipe sizes over 1/2 inch, black welded or seamless steel pipe per ASTM A53-90b.

2. Fittings:

a. 1/2 inch and Under: 300 pound malleable iron flat banded pattern screwed fittings per ANSI B16.3-85.

b. Over 1/2 inch to 1-1/2 inches: Same as above except 150 pound class, screwed or welding fittings per joints below.

c. Over 1-1/2 inches: Schedule 40, seamless carbon steel welding fittings, long radius, 150 pound class, dimensions per ANSI B16.9-1986; ASTM A234, Grade WPB.

3. Joints:

a. 2 inches and Under: Threaded using joint compound resistant to gas- air mixture, such as "gasolia".

b. 2-1/2 inches to 4 inches: Butt-welded.

END OF SECTION

SECTION 15160
VIBRATION ISOLATION

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on drawings and/or herein specified, including all labor, materials, equipment, and incidentals necessary and required for their completion.

1.2 SUBMITTALS

A. Shop Drawings and Product Data: Submit for the following in accordance with Sections 01300 and 15010.

1. SPECIFICATION D

PART 2 - PRODUCTS

2.1 GENERAL

A. Approved Manufacturers: Amber-Booth Inc., Mason Industries, Inc., Peabody Noise Control, Inc., Vibration Mounting & Controls, Inc. or approved equals.

B. The following specification numbers of Mason Industries, Inc. are used to set the quality of isolators required.

2.2 SPECIFICATION D

A. Vibration hangers shall contain a steel spring and 0.3 inch deflection neoprene element in series.

B. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box.

C. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring.

D. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.

E. Submittals shall include a scale drawing of the hanger showing the 30 degree capability.

F. Hangers shall be Type 30N.

PART 3 - EXECUTION

3.1 INSTALLATION OF VIBRATION ISOLATION DEVICES

A. Install Vibration Isolation Devices in full compliance with manufacturer's recommendations. Clarify all questions or conflicts with Engineer prior to starting work. Do not proceed until written response is received from the Engineer/Architect.

B. INSTALLATION SCHEDULE

1. The following equipment shall receive vibration isolation treatment:

Item	Specification
EXHAUST FANS	D

END OF SECTION

SECTION 15180
PIPE INSULATION

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section

B. Provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on drawings and/or herein specified, including all labor, materials, equipment, and incidentals necessary and required for their completion.

C. Related Sections:
1. Section 07210: Building Insulation
2.
3. Section 15060: Pipe and Accessories

1.2 SUBMITTALS

A. Shop Drawings and Product Data: Submit for the following in accordance with Section 15010.

1. Domestic Water Pipe Insulation

2. Underground Pipe Insulation

3. Above ground exterior pipe Insulation
   a. UV protective jacketing

1.3 FIRE HAZARD RATINGS

A. All insulation shall have composite (insulation, jacket and adhesive used to adhere the jacket to the insulation) fire and smoke hazard ratings as tested under procedure ASTM E 84, NFPA 255 and UL 723, not exceeding:

1. Flame Spread: 25

2. Smoke Development: 50

PART 2 - PRODUCTS

2.1 GENERAL

A. It is the contractor's and manufacturer's responsibility to assure themselves that the code authority will approve any product to be installed on the project

B. Approved Manufacturers:

1. Armstrong World Industries, Inc.
2. Certainteed Corp.
3. Knauf Fiber Glass
4. Owens Corning Fiberglass Corp.
5. Pittsburgh Corning Corp.
6. Johns Manville Corporation (Schuller International)

2.2 DOMESTIC HOT & COLD WATER PIPING

A. Insulate domestic hot and cold water piping with U.L. approved, flame resistant, white vapor barrier jacketed, glass fiber snap-on insulation. Insulate valves and fittings with glass fiber blanket insulation and pre-molded PVC covers (covers to be U.L. 25/50 rated). It is the contractor's and manufacturer's responsibility to assure themselves that the code authority will approve any product to be installed on the project. Maximum k-value shall be 0.24 BTU-IN/HR-SQ FT/Degrees.

B. Thickness of piping and pipe fitting insulation shall be per the Table in Section 3.2.

2.3 UNDERGROUND OR EXTERIOR PIPING

A. FoamGlas by Pittsburgh Corning or approved equal that is approved by the manufacturer for underground and outdoor use. Sized per manufacturer's recommendations for pipe size indicated in drawings and specifications.

B. Provide PittWrap Jacketing or approved equal for underground piping.

C. Provide .016 inch Aluminum Jacketing with hard plastic UV protection for all above ground exterior piping.

PART 3 - EXECUTION

3.1 APPLICATION

A. Pipe insulation shall be applied over clean, dry surfaces, with the pipe at approximately room temperature. Adjoining sections of insulation shall be butted firmly together, and the longitudinal seam of the jacket sealed with a flame retardant vapor barrier lap cement. Longitudinal seam shall be located on the bottom half of the pipe. End joints and perforation shall be sealed with factory furnished 4 inch vapor barrier strips applied with same vapor barrier adhesive. Ends of pipe insulation shall be sealed off with vapor seal adhesive at all fittings, flanges and valves and at intervals not exceeding 21 feet.

B. Where exposed insulated piping pierces walls, floors or ceilings, provide a minimum of 2 inch wide stainless steel bands fitted snugly to the finished surface and held in place on the insulation with sheet metal screws. Screws to be installed so as not to be visible when viewing the pipe from a normal position.

C. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

D. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

F. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

G. Keep insulation materials dry during application and finishing.

H. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

I. Apply insulation with the least number of joints practical.

J. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

K. Hangers and Anchors: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for insulation requirements at Pipe Hanger and Supports.

    a. Seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

    b. Piping 1-1/2 inches and smaller and operating below Ambient Air Temperature: Apply insulation continuously through hangers. Protect insulated horizontal pipe at point of support with 180 degree, 12 inch long sheet metal thermal-hanger shield. No hanger shall penetrate or crush insulating material.

    c. Piping 1-1/2 inches and smaller and operating above Ambient Air Temperature: Apply insulation continuously through hangers. Protect insulated horizontal pipe at point of support with 180 degree, 12 inch long sheet metal thermal-hanger shield. No hanger shall penetrate or crush insulating material.

        1) At contractor’s option: Wrap pipe and hanger. Hangers sized for piping. Clamp may project through insulation.

    d. For insulation application, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Insulation Terminations: Taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

M. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

N. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

    a. Seal penetrations with vapor-retarder mastic.

    b. Apply insulation for exterior applications tightly joined to interior insulation ends.

c. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.

d. Seal metal jacket to roof flashing with vapor-retarder mastic.

O. Exterior Wall Penetrations: For penetrations of walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic. At above grade walls, provide metal escutcheon at penetration sized to completely cover mastic and sealant.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

Q. Firestopping and fire-resistive joint sealers if applicable are specified in Division 7 Section "Firestopping."

R. Floor Penetrations: Apply insulation continuously through floor assembly.

S. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.2 PIPING AND PIPE FITTING INSULATION THICKNESS

A. Service Water Piping

		Insulation Thickness for Pipe Sizes[1]		
Service Water	Non-circulating	Circulating Mains and Runouts		
Temperatures	Runouts Up to 1 1/2 in.	Up to 1-1/4 in.	1-1/2 to 2 in.	Over 2 in.
(°F)	(In.)	(In.)	(In.)	(In.)
140-160	0.5	1.5	2.0	2.0
100-130	0.5	1.0	1.0	1.5
Below 100°	0.5	.5	1.0	1.0
Sanitary Waste Piping Exposed to outdoor temps	1.5	1.5	1.5	2.0
Refrigerant Suction and Gas Lines	1.0	1.5	1.5	1.5

[1]Nominal copper pipe and insulation thickness.

END OF SECTION

SECTION 15400
PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on drawings and/or herein specified, including all labor, materials, equipment, and incidentals necessary and required for their completion.

C. Related Sections:
1. Section 15010: General Mechanical Requirements
2. Section 07920: Joint Sealants
3. Section 15450: Plumbing Fixtures and Trim

1.2 SUBMITTALS

A. Shop Drawings and Product Data: Submit for the following in accordance with Division 1 and Section 15010.

1. Plumbing Fixtures (Refer to 15450)
2. Water Heater and Accessories
3. Drinking Fountain (EWC)

B. Operating Instructions and Maintenance Data: Submit for the following in accordance with Division 1 and Section 15010.

1. Plumbing Fixtures
2. Water Heater
3. Drinking Fountain (EWC)

C. Refer to project-specific Submittal Log provided at Pre-Bid Meeting.

D. Extend water service line into building. Piping shall have adequate anchoring at all vertical and horizontal bends. Provide concrete thrust blocks as required.

E. Provide sleeve for water service entry through foundation wall, make entry watertight.

F. Water service shall be a minimum of 5 feet 0 inches below grade.

G. Immediately install water service, provide temporary (frost proof) outlet with hose valve outside building for construction purposes.

H. Building Piping: Provide a complete piping system in building from valve on service to all fixtures and equipment outlets requiring a cold and/or hot water supply. All branch mains and connections to risers shall be valved and drip cocks provided so that entire system may be drained. Provide swing or swivel joints on connections from mains to risers, from risers to branches, with loops, bends, expansion joints, guides, anchors, as required to prevent noise or

shock. Provide fixture stops at all hose bibbs, wall hydrants, etc. so that entire system does not need to be shut off when replacing washers.

I. Damage by Leaks: Plumbing Contractor shall be responsible for damages to the grounds, walks, roads, buildings, piping systems, electrical systems or their equipment and contents caused by leaks in the piping systems being installed or having been installed under this contract. He shall repair at his expense all damage so caused as directed by the Architect. The Owner reserves the right to make emergency repairs as required without voiding the Contractor's guarantee bond, nor relieving the Contractor of his responsibilities during the bonding period.

1.3 SANITARY DRAINAGE SYSTEM

A. Provide a complete sanitary system, including all fixtures, traps, vents, waste piping, manholes, rough-ins, and connections as shown or specified.

1.4 GAS PIPING SYSTEM

A. Provide dielectric fittings and lubricated plug valve on house side of meter.

B. Provide all gas piping from gas meter to all gas outlets and equipment requiring gas connection. Make all connections to such outlets and equipment and provide a full main size plug valve for each. Gas pipe sizes 2 inch and smaller may be welded or threaded; 2-1/2 inch and larger to be all welded. All gas piping from underground shall be welded.

PART 2 - PRODUCTS

2.1 GAS VALVES

A. Valves, NPS 2 inch and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 inch and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

C. Gas Valves, NPS 2 inch and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

D. Gas Stops (at appliance only): Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

E. Plug Valves, NPS 2-1/2 inch and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

2.2 WATER PRESSURE REDUCING VALVE

A. Furnish and install a one or two stage pressure reducing station as required on cold water supply main in the event that water is supplied from water company source at a pressure in excess of 75 psi. Reducing station to be located at service entry where shown or directed. Basic requirements are as follows:

B. Reducing Valve: Conbraco, Fisher Co., Mueller Co., single seated regulation valve having a full line size capacity to reduce from main pressure to 45 psig, pressure drop across valve not to exceed 10 psi when valve is wide open.

C. Provide a strainer and a three valve by-pass with a ball valve in the by-pass line and a Josam No. 75000 shock absorber on the low pressure side.

D. Install pressure gauge with cocks on both high and low pressure sides of the regulator.

2.3 REDUCED PRESSURE BACKFLOW PREVENTER

A. Approved Manufacturers: Conbraco, Febco, Watts, Wilkins.

B. Provide full line size reduced pressure backflow preventer as shown on plans and detail.

C. Backflow preventer shall consist of two independently operating, spring loaded "Y" pattern check valves and one hydraulically dependent differential relief valve. The device shall automatically maintain a 5 psi pressure difference in the "zone" between the check valves. Valve body and caps shall be bronze. Check valve and relief valve components shall be constructed so they may be serviced without moving the valve body from the line. Shutoff valves and test cocks shall be rated to a minimum 175 psi water working pressure and water temperature range from 32^{o}F to 180^{o}F. The device shall meet the requirements of ASSE Standard 1013; AWWA Standard Code C506-78; and VSC foundation for cross connection control and Hydraulic Research, Sixth Edition.

2.4 HYDRANTS AND SHOCK ABSORBERS

A. Approved Manufacturers: Josam, J.R. Smith, Woodford Co., Zurn.

1. Shock Absorbers: Zurn Shoktrol Series Z-1700 stainless steel shell, stainless steel bellows pressurized pneumatic cushion. Install where required to prevent shock or water hammer in the piping systems.

2.5 THERMOMETERS

A. Approved manufacturers are Marsh, Moeller, Taylor, Trerice, U.S. Gage, and Weiss. Mercury industrial type 7 inch scale, 30^{o}F to 200^{o}F red reading, inclined form brass case, separable socket. Mount where easily readable from the floor.

2.6 PRESSURE GAUGES

A. Approved manufacturers are Ashcroft, March, Lonergan, Taylor, Trerice, U.S. Gage and Weiss. 4-1/2 inch size, cast aluminum case, phosphor bronze bourdon tube, monel rotary movement, nylon gears, silver soldered joints with gauge cock and impulse dampener. Average operating pressure shall fall approximately in the middle of the scale selected.

2.7 PRESSURE AND TEMPERATURE GAUGE TEST PLUGS

A. Approved manufacturer is Peterson Equipment Co., Peterson plug #710. Test plug and cap to be provided where thermometers and pressure gauges are shown on Drawings. Provide two pressure gauge adapters and two testing thermometers, ½ inch NPT, Nordel or EPDM core. Approved equals: Sisco BNO-500, Hydro-Temp, MGP/T, deliver to Owner's representative.

2.8 TEMPERATURE-PRESSURE RELIEF VALVES

A. Approved manufacturers are McDonnel, Miller and Watts. Self-closing, all bronze, set at 100 psi, 210^{o}F ASME approved. Provide copper drain pipe, full size of outlet, extend to floor drain.

2.9 DRAINAGE SPECIALTIES

A. Approved Manufacturers: Josam, J.R. Smith, Zurn and ACO or CDOT-approved-equals. See Architectural and Mechanical Plans for Locations.

1. 4-inch Floor Drains Zurn Z415 Body Assembly with “Type B” Strainer

2.10 CLEANOUTS

A. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

B. Floor Cleanouts: Cast-iron body and frame; cleanout plug; adjustable round top as follows:

1. Nickel-Bronze Top: Manufacturers standard cast unit of the pattern indicated:

a. Pattern: Exposed rim type, with recess to receive 1/8 inch thick resilient floor finish.
b. Pattern: Exposed rim type, with recess to receive 1 inch thick terrazzo floor finish.
c. Pattern: Exposed finish type, standard mill finish.
d. Pattern: Exposed flush type, standard non-slip scored or abrasive finish.

C. Grade Cleanouts: Cast-iron body and frame; cleanout plug; adjustable round top as follows:

1. Cast-iron Top: Manufacturers standard cast unit of the pattern indicated:

a. Pattern: Exposed flush type, standard mill finish.
b. Pattern: Exposed flush type, standard non-slip scored or abrasive finish

D. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.

2.11 VENTS THROUGH ROOF

A. Provide all vents with vandal-proof caps, cast iron, with vandal-proof hood and set screws, Josam Series 26700 or equal by Stoneman Co.

2.12 DOMESTIC WATER HEATERS (ELECTRIC)

A. Approved Manufacturers: A.O. Smith, Bradford White, Lochinvar, Rheem, Ruud and Inc, and State.

B. Heaters to be electric tank type with three year Limited parts warranty, built-in electronic blower, digital display showing temperature settings and maintenance codes, vents horizontally or vertically. Provide 20 gallon capacity, 150 psi working pressure, ASME rated temperature and pressure relief valve with full size drain piped to floor. Provide with hot water recirculation pump, piping and valves. Refer to schedules on plans for model and capacity.

C. Provide full size ball valve in cold and hot water inlet line to heater.

D. Provide dielectric unions at heater inlet connections.

2.13 FIXTURES

A. Approved Manufacturers: See Section 15450, 2.1 (Plumbing Fixtures and Trim).

B. Fixtures shall be delivered to the job and the CDOT Representative notified in sufficient time so that inspection before installation may be made without delaying the progress of the work. The Contractor is fully responsible for protection of fixtures before and after inspection until final acceptance of the entire building by the Owner. All damaged fixtures shall be immediately replaced by this Contractor regardless of who caused the damage. All exposed brass pipe shall be chrome plated.

C. Fixture List: Refer to fixture list on drawings.

PART 3 - EXECUTION

3.1 SIZE OF FIXTURE CONNECTIONS

A. Branch connections to fixtures shall be as follows, unless shown otherwise:

Water closets, tank type	1/2 inch	CW
Sinks, service sinks	1/2 inch	H & CW
Lavatories	1/2 inch	H & CW
Urinals	1/2 inch	CW
Drinking fountains & electric water coolers	1/2 inch	CW
Sinks	1/2 inch	H & CW

3.2 EXAMINATION

A. Examine roughing-in for water and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball or globe valve if stops are not specified with fixture.

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install toilet seats on water closets.

K. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

L. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

M. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

O. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.

P. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

F. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 SHOCK ABSORBERS

A. Provide shock absorbers on all water lines servicing quick closing valves, such as flush valve water closets, urinals, clothes washers and dishwashers. Install per manufacturer's recommendations.

3.6 SANITARY DRAINAGE SYSTEM

A. Contractor to verify size, location and elevation of existing sanitary sewers before starting work.

B. Line and Grades: Lay piping true to line and grade so that sewer will have smooth and uniform invert throughout its length. Grade piping by measuring with rod from overhead grade line set horizontal and set taut between grade bars to prevent sagging. Contractor to verify elevations of existing sewers before starting work. Unless otherwise indicated or directed, maintain 30 inch minimum cover above piping. All drainage piping inside of building shall have a uniform grade of not less than 1/4 inch per foot in direction of flow as required by local building department, unless otherwise noted.

C. Flashings:

1. Vents through roof shall terminate 12 inches above roof. Secure vents to roof to protect from snow load or snow dump.

2. Flash vents and roof drains with 4 lb. lead, extend vent flashing around pipe and over top 2 inches, beat down in pipe 1 inch.

3. The base of the flashings shall be minimum 12 inches x 12 inches on the roof for 2 inch and 3 inch vents; 18 inches x 18 inches for 4 inch vents; 24 inches x 24 inches for 6 inch vents, 30 inches x 30 inches for roof drains.

4. For each floor drain above grade, provide 24 inches square 4 lb. sheet lead flashing clamped or soldered into flashing ring of drain.

3.7 GAS PIPING SYSTEM

A. Gas piping shall be installed in strict accord with NFPA Pamphlet No. 54.

B. All gas piping run outside and above grade shall be finished with a corrosion resistant enamel paint, black color or color as directed by architect to match building color. All gas piping running inside of building and above grade shall be painted yellow.

C. All underground gas piping outside of building shall be machine wrapped with "Scotchrap" PVC tape using 50% overlap wrap minimum. Fittings and all joints shall be double wrapped, and fitting wrapping shall extend not less than 6 inches past the end of the fittings onto the pipe section. All testing of pipe and fittings shall be done prior to wrapping the fittings. Pipe may be wrapped prior to testing.

D. All steel and iron pipe shall be coated with "Scotchrap" primer before wrapping.

E. All pipe wrapping shall conform to the following schedule:

		Scotchrap No.	
Pipe Size	Tape Width	10 Mil	20 Mil
1/4" - 3/4"	1"	50	51
1" - 1-1/2"	2" or 4"	50	51
2" and larger	4"	50	51
Color Backing		Black	Black

Note: During application of wrap, if the ambient temperature is 40º or less, use only "Scotchrap" No. 40 tape. If ambient temperature is 41ºF or more, use only "Scotchrap" No. 50.

F. Gas piping under floor slabs, inside of building, shall not be used.

G. ASTM-A-106 welding fittings shall be used on all gas piping 2-1/2 inches and larger.

3.8 TESTS FOR PLUMBING AND DRAINAGE SYSTEMS

A. Test all plumbing work as specified below and according to local code regulations. See "Schedule of Testing" in "General Mechanical Requirements" of the specifications.

B. Sectionalizing: Piping may be tested a section at a time in order to facilitate the construction.

C. All hot and cold water lines shall be capped or plugged and tested with 100 lb. hydrostatic test, and proved tight before all piping is covered or concealed in any part of the building construction. Fill the section of pipe to be tested with water and bring the section up to pressure with a test pump. Tests shall be conducted by the Mechanical Contractor in the presence of the General Contractor. These tests shall be conducted before any insulation is installed, and all insulation installed prior to these tests shall be removed. Gauges in the tests shall have been recently calibrated with a dead weight tester. All tests shall apply full test pressure to the piping for a minimum of 24 hours.

D. Inability to Hold Pressure: When test pressure has fallen over 5% during the 24 hour test period, the point of leakage shall be found, repaired, and the test repeated. This procedure shall be followed until the piping system has been proven absolutely tight.

E. All soil, waste, and vent piping within the building shall be tested to a 10 feet hydrostatic test, and all joints inspected while under pressure.

F. All soil, waste, and vent piping outside the building shall be tested to a minimum 10 feet of pressure head. Each joint shall be watertight after 15 minutes.

G. All gas piping shall be tested under, and proven tight, at an air pressure of 100 lbs. per square inch gauge for a period of 2 hours. All gas pipe testing shall be performed in the presence of a representative of the Mechanical Engineer or Owner.

H. All piping shall be tested and proved to be tight before being concealed in the building construction.

I. Before final acceptance of the system as a whole, this Contractor shall make all adjustments as required and place the entire plumbing system in perfect operating condition.

3.9 STOP VALVES

A. All fixtures, wall hydrants, yard hydrants, hose bibs, rough-ins, etc., to be supplied with stop valve to prevent shutting down entire water system when replacing faucet washers.

3.10 VACUUM BREAKERS

A. Provide line size vacuum breaker on all branch lines to all outlets with threaded outlets where a hose may be attached.

3.11 WATER SUPPLY SYSTEM

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures as described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.13 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust disposers, water dispensers, and controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

3.14 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.15 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

3.16 PLUMBING SPECIALTIES INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe

diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

2. Do not install bypass piping around backflow preventers.

B. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

C. Install strainers on supply side of each pressure regulator.

D. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

E. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 inch Use NPS 4 inch for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 inches and smaller and 100 feet (30 m) for larger piping.

4. Locate at base of each vertical soil and waste stack.

F. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

G. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

H. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

I. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

J. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

K. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.

2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.

b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.

c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

L. Install interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

M. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

N. Fasten recessed-type plumbing specialties to reinforcement built into walls.

O. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

P. Install individual shutoff valve in each water supply to plumbing specialties. Use ball or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Section 15050 Subsection "Valves" for general-duty ball, butterfly, check, and globe valves.

Q. Install air vents at piping high points. Include ball or globe valve in inlet and drain piping from outlet to floor drain.

R. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

S. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

T. Plumbing Specialty Connections

1. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

2. Install piping adjacent to equipment to allow service and maintenance.

3. Connect plumbing specialties to piping specified in other Division 15 Sections.

4. Ground equipment.

5. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

6. Connect plumbing specialties and devices that require power according to Division 16 Sections.

3.17 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft, 0.0938-inch thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft., 0.0625-inch thickness or thinner.

2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.18 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

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SECTION 15450
PLUMBING FIXTURES & TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Related Sections:

1. Section 15400 Plumbing

1.2 DESCRIPTION OF WORK

A. The work covered under this section consists of furnishing all fixtures and trim and all labor necessary to make the installation of the plumbing fixtures. It also includes furnishing and hanging a combination emergency shower and face/eyewash.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. Approved Manufacturers:
1. American Standard
2. Crane
3. Eljer
4. Fiat
5. Florestone (Service (utility) sink only)
6. Kohler
7. Oberon
8. Sterns-Williams
9. Toto

B. All Fixtures and Trim shall be of the same Manufacturer, as close as possible.

C. Trim Manufacturers (as specified for fixtures):
1. Chicago Faucet
2. Crane
3. Delta
4. Kohler
5. Moen
6. Speakman

D. Seats (Seats shall be solid plastic type, with open front per code, color to match fixture):
1. Church
2. Olsonite
3. Beneke
4. Bemis

E. Stainless Steel (Sinks and Drinking Fountains)
1. Bradley

2. Dayton
3. Elkay
4. Haws
5. Just
6. Kohler

F. All exposed pipes shall be chrome plated

G. All exposed screws (faucets, valves, etc.) to be vandal-proof type.

H. All fixtures shall be white unless otherwise noted.

I. Refer to project-specific “Submittal Log” provided by owner at Pre-Bid Meeting.

2.2 PLUMBING FIXTURE LIST

A. WC-1 Water Closets (ADA compliant with specified seat): Basis of Design: Toto CST 744 SL, white vitreous china elongated rim, low-consumption (1.6 gals/flush), siphon jet flushing action. Tank cover, fittings and trip lever chrome-plated (16 ½ inch high complete with backflow preventer. #K-4670C Lustra seat for elongated bowl, open front less cover with stainless steel check hinge. 3/8 inch supply with l.k. stops. Provide with trip level on side of water closet away from the wall.

B. LAV-1 Lavatory (ADA compliant): Basis of Design: Toto LT 307 or American Standard 0355 19 inch x 20 ½ inch white vitreous china wall hung lavatory. American Standard 7385.046 - Reliant 3 Centerset Faucet, Indexed Red/Blue Metal Lever Handle with polished chrome finish.

C. S-1 Surface-Mounted Sink: Basis of Design: Kohler Surface Mounted Stainless Steel Stacatto Bar Sink, Dimensions 20 inch x 20 inch x 8 inch with 3 holes. Faucet to be Delta 300-SS-DST-L Classic Single Handle Kitchen Faucet with integral Spray or approved equal.

D. MSB-1 Mop Sink Basin: Florestone MSR2424. 3 inch stainless steel drain and strainer, with stainless steel guards on sides. 10 inch spout with wall brace and pail hook, ¾ inch male hose thread outlet, vacuum breaker. Plastic construction with brass faucets.

E. UR-1 Urinal: High–efficiency, 0.5 gallons / flush or less, wash-down flushing action; privacy shields, integral trap, ADA-compliant. Wall-mounted Toto model UT447E, white vitreous china. Provide with surface mounted manual flushometer.

F. EWC-1 Electric Water Cooler Drinking Fountain: Drinking fountain to be stainless steel, barrier free, ADA Compliant, wall mounted, with electric water cooler providing minimum of 8 gph chilled water. Elkay Model EMABF8 or approved equal with pre punched glass filler hold in top deck. Drinking fountain to have factory provided glass filler, Elkay Model LK1110 Glass Filler Kit to be provided including tubing, fittings, and instructions. (Elkay Model #98498C). Mounting height per ADA requirement.

G. GD-1 Garbage Disposal Insinkerator Model Badger 5, continuous feed, with 1/2 HP motor, galvanized steel grinding elements with two stainless steel swivel lugs. 115V/1ph/60hz, 6.9 amps. Provide wall switch.

PART 3 - EXECUTION

A. The Contractor is fully responsible for protection of fixtures before and after inspection until final acceptance of the entire building by Owner. Any damaged fixtures shall be immediately replaced by this Contractor regardless of who caused the damage.

B. All fixtures shall be securely mounted to walls and floors.

C. Rough-in only hot and cold water, gas, waste, vent, soil, drainage piping to all fixtures and equipment as well as fixtures and equipment furnished by General Contractor and/or Owner as shown on drawings. Provide fixture stops and "P" traps as required for all plumbing fixtures. Coordinate locations, sizes, etc. with equipment drawings and schedule.

D. Contractor shall be responsible for all incidental parts for both new and existing equipment to provide a complete operating system.

3.2 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.

B. Comply with the installation requirements of ANSI A117.1, ADA Guidelines and the International Building Code with respect to plumbing fixtures for the physically handicapped.

C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

D. Install a stop valve in an accessible location in the water connection to each fixture. Install access panels in wall for access to conceal stop valves.

E. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.

F. Seal fixtures to walls and floors using silicone sealant as specified in Section 07900. Match sealant color to fixture color.

3.4 FIELD QUALITY CONTROL

A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

B. Inspect each installed unit for damage. Replace damaged fixtures.

3.5 ADJUSTING

A. Adjust water pressure at faucets and flush valves to provide proper flow and stream.

B. Replace washers of leaking or dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.7 PROTECTION

A. Provide protective covering for installed fixtures, drinking fountains, and trim.

B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the CDOT Representative.

END OF SECTION

SECTION 15500
AIR CONDITIONING SYSTEMS

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Set all equipment and make duct and or piping connections. Provide adequate access to controls, valves, piping connections, filters motors, drives, etc. as necessary.

1.2 DESCRIPTION OF THE WORK

A. Types of air distribution components in this section include the following

1. Air-Cooled, Split-System air conditioner unit

1.3 QUALITY ASSURANCE

A. Codes and Standards:

1. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.

2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 9, "Small Forced-Air Heating and Cooling Systems," and Chapter 36, Solar Energy Equipment" for design and installation of equipment.

3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

1.4 SUBMITTALS

A. Furnish manufacturer's submittal data for:

1. Air cooled condensing unit

B. Submit refrigerant piping diagram showing manufacturer's recommended pipe sizes and accessories.

1.5 WARRANTY

A. Compressor: Five year

PART 2 - PRODUCTS

2.1 AIR COOLED CONDENSING UNIT

A. General: Assembled on integral steel base, weatherproofed, holding charge of R-22, top control box access panel, removable end panels for access to major components and controls. Dual compressor units shall have separate and independent refrigeration circuits.

B. Casing: One-piece welded assembly of 18-gauge zinc-coated, galvanized steel with epoxy resin primer and enamel finish.

C. Compressor: Direct-drive, hermetic reciprocating compressor with centrifugal oil pump, crankcase heater and well, suction and discharge valves, rubber-in-shear vibration isolators, suction gas cooled motor with internal temperature and current-sensitive motor overloads, filter dryer, and sightglass.

D. Condenser Fans and Motors - Vertical discharge, direct-drive fans, statically and dynamically balanced, with aluminum blades and zinc-plated steel hubs; motors with permanently lubricated ball bearings, built-in current and thermal overload protection, weathertight slingers over bearings.

E. Condenser Coil - Aluminum fins mechanically bonded to copper tubes, subcooling circuit for each refrigeration circuit, factory pressure and leak-tested to 425 psig, condenser coil hail guard.

F. Controls - 24-volt control circuit with fusing and control power transformer; factory-wired complete with magnetic contactors for the compressors, cooling low ambient fan switches, high pressure cut-outs, internal pressure relief valves, low pressure cut-outs and reset relays, terminal block for power wiring, time delay timers to prevent simultaneous dual compressor start-up, anti-cycle timers.

G. Low ambient controls as noted on the drawings.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION:

A. All equipment shall be installed complete with bases, supports, mounting frames, piping connections, vents, etc., as required. Installation, shop drawings, etc., of all equipment shall be coordinated with other trades. Equipment to be bolted securely to housekeeping pads.

B. All air moving equipment is to be rated, selected and adjusted to deliver air quantities shown at site elevation. Fan speeds are to be changed as required to deliver CFM shown and new sheaves furnished and installed if necessary.

3.2 ELECTRICAL WIRING:

A. All the wiring in connection with the automatic temperature control system, except wiring carrying the full load current, shall be furnished under this section as required to make a complete and operating temperature control system. All interlock wiring specified under this Section shall also be provided. All electrical wiring shall be installed

in accordance with prevailing National and Local Codes (see Division 16 on Electrical Work for Coordination required) and shall be stranded continuous wire run in conduit.

B. Items to be controlled:

1. Air-Cooled Split-System Air Conditioner Unit

3.3 REFRIGERATION SYSTEM START-UP AND TESTING

A. Charge system with refrigerant, test entire system for leaks after completion of installation. Repair leaks, put system into operation, test equipment performance.

END OF SECTION

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SECTION 15600
HEAT GENERATION

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Provide all items, materials, articles or methods listed or scheduled on drawings or herein specified, including all labor, materials, equipment and incidentals necessary and required for their completion.

1.2 SUBMITTALS

A. Shop Drawings and Product Data: Submit for the following in accordance with Section 15010.
   1. Gas-Fired, High-Efficiency Furnace
   2. Electric Unit Heater
   3. Electric Base Board Radiator

B. Operating Instructions and Maintenance Data: Submit for the following in accordance with Section 15010.
   1. Gas-Fired, High-Efficiency Furnace
   2. Electric Unit Heater
   3. Electric Base Board Radiator

C. Refer to Project-Specific “Submittal Log” provided by Owner at Pre-Bid Meeting.

1.3 WARRANTY

A. Furnace: Five Year

PART 2 - PRODUCTS

2.1 GAS FIRED FURNACE

A. Approved Manufacturers: Carrier, Trane, York & Lennox.

B. Furnace shall be a 92% or higher gas- fired, multipoise design with PVC combustion air and venting thru roof or sidewalls.

C. Furnish a 3-ton, fixed-capacity, gas-fired condensing furnace for use with natural gas.

D. Unit will be designed, tested and constructed to the current ANSI Z 21.47/CSA 2.3 design standard for gas-fired central furnaces.

E. Components shall include: slow-opening gas valve to reduce ignition noise, regulate gas flow, with electric switch gas shut-off; flame proving sensor, hot surface igniter, pressure switch assembly verifies inducer operation; flame rollout switch, drain tubing and installed condensate drain trap, blower and inducer assembly, 40va transformer; low-voltage (heating) (heating/cooling) thermostat.

F. Blower Wheel and Blower Motor: Galvanized blower wheel shall be centrifugal type, statically and dynamically balanced. Blower motor of PSC type shall be permanently lubricated with sealed bearings and shall be multiple-speed direct drive. Blower motor shall be soft mounted to the blower scroll to reduce vibration transmission.

G. Thermostat: 24 VAC, solid-state, programmable, microprocessor-based wall mounting unit with automatic switching from heating to cooling, preferential rate control, multiple temperature presets selectable by day and time, and battery back-up protection of program settings against power failure.

H. Filters: Furnace shall have 1 inch thick throwaway filters.

I. Casing shall be of .030 inch thickness minimum, pre-painted galvanized steel.

J. Inducer Motor shall be soft mounted to reduce vibration transmission.

K. Primary Heat exchangers shall be 3-Pass 20 gauge corrosion resistant aluminized steel of fold- and -crimp sectional design, which operates under negative pressure.

L. Secondary Heat Exchangers shall be of a flow-through design having a patented interior laminate coating of polypropylene for greater corrosion resistance with fold-and-crimp design, which operates under negative pressure.

M. Controls shall include a micro-processor based integrated electronic control board with at least 11 service troubleshooting codes displayed via diagnostic flashing LED light on the control, has ability to store fault codes, when activated a self-test feature checks all major functions of the furnace within one minute, and a replaceable automotive-type circuit protection fuse. Multiple operational settings available including separate blower speeds. Cooling airflow will be selectable between 350 or 400 CFM per ton of air conditioning.

2.2 ELECTRIC UNIT HEATER

A. Approved Manufacturers: Berko, Brash, Chromalox, Indeeco, Markel, Q-Mark, Singer, & Trane.

B. Commercial Fan-Forced Wall Heater, CFM: 100

C. Temp Range: 40 degrees Fahrenheit – 90 degrees Fahrenheit

D. Provide with wall mounted thermostat, installed at a maximum height of 48 inches above finish floor in compliance with ADA requirements.

E. Refer to drawings for more detailed information.

2.3 ELECTRIC BASE BOARD RADIATOR

A. Approved Manufacturers: Berko, Brash, Chromalox, Indeeco, Markel, & Q-Mark.

B. UL Listed for installation on wall or level floor surface.

C. Provide manufacturer's standard powder coat finish.

D. Provide with wall mounted thermostat, installed at a maximum height of 48 inches above finish floor in compliance with ADA requirements.

E. Refer to drawings for more detailed information.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION:

A. All equipment shall be installed complete with bases, supports, mounting frames, piping connections, vents, etc., as required. Installation, shop drawings, etc., of all equipment shall be coordinated with other trades.

B. All air moving equipment is to be rated, selected and adjusted to deliver air quantities shown at site elevation. Fan speeds are to be changed as required to deliver CFM shown and new sheaves furnished and installed if necessary.

3.2 ELECTRICAL WIRING:

A. All the wiring in connection with the automatic temperature control system, except wiring carrying the full load current, shall be furnished under this section as required to make a complete and operating temperature control system. All interlock wiring specified under this Section shall also be provided. All electrical wiring shall be installed in accordance with prevailing National and Local Codes (see Division 16 on Electrical Work for Coordination required) and shall be stranded continuous wire run in conduit.

B. Items to be Controlled:

1. Gas-Fired, High-Efficiency Furnace
2. Electric Base Board Radiator
3. Electric Unit Heater

END OF SECTION

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SECTION 15800
AIR DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Set all equipment and make duct connections. Provide adequate access to controls, valves, piping connections, filters motors, drives, etc. as necessary.

1.2 DESCRIPTION OF THE WORK

A. Types of air distribution components in this section include the following
   1. Exhaust Fans
   2. Grilles, Registers and Diffusers

1.3 QUALITY ASSURANCE

A. Codes and Standards:

   1. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.

   2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1, "Duct Construction," for fabrication and installation of metal ductwork.

   3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

1.4 SUBMITTALS

A. Shop Drawings: Submit scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced. Submit for the following in accordance with Section 15010.

B. Operating Instructions and Maintenance Data: Submit for the following in accordance with Section 15010.
   1. Exhaust Fans

PART 2 - PRODUCTS

2.1 EXHAUST FANS (MECHANICAL ROOM AND WATER CLOSET)

A. Approved manufacturers: Acme, Carnes, Canarm, Cook, Greenheck, Pace, Penn.

B. Type: Shall be of the centrifugal fan, integral grille and housing type, all completely self-contained. Integral backdraft damper shall be located in fan outlet.

C. Capacity:

1. Water Closet Fan: Capacity and model number of the unit shall be as shown on drawings. Exhaust fan shall be sized to exhaust 50 cfm per water closet.

D. Motor and Drive: Fan shall be of the direct drive type and motor shall be of the permanently lubricated ball bearing type and shall be directly coupled to the fan. The motor and fan shall be easily removable thru the in-take grille for service. Provide two-speed, reversible, manual switching.

2.4 GRILLES, REGISTERS, DIFFUSERS

A. Approved manufacturers: Krueger, Price, Titus

B. Material to be Steel with powder coat finish

C. Manual Volume Dampers

D. Types: Supply
1. Lay-in or Surface Mount:
a. Frame: 12 inch x 12 inch or 24 inch x 24 inches
b. Models: Krueger: 6200; Price: PDC / SCD; Titus: PCS

2. Supply Grille: Ceiling or Sidewall
a. Frame: 8 inch x 8 inch or 12 inch x 8 inch
b. Models: Krueger: 880/5880; Price: 520 / 620; Titus: 300R / 300F

E. Types: Return and Exhaust
1. Lay-In
a. Frame: 24 inch x 24 inch
b. Models: Krueger: 6490; Price: PDDR; Titus: PAR

2. Return Grilles: Ceiling or Sidewall
a. Frame: 6 inch x 6 inch, 12 inch x 6 inch, 12 inch x 10 inch, 16 inch x 6 inch, or 24 inch x 12 inch
b. Models: Krueger: S80; Price: 530; Titus: 350R

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION:

A. All equipment shall be installed complete with bases, supports, mounting frames, piping connections, vents, etc., as required. Installation, shop drawings, etc., of all equipment shall be coordinated with other trades.

B. All air moving equipment is to be rated, selected and adjusted to deliver air quantities shown at site elevation. Fan speeds are to be changed as required to deliver CFM shown and new sheaves furnished and installed if necessary.

3.2 ELECTRICAL WIRING:

A. All the wiring in connection with the automatic temperature control system, except wiring carrying the full load current, shall be furnished under this section as required to make a complete and operating temperature control system. All interlock wiring specified under this Section shall also be provided. All electrical wiring shall be installed in accordance with prevailing National and Local Codes (see Division 16 on Electrical Work for Coordination required) and shall be stranded continuous wire run in conduit.

1. Items to be Controlled:
   a. Exhaust Fans.

END OF SECTION

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SECTION 15900
TEMPERATURE CONTROL (ELECTRIC)

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Approved Equipment Manufacturers: Honeywell, Johnson Service Co., Penn, Powers or Robertshaw.

C. Temperature control system shall be of the electric or electronic type, with electric or electronic components to comprise a complete system, furnished and installed, by Mechanical Contractor, connected by the Electrical Contractor, put into operation and adjusted under operating conditions, and carefully coordinated with Mechanical and Electrical Contractors.

D. System shall include all valves, thermostats, motorized dampers, damper motors, controllers and other control devices shown on drawings or as specified. All control devices shall be connected complete to perform the functions indicated, so as to operate in the required sequence.

E. All temperature control bulbs and thermometers sensing air temperature shall be properly located to best compensate for possible stratification of air in the system.

F. All automatic control dampers, unless otherwise specified, shall be furnished and installed by Mechanical Contractor.

1.2 SUBMITTAL

A. Submit for approval four (4) sets of information including descriptive literature, control wiring diagrams, damper schedules.

B. After approval, this Contractor shall furnish a sufficient quantity of drawings to all crafts involved and shall make certain they are familiar with all work they must perform in conjunction with the control system.

1.3 GUARANTEE

A. The control system shall be guaranteed by the manufacturer for a period of one (1) year from date of acceptance by the owner. During this period, the manufacturer shall furnish all labor and material necessary to the satisfaction of the Owner, assuming such material and workmanship is necessary because of original defects.

PART 2 - PRODUCTS

2.1 CONTROL COMPONENTS

A. Controllers: Thermostats and other controllers shall be solid state devices providing full proportional control, either direct or reverse action, or both as required for sequential control. Control supply voltage shall normally be 24 volt, and control signal voltage 0-10 volt DC.

2.2 THERMOSTATS

A. Thermostats shall be complete with automatic heating-cooling changeover, night set back control, and "on-off" fan switch. U.L. Listed.

B. Automatic changeover thermostats shall be Honeywell T7300A1005 with Q7300B1008 sub-base, or equal. Alternate Product: Honeywell RTH8500D.

PART 3 - EXECUTION

3.1 WIRING

A. All control wiring and conduit shall be installed by the Electrical Contractor. All costs of controls, wiring, conduit, and associated labor shall be included in electrical bid, except as otherwise noted.

B. Control wiring, conduit, fittings, etc. shall be furnished in accord with requirements of electrical section of the specifications. All necessary control wiring and interlocks not shown on electrical drawings to be provided by Electrical Contractor.

C. All electric wiring shall be performed in accord with National Electrical Code and local standards.

3.2 THERMOSTATS

A. Thermostats to be mounted a maximum of 48 inches above the floor in compliance with ADA and ANSI requirements.

END OF SECTION

SECTION 15990
TESTING, BALANCING & ADJUSTING

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Extent of testing, adjusting, and balancing work required is indicated by requirements of this section; and is defined to include but is not necessarily limited to, air distribution systems, hydronic distribution systems, and associated equipment and apparatus of mechanical work. The work consists of setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by contract documents.

C. The Mechanical Contractor shall procure the services of an independent testing, adjusting and balancing agency specializing in the testing, adjusting and balancing or environmental systems to perform the above mentioned work. Testing, adjusting and balancing work shall be directly supervised and the results attested by a Registered Professional Engineer. This Engineer shall represent the Testing, Balancing and Adjusting Firm in progress meetings as required, and shall be available for interpreting all material found in the balance report.

D. Tester's Qualifications: Firm with at least 5-years of successful testing, adjusting, and balancing experience on projects with testing, adjusting and balancing requirements similar to those required for this project.

E. NEBB Compliance: Comply with NEBB's "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems" as applicable to mechanical air and hydronic distribution systems, and associated equipment and apparatus.

1.2 APPROVAL OF CONTRACTOR

A. The Mechanical Contractor shall submit the name of the Testing Balancing and Adjusting Firm to the CDOT Representative within 30 days of contract award to ensure that the Testing Balancing and Adjusting firm is on the project from the outset of construction. All Testing Balancing and Adjusting firms desiring to offer their services for this work shall submit their qualifications to the CDOT Representative, not less than seven (7) calendar days before the bid date. Approval or disapproval will be given on each request and this action will be given in writing prior to bidding the work.

B. Firms acceptable to do the work are:

1. Able Balance Company
2. Complete Air Balance
3. Griffith Engineering Service Co.
4. JPG Engineering
5. TAB Services, Inc.
6. Other firms may be submitted to the Architect or Owner for approval

C. Other firms desiring to bid the balance work shall submit a booklet of qualification which will be reviewed by the Mechanical Engineer and CDOT Representative.

1.3 SUBMITTALS

A. Submit certified test reports, signed by Test and Balance Supervisor who performed Testing, Balancing and Adjusting work. In addition, have report certified by Professional Engineer who is familiar with Testing, Balancing and Adjusting work and also with project, and who is registered in jurisdiction where testing is being conducted.

B. Include identification and types of instruments used, and their most recent calibration date with submission of final test report.

C. Submit biographical data on Professional Engineer who is to directly supervise testing, adjusting, and balancing work.

1.4 JOB CONDITIONS

A. Do not proceed with testing, adjusting, and balancing work until work has been completed and is operable. Ensure that there is no latent residual work still to be completed.

B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt, and discarded building materials.

C. Put all heating and ventilating systems and equipment into full operation and continue operation of same during each working day of testing and balancing. Preliminary Testing, Balancing and Adjusting requirements shall be ascertained prior to the commencement of work through a review of available plans and specifications for the project. In addition, visual observations at the site during construction shall be made to determine the location of required balancing devices and that they are being installed properly for the need.

D. Before any air balance work is done, the system shall be checked for duct leakage, assure filters are installed, see that filters are changed if they are dirty, check for correct fan rotation, equipment vibration, and check automatic dampers for proper operation. All volume control dampers and outlets shall be wide open at this time.

1.5 TEST INSTRUMENTS

A. Utilize test instruments and equipment for Testing, Balancing and Adjusting work required, of type precision, and capacity as recommended in the following Testing, Balancing and Adjusting standard:

1. NEBB's Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.6 GUARANTEE OF WORK

A. The Testing, Balancing and Adjusting Contractor shall guarantee the tests and balance for a period of 90 days from date of final acceptance of the test and balance report. During this period, the Testing, Balancing and Adjusting Contractor shall make personnel available at no cost to the Owner to correct deficiencies in the balance.

1.7 RETAINAGE

A. Contract payment retainage may be withheld against the Mechanical Contractor until the final completion of this section of work has been demonstrated by the submission of the Testing, Balancing and Adjusting report and an evaluation of its contents has been made by the Engineer.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

A. Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation, duct work and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

1. At Tester's option, plastic plugs with retainers may be used to patch drilled holes in duct work and housings.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned, and is operable. Do not proceed with Testing, Balancing and Adjusting work until unsatisfactory conditions have been corrected in manner acceptable to Tester.

B. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards.

C. Test, adjust and balance system during winter season for heating systems, including at least period of operation at outside conditions within 5°F (3°C) wet bulb temperature of maximum summer design condition, and within 10°F (6°C) dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, then take final temperature reading when seasonal operation does permit.

D. Balance all air flows to terminals within + 10% to -5% of design flow quantities. Measure and record the following data.

E. Air Balance: Air supply, return and exhaust systems with air quantities for each air device; air handling units including supply, return, mixed, and outside temperatures and fan data including CFM, static pressure, fan RPM, motor running and full load amperage before and after final balance. Air diffusion patterns shall be set to minimize objectionable drafts and noise.

F. The supply, return and exhaust fan static pressure shall be set by the balancing firm and the control contractor if the systems have fan volume control dampers. The duct static shall be confirmed both through the instrumentation installed on the job and by the balancing contractor. The system shall be tested in all operation modes (full return air, full outside air, modulated damper position, full cooling) with the design diversity and full cooling with no design diversity. Amperages shall be recorded in all modes. The fan speed resulting in satisfactory system performance shall be determined at full design delivery. Inlet or outlet fan volume control

dampers shall be in the wide open position and one path representing the greatest resistance to flow shall be fully open and unobstructed.

G. Final adjustments shall include but not be limited to the following:

ITEM	ADJUSTMENT
All Fans: Belt Drive	RPM. Include sheave and belt exchange to deliver air flow within limits of installed motor horsepower and mechanical stress limits of the fan. Determine the limiting fan tip speed before increasing RPM. Final fan speed setting shall allow for predicted filter loading and shall establish proper duct pressures for operation of zone CFM regulators.
All Fans: Direct Drive	Direct Drive RPM with speed taps. Set fan speed on tap which most closely approaches design CFM. Report tap setting on equipment data sheet as high, medium or low. RPM with speed control rheostat. Set output of fan at design CFM by adjusting the SCR. After adjustment, check fans ability to restart after powering down. Increase setting if required for proper starting.
Motor Starter, Thermal Heaters	Mechanical Contractor Furnished Magnetic and Manual Starters. Furnish and exchange thermals as required for proper motor protection.

3.2 REPORT OF WORK

A. The Testing Balancing and Adjusting Contractor shall submit six (6) bound copies of the final testing and balancing report at least 15 days prior to the Mechanical Contractor's request for final inspection. All data shall be recorded on applicable reporting forms. The report shall include all operating data as listed in sections above, a list of all equipment used in the testing and balancing work, and shall be signed by the supervising engineer and affixed with his certification seal. Final acceptance of this project will not take place until a satisfactory report is received.

B. When deemed necessary by the Mechanical Engineer, the balancing firm shall run temperature and/or humidity recordings and shall read all of the reported quantities in the presence of the engineer for verification purposes.

C. When all balancing is done and all dampers are set, all test holes shall be plugged and all dampers shall be marked. The following information shall be recorded in the final report: Design inlet or outlet size, actual inlet or outlet size, design CFM and velocity through the orifice, for each terminal in the system.

D. The pilot tube traverse method for determining CFM shall be used and recorded wherever possible.

3.3 BALANCING REPORT

A. After all balancing is complete and all coordination with the contractor and the engineer is complete, the balancing firm shall furnish a bound report which shall contain the following information:

B. RPM, drive sheave information (as installed and as changed), fan nameplate information, motor nameplate information, and amperage and voltage to all motors (in all operating modes).

1. Static pressure across all components of the system.

2. Required and final balanced CFM at each system terminal. Include the terminal size, reading orifice size, and velocities read to attain the CFM.

3. Pump and motor nameplate information, amperage and voltage to all motors, pressure drop across all system terminals, pressure rise across the pump in psi and feet of head.

4. Thermal protection for all motors shall be recorded. Starter brand, model, enclosure type, installed thermal heaters and the rating of the heaters, required thermal heaters and the rating of the heaters if different than installed shall be recorded. If the starters were furnished by the mechanical contractor, the heaters shall be changed to the correct size and so noted in the report. If the starters were furnished by the electrical contractor, the correct heater sizes shall be noted in the report and the electrical contractor shall be advised.

5. The report shall include a sheet which shall report the method of balance, project altitude, all correction factors used in the calculations.

3.4 OWNERS INSTRUCTIONS

A. General:

1. Upon final completion of the job, the Mechanical Contractor shall schedule time with the CDOT representative and Mechanical Engineer to review each component of the mechanical system and to instruct the Owner's representative on proper operation and maintenance of the system. The Mechanical Contractor shall be present to review all temperature control systems.

B. Patch holes in insulation, ductwork, and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer.

C. Mark equipment settings, including damper control position, valve indicators, fan speed control levers, and similar controls and devices, to show final settings at completion of Testing Balance and Adjusting work. Provide markings with paint or other suitable permanent identification materials.

D. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced; including, where necessary, modifications which exceed requirements of contract documents for mechanical work.

E. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

END OF SECTION

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SECTION 16050
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wire and connectors
2. Supporting devices for electrical components
3. Concrete equipment bases
4. Cutting and patching for electrical construction
5. Touchup painting

B. Provide complete raceway systems for conductors unless otherwise specified.

C. Provide complete system of conductors as required for raceway systems. Where quantities of conductors are not specifically indicated, provide necessary number to maintain circuits and function

D. Provide metal boxes for use as outlet boxes, pull boxes, or junction boxes. Boxes to include pressed steel boxes, masonry boxes, and weatherproof cast steel or aluminum boxes

E. Provide support for conduit, wireway, junction boxes, pull boxes and related equipment.

F. Provide fire sealing of holes and voids through fire rated barriers

1.3 DESIGN RESPONSIBILITY

A. Wire and cable sizes indicated are copper. Aluminum may be used for service and feeder conductors sized #2 AWG and larger, unless otherwise indicated. Should aluminum be used, the Contractor is responsible for determining revised:
1. Conductor sizes to achieve the same ampacity and voltage drop as copper sizes indicated.
2. Raceway boxes and equipment sizes and locations
3. Short circuit current values and AIC ratings of equipment

B. Contractor to resolve to the satisfaction of CDOT and the Engineer problems that are a direct result of the use of aluminum in lieu of copper.

1.4 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

1.5 SUBMITTALS

A. Product Data:
   1. Conduit, fittings and supports
   2. Boxes
   3. Fire Seals where applicable

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

C. Should aluminum wire and cables be used, provide a revised one-line and partial plans indicating revised conductor, raceways, box, equipment size, locations, fault calculations and AIC ratings of equipment

1.6 QUALITY ASSURANCE

A. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to metallic and nonmetallic electrical raceway.

B. UL labels: Provide electrical raceways, boxes, conductors, and connectors which have been approved, listed and labeled by UL.

C. ANSI/ASTM Compliance: Provide electrical raceways and conductors which comply with applicable portions of ANSI/ASTM standards for construction of raceways and conductors.

D. NEMA/ICEA Compliance: Provide conductors which comply with applicable portions of NEMA/ICEA standards pertaining to material, construction, and testing of conductors.

E. Federal Specification: Provide electrical raceways and conductors which meet applicable portions of Federal Specification.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

   1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid metal conduit shall be steel, galvanized inside and outside. Factory made threads shall be full cut and galvanized after threading. The conduit shall be UL listed and shall meet the requirements of UL 6 and ANSI C80.1.

B. Electrical metallic tubing shall be hot-dipped galvanized or electro-galvanized steel with an inner coating to protect cables and aid pulling. The conduit shall be UL listed and shall meet the requirements of UL 797 and ANSI C80.3.

C. Flexible metal conduit shall be composed of one spirally wound continuous strip of interlocked galvanized steel. The conduit shall conform to Federal Specification WW-C- 566C and shall meet the requirements of UL 1.

D. Liquid tight flexible metal conduit shall be galvanized steel with an oil and sunlight resistant polyvinyl chloride jacket bonded or extruded onto the exterior. Liquid tight flexible metal conduit shall be approved for grounding. Liquid tight flexible metal conduit shall meet UL Standard For Safety, UL 360.

E. Rigid nonmetallic conduit, unless otherwise noted, shall be Schedule [40] [80] rigid plastic, PVC rated for use with 90 degree C wire and shall be UL listed and conform to UL 651 and NEMA TC-2.

F. Rigid nonmetallic type EB-20 conduit shall be ETL listed, tested to UL-651-A, and meet the requirements of NEMA TC-6 and ASTM F-512.

2.2 CONDUIT FITTINGS

A. Fittings for rigid metal conduit shall be galvanized or cadmium plated. Fittings shall be threaded. Couplings shall be of galvanized steel. Locknuts and bushings shall be steel or malleable iron. Bushings shall have nylon insulated throat.

B. Connectors, couplings and combination couplings for EMT shall be steel set screw or steel compression type. Insulated throat connectors shall be used for sizes 1 inch (DN27) and smaller. Uninsulated connectors with insulated bushing shall be used for sizes larger than 1 inch (DN27).

C. Fittings for flexible metal conduit and liquid tight flexible metal conduit shall be of a type specifically designed for the purpose.

D. Fittings for rigid nonmetallic conduits shall be of same material and manufacturer as conduit. Non-metallic fittings shall be UL listed and conform to UL 514.

E. Expansion fittings across structural joints shall be of a design to compensate for expansion and contraction and shall be sealed to prevent entrance of water or moisture. Expansion fittings shall be approved for grounding duty.

F. Adapters for joints between PVC and steel conduits shall be UL listed Carlon E942 and E943 series.

2.3 WIRE AND CABLE

A. Conductors shall be new and unused. Wire and cable shall be copper single conductor type with 600 V insulation, unless otherwise noted. Conductor shall be soft annealed Class B, per ASTM B-3 for solid wire and ASTM B-8 for stranded wire. Conductors shall be minimum 98% conductive.

B. Aluminum conductors shall be an aluminum alloy that is listed or labeled by UL as "component aluminum-wire stock (conductor material)." Type EC/1350 aluminum is not acceptable. Conductors shall be "Stabiloy" as manufactured by Alcan.

C. Number 10 AWG and smaller wire except for motor circuits shall be solid with Type THHN, or THWN insulation. Larger wire and motor circuit feeders shall be stranded with Type THHN, or THWN insulation. Conductors for service entrance use or where used underground shall be type XHHW only. Grounding conductors shall be copper.

D. Insulation shall be flame retardant, heat resistant polyvinyl chloride (PVC), ethylene propylene (EP) or polyethylene (PE) with minimum insulation thicknesses per table 310-13 of the NEC. The insulation shall conform to the requirements of UL 83 ICEA S-68-516 for EP, ICEA S-61-402 for PVC and PE.

E. Type THWN or THHN wire and cable shall have a outer nylon jacket conforming to UL-83. Cables shall be manufactured to meet the standards of Insulated Cable Engineer's Association (ICEA).

F. MC Cable shall be UL listed, and consist of color-coded insulated conductors wrapped surrounded with a moisture resistant tape and enclosed in a galvanized steel interlocked cladding. Each cable shall contain a full sized ground wire.

G. NM cable shall be UL listed, and consist of color-coded thermoplastic insulated conductors enclosed in a polyvinylchloride plastic overall jacket. Each cable shall contain a full sized ground wire.

H. All homeruns shall be in EMT. Electrical contractor shall obtain written approval from design engineer for the use of type MC and type AC cabling. Type MC and AC cable shall be permitted for branch circuit wiring in approved locations only and installed per the latest adopted edition of the National Electrical Code.

I. Wire-pulling lubricant shall be equal to Ideal "Aqua Gel CW" or Dow Corning compound #7.

2.4 CONNECTORS AND SPLICES

A. For solid wire size #10 and smaller, "Scotchlok" insulated twist-on connectors or compression type, 600 V insulated or acceptable substitution.

B. For stranded wire, "Burndy Hydent" hydraulic compression type, taped to 600 V insulation level.

2.5 PULL AND JUNCTION BOXES

A. Provide code gauge sheet metal boxes with suitable covers, trims, etc. Boxes to be sized, per the NEC, by number and size of conduits and conductors, unless otherwise noted.

2.6 OUTLET BOXES

A. Boxes shall be zinc or cadmium-plated code gauge pressed steel and of the knock-out type. Depth may vary to suit requirements of location.

B. Boxes shall accommodate devices to be installed and shall be sized as required by the NEC for number and size of conduits and conductors entering and leaving. Round boxes shall not be permitted, except where specifically called for.

C. Special oversized outlet boxes shall be code gauge steel and of the knock-out type. Boxes shall have screw mounted covers for surface or flush mounting. Boxes shall be sized as indicated or as required by the National Electrical Code. Special outlet boxes shall accommodate the equipment served.

D. Weatherproof boxes shall be cast aluminum with threaded hubs. Boxes shall have screw mounted, gasketed covers.

2.7 SUPPORTS

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.
   1. Channel Thickness: Selected to suit structural loading.
   2. Fittings and Accessories: Products of the same manufacturer as channel supports.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

G. Expansion Anchors: Carbon-steel wedge or sleeve type.

H. Toggle Bolts: All-steel springhead type.

I. Powder-Driven Threaded Studs: Heat-treated steel.

2.8 CONDUIT SUPPORTS

A. Single Runs: Galvanized malleable-iron conduit straps for surface mounting or 3/8 inch (0.95 cm) threaded rod with steel one bolt conduit clamps for all suspended runs.

B. Multiple Runs: Channel support for surface mounting or trapeze style hangers of 1-5/8 inches by 1-5/8 inches (4.13 cm by 4.13 cm) galvanized steel channels, supported by 3/8 inch (0.95 cm) threaded rod for all suspended runs. Size hangers to allow for 25 percent additional conduits.

C. Supports and hardware shall be galvanized steel, except that high carbon spring steel supports may be used in steel stud walls to support horizontal and vertical conduit up to ¾ inch (DN21).

D. Perforated plumbing tape is not permitted in any support application

E. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.

F. Conductors, Larger than No. 10 AWG: Stranded copper.

G. Insulation: Thermoplastic, rated at 75 deg C minimum.

H. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.9 ANCHOR METHODS

A. Hollow Masonry: Toggle bolts or spider type expansion anchors.

B. Solid Masonry (excluding concrete): Steel expansion bolts.

C. New Concrete: Preset inserts with machine screws and bolts. Existing Concrete: Steel expansion bolts or explosive powder driven inserts.

D. Wood Surfaces: Wood screws.

E. Steel: Welded threaded studs or galvanized steel clamps.

F. Light Steel: Sheet Metal Screws

2.10 CONCRETE BASES

A. Concrete Forms and Reinforcement Materials: As specified in Section 03300 "Cast-in-Place Concrete."

B. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Section 03300 "Cast-in-Place Concrete."

2.11 TOUCHUP PAINT

A. Refinish and touch up paint. Paint materials and application requirements are specified in Section 09900 "Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
4. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
5. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 TYPES OF CONDUIT INSTALLATION

A. Buried raceways, except where concrete encased, shall be rigid metal conduit or rigid nonmetallic conduit.

B. Raceways embedded in concrete slabs at or below grade level shall be rigid nonmetallic conduit, except in classified hazardous areas.

C. Where rigid nonmetallic conduit is used for buried or encased and buried conduit runs, use a minimum of 5 feet (1.52 m) of rigid metallic conduit at foundation penetrations.

D. Raceways embedded in concrete slabs above grade level shall be rigid metal conduit, electrical metallic tubing, or rigid nonmetallic conduit.

E. Hazardous areas raceways shall be rigid metal conduit only.

F. Raceways outdoors, and in locations subject to mechanical injury shall be rigid metal conduit.

G. Motor, vibrating equipment, and rooftop mounted heating, ventilating, and air conditioning equipment connections shall be made with PVC jacketed liquid tight flexible metallic conduit for the last 2 feet (0.61 m) with liquid tight connectors. Similar equipment connections in environmental air plenums shall be made with flexible metal conduit.

H. Raceways in other areas shall be electrical metallic tubing unless otherwise noted.

3.2 CONDUIT SIZES

A. Minimum size allowable for galvanized rigid metal conduit or EMT shall be 3/4 inch (DN21).

B. Minimum size allowable for liquid tight flexible metal conduit shall be 3/4 inch (DN21).

C. Minimum size allowable for flexible metal conduit shall be 3/4 inch (DN21) except for luminaire and control wiring for which 3/8 inch shall be allowed

3.3 CONDUIT INSTALLATION

A. Unless noted as aluminum, conductor and conduit sizes shown on Drawings are based on the use of copper conductors.

B. Wire and cable shall be run in metal raceways, except where nonmetallic raceways have been specifically approved.

C. Conduit shall be run parallel to walls, ceilings, and building lines wherever possible.

D. Conduit shall be installed in finished walls and above suspended ceilings. Conduit routed above suspended ceilings shall be surface mounted to the structural ceiling. When above suspended ceilings, route conduits above suspended lay-in ceiling instead of suspended hard ceilings wherever possible. Coordinate the routing of all other conduit with the Architect prior to rough-in.

E. Where flexible metal conduit is used for equipment connections or other special (approved) situations, ground continuity shall be provided in accordance with the NEC. Liquid tight flexible metal conduit shall be used for flexible equipment connections in damp and wet areas except where installed in environmental air plenums where flexible metal conduit shall be used.

F. Do not cut, notch or drill structural framing members for the installation of conduit without the Architect's approval in each case.

G. Where rigid metal conduit enters a box, fitting or device through a knockout, double locknuts and an insulated metallic bushing shall be used. EMT shall terminate at knockouts with an insulated throat fitting and one locknut. Connectors shall be made up tight to ensure electrical continuity of the raceway system. Provide grounding bushings at each junction box, pull box, or enclosure as required by the NEC.

H. Rigid metal conduit shall be reamed after threads are cut. Joints shall be cut square and shall butt solidly into couplings. Running threads shall not be permitted. Cut ends of EMT shall also be reamed.

I. Bends in rigid metal conduit and EMT runs larger than 1-1/4 inches (DN35) shall be factory-made elbows unless otherwise specifically approved. Bends in 1-1/4 inch (DN35) and 1 inch (DN27) runs shall be made in an approved bending machine or factory made. Hickey bends shall not be permitted in conduits larger than 3/4 inch (DN21). Field bends shall be in accordance with the requirements of the NEC.

J. Conduits run in masonry shall be placed at least 1 inch (DN27) from the surface.

K. Install expansion fittings where conduit crosses an expansion joint in structure or is in an environment where temperature changes combined with conduit run length produce expansion or contraction stress on the installation. Ends of conduit shall be provided with insulated grounding bushings. Copper ground rings or a flexible bonding jumper, equal to at least three times the nominal width of the joint, shall be provided to insure a continuous ground between conduit and fitting.

L. Provide separate code-sized ground conductor for each run of conduit. Conduit shall be sized to accommodate ground conductor.

M. Install under floor conduit in floor slab.

N. Install buried or encased and buried conduits in accordance with Sections 300-5 of the NEC. Where possible, exterior conduits shall be buried at minimum of 30 inches (76.2 cm) below grade or as indicated on the Drawings. Contractor shall verify with Architect, prior to installation,

exterior buried conduits not buried a minimum of 30 inches (76.2 cm) below grade. Slope conduit to drainage point at least 4 inches (10.16 cm) per 100 feet (30.48 m).

O. Adjustments in line and grade for direct buried or encased and buried conduits shall be via long sweeps with minimum of 48 inch (121.92 cm) radius. Route such conduits below existing or new gas lines.

P. Multiple runs of conduit below grade under slab shall be installed in trenches backfilled with sand. Each layer of conduit shall be installed separately, backfilled with sand, and compacted to the depth needed to provide continuous support for the next layer of conduit. Sand shall be spread evenly and compacted to grade level for coverage of the final layer of conduit. Offset joints to maintain uniform spacing between conduit.

Q. Direct buried or encased and buried conduits shall first be swabbed out and then shall be capable of passing a rigid ball 1/4 inch (0.64 cm) smaller than the inside diameter of conduit. Such conduits for future use shall be capped to prevent entry of dirt and debris.

R. Provide roof jacks for waterproofing conduit penetrations of roof. Conduit routing and mounting on roofs shall be coordinated with the CDOT Representative. Unless otherwise indicated or required, conduit shall be mounted 12 inches (30.48 cm) above the finished surface of flat roofs on redwood or treated wood standoffs. Conduits shall be permanently attached to standoffs. Standoffs shall rest freely on roof without being anchored to roof surface.

S. Joints for rigid nonmetallic conduit shall be solvent cemented in strict accordance with manufacturer's recommendations.

T. Elbows from below grade conduit to above grade shall be PVC jacketed rigid metal conduit and shall extend 6 inches (15.24 cm) above grade or finished floor. PVC corrosion resistant tape shall not be permitted.

U. Conduit extending from below grade to above grade, or conduit stubbing out of floors, shall be rigid metal conduit for a minimum of 12 inches (30.48 cm) above grade or finished floor.

V. Wherever conduits enter structure through foundation below ground level, grout around conduit with waterproof grout or install wall and floor entrance seals. Seals shall be OZ/Gedney WS series for new construction and OZ/Gedney CSM series for existing structures.

W. Conduits which pierce air tight spaces or plenums shall be sealed to prevent leakage.

X. Care shall be taken to avoid placing conduits where they shall be subjected to excessive heat. Locate conduits a minimum of 12 inches (30.48 cm) from flues, steam lines, hot water lines, etc.

Y. Conduit ends shall be capped using standard capped bushings to prevent entrance of foreign materials during and after construction. When conduit installation is not in progress close open ends of conduit with temporary plugs or caps.

Z. Clean conduits prior to installation of wires. Install a nylon pulling line in each conduits run assembly or after completion of each conduit run assembly for installation of wires or for future use.

AA. Wire shall not be installed until work which might cause damage to conduit or wire has been completed.

BB. PVC-coated rigid metal conduit shall be installed by a manufacturer-certified installer.

3.4 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.5 WIRE AND CABLE INSTALLATION

A. Minimum wire size for lighting and power circuits shall be #12. Signal and control circuits may use #14 except as noted. Wiring shall be installed in conduit, unless otherwise noted.

B. Unless otherwise indicated, the maximum number of branch circuits allowed in each conduit shall be three. In such cases, the branch circuits shall also be of different phases.

C. Unless otherwise indicated or required, the following schedule shall be adhered to for conductor sizes:

CIRCUIT OVERCURRENT DEVICE RATING	COPPER CONDUCTOR SIZES
20A or Less	#12 AWG
30 A	#10 AWG
40 A	#8 AWG
50 A	#6 AWG
60 A	#4 AWG
70 A	#4 AWG
80 A	#3 AWG
90 A	#2 AWG
100 A	#1 AWG

D. To limit voltage drop, 120 V branch circuits with length from panel to first outlet exceeding 75 feet (22.86 m) shall be #10 or larger. For 277 V branch circuits with length from panel to first outlet exceeding 175 feet (53.34 m) shall be #10 or larger. Wire sizes for other branch circuits shall be sized to limit voltage drop to 3 %.

E. Solid wire #10 and smaller shall be connected as specified herein and shall be made tight in conformance with manufacturers recommendations.

F. Stranded wire shall be connected as specified herein and thoroughly taped with "Scotch" #33 or acceptable substitution approved equal electrical tape.

G. Provide equipment lugs compatible with wire sizes indicated. Lugs shall not be rated less than equipment rating. Provide box sizes to accommodate wire bending radius requirements. Revise feeders as needed, maintaining the ampere rating and fault current values indicated, for compatibility with equipment lugs, UL listings, or manufacturer's recommendations.

H. Install wiring after concrete, plastering, etc., work is complete. Carefully pull wire unspliced between outlets. Use approved pulling lubricant as necessary to prevent insulation cutting or

nicking. Branch circuit and feeder wiring shall be color coded in accordance with NEC and in accordance with the following schedule:

1. Conductor Color Coding
2. Conductor Insulation Color
3. Conductor

	240/120V, 1 Phase	208Y/120V 3 Phase	480Y/277V 3 Phase
Phase A	Black	Black	Brown
Phase B	Red	Red	Orange
Phase C	--	Blue	Yellow
Neutral	White	White	White
Ground	Green	Green	Green

I. Motor circuits and feeders shall utilize stranded conductors.

3.6 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above removable ceilings or in electrical room, utility rooms, or storage areas.

B. Pull and junction boxes shall be supported independently of the conduit system and shall be plumb. Supports shall be noncombustible and corrosion resistant. Suspended pull and junction boxes shall be supported with threaded rod hangers and galvanized steel clamps, or trapeze hangers of Unistrut or Kindorf channel.

C. Pull and junction boxes shall be accessible.

3.7 OUTLET BOX INSTALLATION

A. Each lighting outlet, switch, convenience outlet, communication outlet, or other miscellaneous device shall be provided with a suitable box.

B. Convenience outlets and telephone and data outlets shall be provided with double gang boxes and single device trim plates where single devices are indicated.

C. Where two or more similar type devices occur adjacent to each other, they shall be in a gang type box with a gang type cover. Where different type devices occur adjacent to each other, space outlet boxes so that finish plates shall be spaced 1 inch (2.54 cm) apart.

D. Install outlet boxes securely in place, plumb with building lines in accordance with NEC Recess outside edge and associated trim plates from finished surface in accordance with NEC. Provide blank covers, which match device plates in area, for outlets not specified with covers. Outlets in plastered, paneled, and furred finishes shall be equipped with trim plates and extensions of such depths as to bring outlets flush with final surface finish.

E. Sectional boxes shall not be used where outlet boxes occur in concrete.

F. Boxes shall be supported independently of the conduit system and shall be plumb. Supports shall be noncombustible and corrosion resistant. Suspended boxes shall be supported with threaded rod hangers and galvanized steel clamps, or trapeze hangers of Unistrut or Kindorf channel. Where the suspended ceiling system is approved for the application, outlet boxes may be supported with bar hangers attached to the ceiling channels.

G. Install additional straps or cross-bracing to ensure complete rigid installation in steel stud system, bracing prior to installation of wall finish material.

H. "Back-to-Back" outlets in the same wall, or "thru-wall" type boxes shall not be permitted. Provide 12 inch (30.48 cm) (minimum) long nipple to offset outlets shown on opposite sides of a common wall to minimize sound transmission.

I. Unused knockouts in boxes shall be left sealed.

J. Provide luminaire outlets with 3/8 inch (0.95 cm) no bolt fixture stud where required.

K. Telephone outlets shall be mounted at the same height as adjacent receptacle outlets unless noted otherwise.

L. Refer to architectural and electrical plans for heights of outlets.

M. Mount outlets horizontally or vertically as directed by the CDOT Representative. Above counter outlets shall be mounted horizontally, unless otherwise noted or directed. Mount outlets at heights that comply with ADA and ANSI requirements.

3.8 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

A. Feeders: Type THHN/THWN insulated conductors in raceway.

B. Underground Feeders and Branch Circuits: Type THWN or single-wire, Type UF insulated conductors in raceway.

C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.

D. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.9 WIRING INSTALLATION

A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

B. Install wiring at outlets with at least 12 inches (300 mm) of slack conductor at each outlet.

C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.10 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.11 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
6. Steel: Welded threaded studs or spring-tension clamps on steel.

    a. Field Welding: Comply with AWS D1.1.

7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.

9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.12 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.13 CONCRETE PADS

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use psi specified in Division 3. 28-day compressive-strength concrete and reinforcement as specified in Section 03300 "Cast-in-Place Concrete."

3.14 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.15 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Raceways
2. Building wire and connectors
3. Supporting devices for electrical components
4. Electrical identification
5. Concrete bases
6. Cutting and patching for electrical construction
7. Touchup painting

B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.

1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
3. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
5. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

3.16 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Section 09900 "Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.17 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 16060
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Sections include the following:
   1. Section 16140: Wiring Devices

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Data: For the following:

   1. Ground rods

C. Field Test Reports: Submit written test reports to include the following:

   1. Test procedures used
   2. Test results that comply with requirements
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

   1. Comply with UL 467.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Grounding Conductors, Cables, Connectors, and Rods:
   a. Galvan Industries
   b. Lyncole XIT Grounding
   c. O-Z/Gedney Co.; a business of the EGS Electrical Group
   d. Raco, Inc.; Division of Hubbell
   e. Thomas & Betts Corporation

2.2 GROUNDING CONDUCTORS

A. Material: Copper

B. Equipment Grounding Conductors: Insulated with green-colored insulation.

C. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

D. Grounding Electrode Conductors: Stranded cable

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3
2. Assembly of Stranded Conductors: ASTM B 8
3. Tinned Conductors: ASTM B 33

G. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel

1. Size: 5/8 by 96 inches (16 by 2400 mm) in diameter.

PART 3 - EXECUTION

3.1 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.

F. Underground Grounding Conductors: Use tinned-copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade or bury 12 inches (300 mm) above duct bank when installed as part of the duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

C. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

E. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

F. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

G. Water Heater: Install a separate equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

H. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6.4-by-50-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Do not install any grounding conductors exposed on the building exterior. All grounding conductors shall be installed underground or routed indoors. Do not install any copper conductors exposed where they could be considered readily accessible to vandalizing or theft.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250-81(c), using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete. Do not install any grounding conductors exposed on the building exterior. All grounding conductors shall be installed underground or routed indoors. Do not install any copper conductors exposed where they could be considered readily accessible to vandalizing or theft.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
    a. Equipment Rated 500 kVA and Less: 10 ohms
    b. Equipment Rated 500 to 1000 kVA: 5 ohms
    c. Equipment Rated More Than 1000 kVA: 3 ohms
    d. Substations and Pad-Mounted Switching Equipment: 5 ohms
    e. Manhole Grounds: 10 ohms
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.8 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

SECTION 16075
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

B. Related Sections

1. Section 16050: Basic Electrical Materials and Methods
2. Section 16140: Wiring Devices
3. Section 16442: Panelboards

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE LABELS

A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

1. Color:
   a. Data: Black letters on orange field.
   b. Phone: Black letters on Blue field.
2. Legend: Indicates voltage and service.

B. Pre-tensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pre-tensioned gripping action when placed in position.

C. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.

1. Not less than 6 inches wide by 4 mils thick (152 mm wide by 0.102 mm thick).
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend indicating type of underground line.

D. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch- (0.4-mm-) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

E. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.

F. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch (0.05 mm) thick, laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application.

G. Brass or Aluminum Tags: 2 by 2 by 0.05-inch (51 by 51 by 1.3-mm) metal tags with stamped legend, punched for fastener.

2.2 NAMEPLATES AND SIGNS

A. Safety Signs: Comply with OSHA Regulations 29 CFR, Chapter XVII, Part 1910.145.

B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.

C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm)
2. Tensile Strength: 50 lb (22.3 kg) minimum
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C)
4. Color: According to color-coding

B. Paint: Formulated for the type of surface and intended use.

1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. 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 Project.

C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Install painted identification according to manufacturer's written instructions and as follows:

1. Clean surfaces of dust, loose material, and oily films before painting.
2. Prime surfaces using type of primer specified for surface.
3. Apply one intermediate and one finish coat of enamel.

E. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:

1. Bands: Pre-tensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
3. Apply the following colors to the systems listed below:

    a. Fire Alarm System: Red
    b. Fire-Suppression Supervisory and Control System: Red and yellow
    c. Combined Fire Alarm and Security System: Red and blue
    d. Security System: Blue and yellow
    e. Mechanical and Electrical Supervisory System: Green and blue
    f. Telecommunication System: Green and yellow

F. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.

G. Circuit Identification Labels on Boxes: Install labels externally.

1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
2. Concealed Boxes: Plasticized card-stock tags.

3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

H. 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 (150 to 200 mm) below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm) overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

I. Color-Coding of Secondary Phase Conductors: Use the following colors for service, feeder, and branch-circuit phase conductors:

1. 208/120-V Conductors:

   a. Phase A: Black
   b. Phase B: Red
   c. Phase C: Blue

2. 480/277-V Conductors:

   a. Phase A: Brown
   b. Phase B: Orange
   c. Phase C: Yellow

3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:

   a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
   b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

J. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.

1. Legend: 1/4-inch- (6.4-mm-) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
2. Tag Fasteners: Nylon cable ties
3. Band Fasteners: Integral ears

K. Apply identification to conductors as follows:

1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.

L. Apply warning, caution, and instruction signs as follows:

1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

M. Equipment Identification Labels: Engraved plastic laminate. Install 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- (13-mm-) high lettering on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:

1. Panelboards, electrical cabinets, and enclosures
2. Access doors and panels for concealed electrical items
3. Electrical switchgear and switchboards
4. Emergency system boxes and enclosures
5. Disconnect switches
6. Enclosed circuit breakers
7. Motor starters
8. Push-button stations
9. Contactors
10. Control devices
11. Transformers
12. Telephone switching equipment
13. Fire alarm master station or control panel

END OF SECTION

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SECTION 16121
COMMUNICATION CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. Provide a complete system of cables for the voice and data service to a single building with one DMARC.

B. Related Sections:

1. Refer to Section 06000 for DMARC plywood panel

2. Refer to Section 16075 for Electrical Identification

1.3 DEFINITIONS

A. AWG: American Wire Gauge

B. DMARC: Demarcation Point – Public Network ends and connects to on premise wiring.

C. EMT: Electrical Metallic Tubing

D. INNERDUCT: Divides large conduit for the placement of underground fiber

E. MULTIMODE FIBER: Optical Fiber used for transmission over short distances

F. OIT: State of Colorado's Office of Information Technology

G. PVC: Polyvinyl Chloride Conduit

H. RNC: Rigid Non-Metallic Conduit

I. SINGLE MODE FIBER: Optical Fiber used for long distance transmission

J. UTP: Unshielded Twisted Pair (Also referred to as "copper" or "Category 5e/6/6a"

1.4 SUBMITTALS

A. Product Data: Communication conduit and fittings, inner duct, copper ground, wall mount server rack, wiring block, multimode fiber, EMT, ladder racks, category 5e or category 6/6A cable,

1. Cable numbering scheme and tagging system

2. Warranty Information

3. As-Builts in accordance with section 01700

1.5 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards (latest edition and/or version), except where more stringent requirements are shown or specified elsewhere.

1. NEC National Electric Code, Current Edition adopted by Jurisdiction

2. NEMA TC-2-2013/NEMA TC-3-2013 Covers electrical PVC conduit normal-duty applications

3. ANSI/TIA/EIA 569B Commercial Building Telecommunications Standard

4. ANSI/TIA/EIA 606A/B Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

5. ANSI/J/STD - 607A Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

6. TIA TSB-140 Additional Guidelines for Field Testing Length, Loss and Polarity of Optical Fiber Cabling Systems

7. BICSI Telecommunications Distribution Methods Manual, 13th Edition, 2014

8. ASTM E-814 Fire Tests of Through Penetration Firestops

9. UL Underwriters Laboratory

10. FCC Federal Communications Commission

11. OSHA Standard 29 CFR 1910.268 COORDINATION

1.6 COORDINATION

A. Coordinate layout and installation of components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Contractor shall supply all material necessary for completion and proper data and voice cabling installation.

PART 2 - PRODUCTS

2.1 UNGERGROUND AND SERVICE ENTRANCE CONDUIT

A. The contractor shall provide and install 2 (two), four inch underground conduits from the existing communication pedestal to the DMARC as indicated on the drawings. Each conduit is to be of 4 inch diameter or per code (whichever is greater).

1. All conduits shall be Schedule 40 PVC RNC and include a #200 nylon pull cord.

2. Conduit shall be installed using sweeps and not elbows and shall not have more than three bends between communication pedestal and the DMARC. The total amount of bends in the conduit shall not exceed 270 degrees.

B. The contractor shall install three (3) 1 1/4 inch single wall (no split) plenum rated, orange, corrugated fiber inner duct with pull in ONE of the 4 inch underground conduits.

1. Inner duct shall be manufactured from High Density Polyethylene (HDPE)

C. When conduit is required from the service jack location to the associated DMARC, contractor shall install a minimum 3/4 inch EMT. All open conduit ends must be reamed and have bushings installed.

1. Service entrance conduits shall be spaced a minimum of 12 inches, but not more than 48 inches from the electrical service

2.2 DMARC

A. A plywood backboard is required in DMARC areas. Refer to section 06000 for backboard requirements.

1. The backboard shall be a minimum of four feet by four feet and sized to fit the specific location, secured to the wall with appropriate anchors

2. The backboard shall not be installed in an accessible route.

3. Mount the backboard with the bottom edge at 36 inches above the floor.

B. Contractor to provide No. 4 AWG minimum copper insulated grounding conductor in raceway from grounding electrode system to DMARC.

2.3 HORIZONTAL COMMUNICATION CABLES

A. Horizontal cabling is the portion of the cabling system that extends from network devices to the DMARC. The system also includes the patch at the DMARC.

B. If the run is vertical, run cables in bundles, neatly tied together and to building supports with Velcro straps Where the run is horizontal, place cables in rings so that the cable is not sitting on the ceiling.

C. Data and voice cable as well as service outlets are to be Plenum Rated Category 5e or Category 6/6A UTP meeting ANSI/TIA/EIA 568-B.3. Data shall be orange in color and voice shall be blue in color.

D. Contractor to pull data and voice cabling from the outlets to homerun at the DMARC. All cable runs are to be homeruns and shall have a service loop of at least 18 inches.

E. Unless otherwise specified, each service outlet shall be a duplex outlet, one for voice and one for data.

F. Wall plates shall be white in color, unless otherwise specified. Empty ports will be filled with blank inserts.

G. Trim all outlets and endpoints. Label each outlet cover plate and label each homerun within the DMARC.

H. Patch cords shall be Category 6/6A UTP and shall be appropriately sized (minimum 3 feet, maximum 5 feet).

PART 3 - EXECUTION

3.1 GENERAL

A. The maximum allowed pulling tension to the cable must not exceed the pulling tension specified by manufacturer. Monitor the cable pull strength at all times by using a remote sensing puller, strain gauge, or running line tension meter.

B. Observe minimum cable bending radius requirements as determined by the cable manufacturer.

C. Run cable continuously from terminating point to terminating point without splices. No splices or cable tape shall be permitted.

D. Support the cable on stands at all times when unreeling or pulling cable. Do not uncoil cable from sides of stationary reels. Provide protection at all times when using pulling loops.

E. Use a pulling lubricant to minimize friction between the cables and the conduit walls when the installation requires multiple bends. Lubricants should only be used for difficult pulls.

F. Where communication cables pass through termination closets, provide a coiled loop of length sufficient to terminate both ends of cable at any location within the closet. Do not cut cables. Termination and testing of cables shall be by contractor.

G. Avoid locating cables close to steam pipes or other heat generating equipment. Do not support from existing piping or conduit.

3.2 TAGGING & AS-BUILTS

A. Label each outlet cover plate and label cables at each junction box, outlet box, and termination point with indelible tags indicating origination and destination along with function of cable. Refer to section 16075 for Identification requirements.

B. Submit cable numbering scheme and tagging system to CDOT Representative for review.

C. Provide As-Built drawings as indicated in Section 01700

3.3 TERMINATION AND TESTING

A. Termination and testing of the cable shall be completed by the contractor. After the building is completed, OIT will activate and make final phone and data connection to the equipment mounted at the demark panel.

1. Testing shall meet the Institute of Electrical and Electronics Engineers Standards Associate Standards by testing the following variables:
   a. Wire Map
   b. Length
   c. Insertion loss
   d. Pair-to-pair near end crosstalk (NEXT)
   e. Power sum near end crosstalk (PSNEXT)
   f. Equal level far end crosstalk (ELFEXT)
   g. Power sum equal level far end crosstalk (PSEFFEXT)
   h. Return loss (RL)
   i. Propagation delay
   j. Delay Skew

B. Ordering and scheduling of phone and data service to be completed by OIT. Coordinate with OIT representative a minimum of twelve weeks prior to Substantial completion for ordering of phone service.

3.4 CERTIFICATION AND WARRANTY

A. Contractor shall be certified to install all components by the manufacturer.

B. The contractor shall provide manufacture's system warranty for all installed components. Such warranty shall include the cable and all components installed as part of the manufacturers' cabling system and shall include a performance warranty that guarantees the horizontal and backbone cabling systems will support performance specifications as stated in ANS/TIA/EIA-568-B. CAT 5 and CAT 6/6A UTP shall be warranted to the link performance minimum expected results defined in ANSI/TIA/EIA-568-B.2-1. Fiber-optic links shall be warranted to the link and segment performance minimum expected results defined in ASIT/TIA/EIA-58-B-4.

END OF SECTION

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SECTION 16130
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Section 16050: "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
2. Section 16140: "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing

B. FMC: Flexible metal conduit

C. IMC: Intermediate metal conduit

D. LFMC: Liquidtight flexible metal conduit

E. LFNC: Liquidtight flexible nonmetallic conduit

F. RNC: Rigid nonmetallic conduit

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Available Manufacturers:

1. Allied
2. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
3. LTV Steel Tubular Products Company.
4. Thomas & Betts Corporation
5. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

E. Plastic-Coated IMC and Fittings: NEMA RN 1.

F. EMT and Fittings: ANSI C80.3.

1. Fittings: Set-screw type.

G. FMC: Zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers:

1. Carlon Products
2. Cantex
3. Certainteed Corp.; Pipe & Plastics Group

4. Thomas & Betts Corporation

B. Rigid Nonmetallic Conduit (RNC): NEMA TC 2 and UL 651, Schedule 40 or 80 PVC.

C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

2.4 METAL WIREWAYS

A. Available Manufacturers:

1. Hoffman
2. Square D

B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 3R.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Hinged type.

F. Finish: Manufacturer's standard enamel finish.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Hoffman
3. Hubbell, Inc.; Killark Electric Manufacturing Co.
4. RACO; Division of Hubbell, Inc.
5. Thomas & Betts Corporation

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Hinged-Cover Enclosures: NEMA 250, Type 3R, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

F. Cabinets: NEMA 250, Type 3R, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.6 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid steel or IMC
2. Concealed: Rigid steel or IMC
3. Underground, Single Run: RNC
4. Underground, Grouped: RNC
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC
6. Boxes and Enclosures: NEMA 250, Type 3R

B. Indoors:

1. Exposed: EMT
2. Concealed: EMT
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations
4. Damp or Wet Locations: Rigid steel conduit
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

    a. Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.

C. Minimum Raceway Size: 3/4-inch trade size (DN 21).

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

3.2 INSTALLATION

A. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

F. Make bends and offsets so internal diameter is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

H. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

I. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

J. Tighten set screws of threadless fittings with suitable tools.

K. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

M. Telephone and Signal System Raceways, 2-Inch Trade Size (DN 53) and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

N. Flexible Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

O. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

P. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION

SECTION 16140
WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Single and double-duplex receptacles, ground-fault circuit interrupters.
2. Single- and double-pole snap switches and dimmer switches.
3. Device wall plates.
4. Pin and sleeve connectors and receptacles.

B. Related Sections include the following:

1. Section 16050: Basic Electrical Materials and Methods
2. Section 16060: Grounding and Bonding
3. Section 16410 Enclosed Switches and Circuit Breakers
4. Section 16075: Electrical Identification
5. Section 16130: Raceways and Boxes

1.3 DEFINITIONS

A. EMI: Electromagnetic interference

B. GFCI: Ground-fault circuit interrupter

C. PVC: Polyvinyl chloride

D. RFI: Radio-frequency interference

E. TVSS: Transient voltage surge suppressor

F. UTP: Unshielded twisted pair

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wiring Devices:

a. Bryant Electric, Inc./Hubbell Subsidiary
b. Eagle Electric Manufacturing Co., Inc.
c. Hubbell Incorporated; Wiring Device-Kellems
d. Leviton Mfg. Company Inc.
e. Pass & Seymour/Legrand; Wiring Devices Div.

2.2 RECEPTACLES

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.

B. Straight-Blade and Locking Receptacles: Heavy-Duty grade.

C. GFCI Receptacles: Straight blade, feed-through type, Hospital grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter.

D. Industrial Heavy-Duty Pin and Sleeve Devices: Comply with IEC 309-1.

2.3 SWITCHES

A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

B. Snap Switches: Heavy-Duty grade, quiet type.

C. Gate Operators: Fire Department Access: Provide Knox Box – Refer to Section 10520

2.4 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Wet Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.5 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70.

2.7 WEATHER PROOF ENCLOSURES

A. NEMA 3R rating while in use when used with manufacturer's recommended outlet box. Gaskets are closed cell foam. Meets OSHA lockout and tagout requirements. Enclosures shall have latching covers and cord openings. UL listed and CSA certified with clearly marked logos. Covers include gasket and mounting screws. Lids have gasketless design. Holes for padlocks are 1/4 inch thick

B. Metallic type shall be die cast allow 360 copper-free aluminum with standard gray baked aluminum lacquer finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.

C. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

D. All 15 ampere and 20 ampere, 120 volt and 250 volt non locking receptacles installed in damp or wet location shall be listed as weather resistant.

E. Remove wall plates and protect devices and assemblies during painting.

3.2 IDENTIFICATION

A. Comply with Section 16075 "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

2. Devices indicated as weather proof shall have a weatherproof enclosure and shall be marked on the outside "Suitable for wet location while in use"

3.3 CONNECTIONS

A. Ground equipment according to Section 16060 "Grounding and Bonding."

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION

SECTION 16410
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:

1. Service disconnecting means
2. Feeder and branch-circuit protection
3. Motor and equipment disconnecting means

B. Related Sections include the following:

1. Section 16140 "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
2. Section 16491 "Fuses" for fusible devices.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter

B. RMS: Root mean square

C. SPDT: Single pole, double throw

1.4 SUBMITTALS

A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

B. Field Test Reports: Submit written test reports and include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:

1. Routine maintenance requirements for components.
2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
3. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA AB 1 and NEMA KS 1.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Fusible Switches:

    a. Eaton Corp.; Cutler-Hammer Products
    b. General Electric Co.; Electrical Distribution & Control Division
    c. Siemens Energy & Automation, Inc.
    d. Square D Co.

2. Molded-Case Circuit Breakers:

    a. Eaton Corp.; Cutler-Hammer Products
    b. General Electric Co.; Electrical Distribution & Control Division
    c. Klockner-Moeller
    d. Siemens Energy & Automation, Inc.
    e. Square D Co.

2.2 ENCLOSED SWITCHES

A. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.

2.3 ENCLOSED CIRCUIT BREAKERS

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

    a. Instantaneous trip
    b. Long- and short-time pickup levels
    c. Long- and short-time time adjustments
    d. Ground-fault pickup level, time delay, and I^2t response

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.
7. Molded-Case Switch: Molded-case circuit breaker without trip units.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4

2.5 FACTORY FINISHES

A. Manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.4 CONNECTIONS

A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.

B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
2. Test continuity of each line- and load-side circuit.

B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 16442
PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:

1. Lighting and appliance branch-circuit panelboards.

B. Related Sections include the following:

1. Section 16075: Electrical Identification
2. Section 16491: Fuses

1.3 DEFINITIONS

A. EMI: Electromagnetic interference

B. GFCI: Ground-fault circuit interrupter

C. RFI: Radio-frequency interference

D. RMS: Root mean square

E. SPDT: Single pole, double throw

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings and finishes.

B. Field Test Reports: Submit written test reports and include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

D. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Eaton Corp.; Cutler-Hammer Products.
b. General Electric Co.; Electrical Distribution & Control Div.
c. Siemens Energy & Automation, Inc.
d. Square D Co.

2.2 FABRICATION AND FEATURES

A. Enclosures: Surface-mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.

B. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

C. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

D. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

E. Bus: Hard-drawn copper, 98 percent conductivity.

F. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.

G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

H. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

I. Gutter Barrier: Arrange to isolate individual panel sections.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.

B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

E. Install filler plates in unused spaces.

F. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 16075 "Electrical Identification."

B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

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SECTION 16491
FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

1.2 SUMMARY

A. This Section includes cartridge fuses, rated 600 V and less, for use in switches, panelboards, switchboards, controllers, and motor-control centers; and spare fuse cabinets.

B. Related Sections include the following:
1. Section 16410: Enclosed Switches and Circuit Breakers
2. Section 16442: Panelboards

1.3 SUBMITTALS

A. Product Data: Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings for each fuse type indicated.

B. Maintenance Data: For tripping devices to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide fuses from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Cooper Industries, Inc.; Bussmann Div.
   2. General Electric Co.; Wiring Devices Div.
   3. Tracor, Inc.; Littelfuse, Inc. Subsidiary

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Main Service: Class RK1, fast acting

B. Main Feeders: Class RK1, fast acting

C. Motor Branch Circuits: Class RK5, time delay

D. Other Branch Circuits: Class RK5, fast acting

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION

SECTION 16511
LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section. Comply with ASHRAE ANSI Standard 90.1 2013 Standards for energy efficiency standards and Lighting Comcheck.

1.2 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures with lamps and ballasts
2. Lighting fixtures mounted on exterior building surfaces
3. Emergency lighting units
4. Exit signs
5. Occupancy sensors

B. Provide luminaires, lamps, ballasts, and accessories in accordance with the Drawings and Specifications.

C. Luminaires requiring caps, mounting spaces, hold-down clips or other accessory items shall be furnished complete with same whether the descriptions, catalog numbers and notes on the Drawings include such items or not.

1.3 DEFINITIONS

A. BF: Ballast factor. Ratio of light output of a given lamp(s) operated by the subject ballast to the light output of the same lamp(s) when operated on an ANSI reference circuit.

B. CRI: Color rendering index.

C. CU: Coefficient of utilization.

D. LER: Luminaire efficiency rating, which is calculated according to NEMA LE 5. This value can be estimated from photometric data using the following formula:

1. LER is equal to the product of total rated lamp lumens times BF times luminaire efficiency, divided by input watts.

E. RCR: Room cavity ratio.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of fixture, including dimensions and verification of indicated parameters
2. Emergency lighting unit battery and charger
3. Lamps

B. Photometric reports performed by independent testing laboratory.

C. Wiring Diagrams: Power, signal, and control wiring.

D. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01782 “Operation and Maintenance Data" include the following:

1. Catalog data for each fixture. Include the diffuser, ballast, and lamps installed in that fixture.

1.5 EXTRA MATERIALS

A. Lenses: 1 for every 100 of each type installed but not less than 1.

B. Guards: 1 for every 20 of each type installed but not less than 1.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.7 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 GENERAL

A. Luminaires shall have manufacturer’s standard finish unless otherwise notes. Provide “Damp Location” label where indicated or required.

B. Recessed or semi-recessed luminaries shall be designed to be compatible with ceiling as installed. Furnish and install frames where required for proper installation. Supply with trim that is compatible with ceiling system in which it shall be installed.

C. Luminaires shall have integral LED drivers unless otherwise noted. LED drivers for recessed luminaires shall be fully accessible through ceiling opening of luminaire unless otherwise noted.

D. Luminaires shall be of the prewired type with integral junction box.

E. Luminaires shall be labeled with acceptable lamping. Labeling shall be in a location that is visible during relamping.

2.2 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

B. Luminaires shall be of manufacturer and type as indicated or scheduled on the drawings or an approved equal.

C. Lamps:

1. General Electric
2. Osram/Sylvania
3. Philips
4. Venture (for metal halide)

D. Battery Pack Assemblies

1. Bodine
2. Lightolier
3. Lithonia

2.3 FIXTURES AND COMPONENTS, GENERAL

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. LED Fixtures: Comply with ANSI C82.11 and be UL Listed

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

E. 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.

F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

G. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is scheduled.
b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

H. Fixture Support Components

1. Comply with Section 16050: "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.

2. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

2.4 EXIT SIGNS

A. XI: LED EXIT SIGNS: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.

1. X1: LED Emergency Exit Sign, universal mount.
   a. Basis of Design Product : Dual-Lite LXUGBE
   b. Acceptable substitution: Lithonia LQM S 3 G 120/277 EL N M6

2. Internally Lighted Signs:
   a. Lamps for AC Operation: 2 for each fixture, 20,000 hours of rated lamp life.

3. Self-Powered Exit Signs (Battery Type): Self-contained, modular, battery-inverter unit with heater, factory mounted within fixture body.
   a. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.
   c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.5 EMERGENCY LIGHTING UNITS

A. EM1: Interior Emergency Lighting, wall-mount.

1. Acceptable Products include:
   a. Lightolier EN-1-18L-T12-W-SD2
   b. Lightolier ER1-T6-WG
   c. Dual-Lite EV-2-1

2. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.

3. Charger: Fully automatic, solid-state type with sealed transfer relay.

4. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

5. Wire Guard: Where indicated, heavy-chrome-plated wire guard protects lamp heads or fixtures.
6. Integral Time-Delay Relay: Holds unit on for fixed interval when power is restored after an outage; time delay permits high-intensity-discharge lamps to restrike and develop adequate output.

B. EM2: Exterior Emergency Egress Lighting Unit, wall mount, LED

1. Product: Dual-Lite PGZ-HTR emergency light with battery back-up and heater. Color: Bronze Operating Temperature -22 degrees F to 122 degrees F
2. Self-contained, modular, battery-inverter unit with heater, factory mounted within fixture body. Comply with UL 924, UL Wet Location Listed, and IES full cut-off compliant with field installed shield.

2.6 INTERIOR FIXTURES (LED)

A. F2: Wall-mount interior fixture, 2 foot long LED surface fixture

1. Basis of Design Product: Lithonia WL2 22L EZ1 LP840

2. Alternate Product: H.E. Williams WMA-2-LEDOH30-840-AF-120

B. F3: Recessed LED can down light, 6 inch diameter recessed can.

1. Basis of Design Product: Lithonia LDN6 35/15 LO6AR TRW 120

2. Alternate Product: Prescolite D6LED-3DM6D9-LED-335K-9WT

C. F3E: Recessed LED can down light, 6 inch diameter recessed can.

1. Basis of Design Product: Lithonia LDN6 35/15 LO6AR TRW 120 EL

2. Alternate Product: Prescolite D6LED-3DM6D9-LED-335K-9WT

D. F4: Interior Office LED Fixture: 2 ft x 4 ft recessed parabolic reflector

1. Basis of Design Product: Lithonia 2AVL4 40L MDR MVOLT EZ1 LP840

2. Alternate Product: Pinnacle Parabolic Reflector ADEO AD24A-2T8-G1-UNV-2C-W

3. Alternate LED Fixture: Pinnacle LU24A-3545-GL-120-1C-W (note Contractor to provide additional battery powered emergency lights when using this option as light doesn't offer emergency backup)

E. F4E: Interior Office LED Fixture: 2 ft x 4 ft recessed parabolic reflector emergency light

1. Basis of Design Product: Lithonia 2AVL4 40L MDR MVOLT EZ1 LP840 EL7L

2. Alternate Product: Pinnacle Parabolic Reflector ADEO AD24A-2T8-G1-UNV-2C-W -1B

F. F6: Surface mount 1 foot x 4 foot LED linear strip fixture for wet locations with polycarb lens.

1. Basis of Design Product: Lithonia ZL1N L48 3000LM FST MVOLT 40K 80CRI WH

2. Alternate Product: Columbia Lighting LUN4-232

2.7 OCCUPANCY SENSORS

A. Provide occupancy sensors in offices, bathrooms, storage rooms, and open admin area in compliance with the ASHRAE 90.1 Standards - 2013.

B. Products: Sensor Switch WSD Series or approved equal

2.8 ACCESSORIES

A. Battery Pack Assemblies: LED luminaires indicated to include battery packs shall contain a battery pack assembly consisting of a battery, charger, inverter, and electronic circuitry enclosed in one compact red case. Battery packs shall operate LEDs to produce a minimum of 1100 lumens unless otherwise noted. Luminaire shall have valid UL label with battery pack installed at luminaire manufacturer's factory.
   1. Test Switch and LED Indicator Light: Charging indicator light to monitor the charger and battery with test switch and hardware. Visible and accessible without opening fixture or entering ceiling space, and integral to luminaire unless otherwise noted.
   2. Battery: High-temperature, maintenance-free, nickel-cadmium type with minimum 10-year nominal life. Capable of operating lamp for a minimum of 90 minutes.
   3. Charger: Fully automatic, solid-state, constant-current type.
   4. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Relay disconnects lamp and battery and automatically recharges when normal voltage is restored.
   5. Self-testing and Self-diagnostic: Continually monitors charging current and battery voltage, and automatically performs a minimum 30 second test and diagnostic routine at least once every 30 days and once a year for 90 minutes. Unit indicates failure by a status indicator light and audible alarm.

B. Poles, bracket arms, appurtenances, and anchorage material shall be of matching color. Same shall be sufficient to support effective projected areas of luminaires and pole supplied without failure, permanent deflection, or damage to lamp filaments against steady winds of 100 mi/hr (160 km/hr) with a gust factor of 1.3.

PART 3 - EXECUTION

3.1 GENERAL

A. Confirm compatibility and interface of other materials with luminaire and ceiling system. In the event of any discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been resolved.

B. Coordinate the installation of luminaires with the schedule of work of other trades to prevent unnecessary delays in the total work.

C. Where luminaires are shown in conflict with locations of structural members, mechanical or other equipment, furnish and install all required supports and wiring to clear the encroachment.

D. Luminaires shall be installed as indicated and/or noted and in accordance with the NEC and the manufacturer's recommendations. Where mounting dimensions are not shown, refer to Architectural drawings for installation details.

E. Luminaires shall be located in accordance with architectural reflected ceiling plans unless otherwise indicated. Luminaire locations shall be exactly moduled with ceiling tile where same occurs.

F. Recessed luminaires shall be complete with all required hardware and accessories in each case. Where "lay-in" luminaires cannot be used in suspended ceilings, recessed luminaires shall be installed complete with bar hangers and shall be supported from the ceiling suspension system.

G. In areas with "lay-in" ceilings, support wires shall be used to connect recessed, surface, or pendant mounted luminaires to the structure above. Recessed and surface mounted luminaires shall also be positively attached to the suspension system of the "lay-in" ceiling assembly.

H. Surface-mounted luminaires shall be supported from outlet box fixture studs, mounting brackets or mounting straps or shall be secured directly to the structural system. Outlet boxes and mounting brackets (or straps) shall be secured to a joist or similar structural unit or to an approved metal support which is secured to such a structural unit. The use of toggle bolts for luminaire support shall not be permitted.

I. Wall-mounted luminaires shall be supported by wall brackets secured to luminaire studs in the outlet boxes or to outlet box "ears."

J. Installation of luminaires in mechanical rooms shall be coordinated with the ductwork and other obstructions. Provide special hangers as required.

K. Photocells shall be mounted in a protected area facing north and shall be shielded to prevent influence from other night lighting sources. Set relay contact closure at approximately 2 footcandles (20 lux).

L. Clean all luminaires of construction dirt and paint prior to project close out. Use methods and materials recommended by manufacturer.

3.2 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners.
2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

C. Adjust aimable fixtures to provide required light intensities.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Verify normal operation of each fixture after installation.

C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

E. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

END OF SECTION

SECTION 16721
FIRE ALARM AND DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract (Design/Bid/Build) and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section

B. Related Sections:

1. Section 10520 Fire Protection Specialties
2. Section 16050 Basic Electrical Materials and Methods

1.2 SUMMARY

A. Work Included: Furnish all labor, equipment, material and performance of all operations associated with the installation of the fire alarm system as shown on the drawings and as herein specified, in order to provide a complete operating system.

B. New horn, strobes, detectors and installation in accordance with the manufacturer's recommendations and as required by the local authority having jurisdiction.

1.3 SUBMITTALS

A. Shop Drawings, Wiring Diagrams and Product Data for review and sign off by CDOT Representative and Fire Department Authority

B. Submit Manufacturer's installation instructions under provisions of Division 1.

C. Submit Manufacturer's descriptive literature for maintenance and repair data under the provisions of Division 1.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers and products include:
1. Basis of Design: Kidde United Technologies
2. Other CDOT approved manufacturers that meet this specification

B. Each and every item of the fire alarm system shall be listed as the product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratory, Inc. (U.L.) and shall bear the U.L. label on all devices, appliances and panels comprising the system. All control equipment shall be listed under the category UOJZ as a single control unit. Partial listings shall be unacceptable.

C. The complete installation shall conform to the applicable sections of NFPA-72, Local Code Requirements, and the National Electrical Code with particular attention to article 760.

2.2 FIRE ALARM PERIPHERAL DEVICES

A. General. The location of devices will be selected to optimize the system layout in order to provide the level of protection, zone identification and control as shown on the drawings.

B. Combination smoke and carbon monoxide detector with battery back-up. Kidde 900-0114A or CDOT approved equal.

C. Fire Alarm Strobe. Provide High impact resistant strobe devices as shown on the plans. Each assembly shall provide wire leads for wiring connections. The strobe unit shall be A.D.A. compliant. Kidde SL177i or CDOT approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring shall be installed in strict compliance with all the provisions of the National Electrical Code, Article 760 A and C, Power limited Fire Protective Signaling Circuits.

1. All junction boxes shall have the covers painted red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the facility.

2. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate contractors.

B. The completed fire alarm system shall be fully tested in accordance with NFPA-72 by the contractor in the presence of the owner's representative and the Fire Marshall. Upon completion of a successful test, the contractor shall so certify in writing to the owner and general contractor the test results in compliance with NFPA-72 sample forms.

C. The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of completed and certified test or from the date of first beneficial use.

1. The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two inspections and tests per year in compliance with the NFPA 72H guidelines.

END OF SECTION

Design/Bid/Build Scope of Work – La Junta Training Room Remodel

Project # 21914
July 12, 2017

Project Location:

28201 West Highway 50, La Junta, CO 81050
SAP Building # 1000/2/47

Project Description:

Qualified General Contractors are invited to bid on an interior remodel of an existing maintenance facility in La Junta, Colorado into a new training facility. Demolition includes demolishing existing plumbing fixtures, light fixtures, two exterior man doors, and two overhead doors. New construction includes patching the exterior walls, providing new insulation, and providing a new training room with associated HVAC system, restrooms, break area, mechanical room and vestibule. The existing building is approximately 1,870 square feet. The entire building shall receive new fixtures and finishes.

Existing asbestos has been identified in the existing vinyl flooring. The asbestos containing materials will be abated by CDOT prior to construction. Lead based paint has been detected on the existing exterior doors to be demolished, but the concentration is below the regulatory criteria and may be disposed of as non-hazardous waste. A copy of the report is available on the disc distributed at the pre-bid meeting.

Scope of Services:

The following documents will be distributed at the mandatory pre-bid meeting: Architectural drawings and specifications by CDOT; and Mechanical, Electrical and Plumbing drawings by contracted engineer MEP Engineering. The Scope of Work, bid drawings and specification should all be referenced during bidding and any contradictory information should be brought to the attention of CDOT; misunderstanding of any of the bid drawings, specifications and/or Scope of Work will not be grounds for change orders after the bid question period.

The Contractor is responsible for obtaining (and paying for) Permits from the State Electrical Inspector and the State Plumbing Inspector. By statute, local building permits are not required. Code inspections (including a framing inspection and insulation inspection) and one final code inspection shall be done by CDOT's contracted code inspector C-West, and shall be paid for by CDOT. Any additional code inspections due to the original inspection not passing will be paid for by the contractor to C-West.

This site falls under the jurisdiction of the La Junta Fire Department. Final Inspection by the Fire Department is required and shall be coordinated and paid for by the Contractor.

Refer to Project Specifications for additional details and requirements.

Site Work:

1. There is no site earth work in this project. No Storm Water Management Plan (SWMP) nor storm water permit is required.

2. Utility line work as shown on the drawings shall be coordinated with City of La Junta Electric. Owner shall pay required electric upgrade fees.

3. Provide a new pad mounted air condensing unit and protect with two (2) new six inch diameter steel pipe bollards.

Demolition:

4. The demolition for this remodel does not require a CDPHE permit. The contractor shall properly dispose of all materials scheduled for demolition. All recyclable materials, such as metals and concrete, should be recycled. Items scheduled to be returned to CDOT should be protected during demolition to prevent damage.

5. Demolish existing plumbing fixtures including one toilet, one lavatory and existing water heater.

6. Demolish existing hard plastic ceiling and existing batt insulation above. Remove existing interior light fixtures and one exterior light fixture and return to CDOT. Patch holes in roof from existing flues to match existing construction.

7. Demolish and dispose of two (2) existing man doors and two (2) existing ten foot by ten foot overhead garage doors and all associated tracks, hardware, motors, conduit and controls. Maintain water-tightness of building during demolition and construction.

8. Demolish exterior metal panels of east wall only. Entire east wall is to be re-sided and re-framed at demolished overhead doors. Maintain water-tightness of building during demolition and construction.

9. Demolish and dispose of one (1) exterior window where new restroom is to be constructed. Infill wall at demolished window to match existing construction.

10. The structure of existing exterior walls is to remain undisturbed. Demolish existing insulation. Replace with new insulation and furr out exterior walls per partition types on drawings.

11. Demolish two (2) existing portable fire extinguishers and replace with new extinguishers as located on the plans or as required by authority having jurisdiction.

12. Demolish existing 100 amp electrical panel. Existing electric meter and pole mounted transformer to remain. Coordinate with City of La Junta Electric for the timing of the upgrade to overhead feeder wire to the building. CDOT will pay utility directly for upgrade charges.

Walls:

13. Exterior walls are to receive new insulation, metal furring studs, vapor barrier and 5/8 inch gypsum board as shown on the drawings. Any existing holes in the exterior walls must be patched to match existing construction. At infill areas at demolished windows and doors, provide new exterior metal panel and vertical metal studs at 16 inches on center to match existing construction.

14. Interior walls shall have sound-attenuated batt insulation that completely fills the wall cavity.

15. Patch and repair existing walls affected by demolition and construction. Provide new paint at all walls.

16. Provide a four foot ceramic tile wainscot in each restroom. Provide 5/8 inch cementitious tile backer board behind tile to height of wainscot. The extent of the tile shall include all four walls in each restroom. Reference the interior elevations for tile layout. Provide a 4-1/4 inch tile cove base as the base course and bullnose tile pieces at the top. Provide sealant between the tile and wall.

17. Walls within two feet of mop sink basin in mechanical room shall have four foot wainscot of FRP, adhered to gypsum board wall.

Ceilings:

18. The new ceiling shall be lay-in acoustical tiles in a suspended grid ceiling with gypsum board at the restrooms and mechanical room ceilings.

Floors:

19. The existing floor is a combination of vinyl flooring and concrete. CDOT will remove vinyl flooring prior to construction. Clean floor of all adhesives and patch and repair concrete at new plumbing. Provide leveling compound as required to provide a smooth floor that has less than two percent slope at all new doors.

20. Provide new luxury vinyl tile throughout building. Refer to specification for more detailed information.

21. Provide four inch rubber cove base at drywall and ceramic tile cove base at restroom walls scheduled for ceramic tile.

Doors:

22. Provide one (1) new 3 foot x 7 foot insulated metal exterior door set in hollow metal frame with half-panel tempered, insulated glass vision panel to replace existing exterior door. Provide door hardware as specified. Note: existing door is

32 inches wide. Widen opening to accept 36 inch door and frame. Door to have keypad lock as specified.

23. Provide new insulated metal exterior double door at east wall set in hollow metal frame. Provide panic hardware and other door hardware as specified. Door to have keypad lock with lever handles.

24. Each restroom and the mechanical room shall have an interior sound-insulated, hollow metal door set in a hollow metal frame with specified hardware.

25. The interior doors at the vestibule and classroom shall be hollow metal doors set in hollow metal frames with specified hardware and half-panel tempered glass. Door at classroom shall be equipped with panic hardware.

Casework:

26. Provide new plastic laminate base cabinets, countertop and backsplash at break area as shown in the interior elevations and details.

Restrooms, Plumbing Fixtures:

27. The restroom shall be accessible and meet all the provisions on ICC/ANSI A117.1, as required by 2015 IBC.

28. Provide three (3) new wall-mounted lavatory sinks and ADA compliant faucets at the locations indicated on the plan. Provide supply and waste piping to new locations. Provide ADA guards at piping as required by code.

29. Provide and install two (2) new toilets and one (1) new urinal at locations indicated on the plan. Patch and repair concrete as required for new plumbing fixtures.

30. Provide new ADA grab bars, two horizontal and one vertical at toilets. Provide new toilet partitions, mirrors, paper towel dispensers, soap dispensers and toilet paper dispensers. Mount all toilet accessories in compliance with ADA required mounting heights and as shown on the drawings. Provide blocking in wall for grab bars and accessories.

31. One (1) new utility mop sink shall be provided in the mechanical room.

32. One (1) new 20 gallon water heater shall be provided in the mechanical room.

33. Provide and install one (1) handicapped-accessible drinking fountain with carafe filler as located on the plan.

34. Provide and install one (1) kitchen sink at break area as located on the plan.

35. Relocate water entry to mechanical room and provide new reduced pressure-type backflow preventer at new water entry.

36. Provide new floor drain with six inch top at each restroom and the mechanical room. Connect to existing waste piping.

Mechanical:

37. Provide electric baseboard heat with thermostat in each restroom. Thermostats to be mounted a maximum of 48 inches above the floor per ADA requirements.

38. Provide a new pad-mounted gas-fired furnace at mechanical room.

39. The entire building is to be air conditioned with a new pad-mounted condensing unit. All penetrations to be sealed and covered with metal escutcheons. Exterior piping to be insulated with hard plastic UV jacketing.

40. Provide exhaust fans as required by code for the restrooms and mechanical room. Locate as indicated on drawings. Provide hooded roof cap and bird screen at exterior vent.

41. Provide two (2) electric unit heaters with thermostats as located on the plan in the vestibule and mechanical room. Thermostats to be mounted a maximum of 48 inches above the floor per ADA requirements.

42. Provide two (2) new outside air/relief louvers in break area and mechanical room. Louvers to be installed as high as possible in ceiling plenum. Motorized damper to be controlled by economizer controller.

Electrical / Lighting:

43. City of La Junta Electric to replace existing overhead feeder line to the building. Existing transformer and utility meter to remain. Contractor to replace existing 100 amp panel with new 150 amp panel as specified in electrical drawings. Contractor to coordinate with City of La Junta Electric for timing of service upgrade.

44. Remove existing electrical receptacles and all associated conduit and wire back to existing panel. Replace with new receptacles that comply with NEC 2014 and conduit and wire back to new panel.

45. Provide GFCI receptacles at restrooms, break area and mechanical room.

46. Provide ceiling mounted duplex receptacle and data port for ceiling mounted projector as located on electrical drawings. Projector to be provided and installed by owner.

47. Remove existing interior light fixtures and one exterior light fixture and return to owner. Protect fixtures during demolition.

48. Provide new 2x4 LED light fixtures in lay-ceiling at classroom, break area and vestibule. Lights in classroom shall be on two separate switches. Ceiling mounted occupancy sensors shall be provided in classroom and break area.

49. Provide recessed, LED down lights at restrooms with one (1) LED vanity fixture centered over each mirror. Provide one (1) LED vanity fixture centered over sink in break area.

50. Each restroom shall have an occupancy sensor to operate the lights and fan with 10 minute delay. Vestibule shall have occupancy sensor to operate lighting.

51. Provide two (2) new surface-mounted LED light fixtures in the mechanical room.

52. Provide illuminated exit signs over egress doors as required by Chapter 10 of the 2015 IBC.

53. Other emergency lighting, as required by code, and above each exterior man door and in the mechanical room.

54. All electrical devices to comply with 2014 National Electrical Code.

Phones/Data:

55. Relocate phone entry to building and provide new phone board and 24 inch wide by 20 inch deep plywood IT shelf in the mechanical room.

56. Data: Provide blue Cat6e drops as indicated on the drawings. All drops homerun to the telecom demark. Trim all outlets and endpoints, label each outlet cover plate and label each homerun within the telecom board. Coordinate with CDOT's OIT for scheduling of work.

57. New phone and data conduit and cabling will be part of the GC scope. CDOT to be notified by GC when subcontractor will perform the work. GC will complete testing of wires, and CDOT OIT will make final terminations. Installation is required to be complete prior to substantial completion.

Life Safety:

58. The classroom and break area shall have hard-wired smoke and carbon monoxide detectors.

59. Provide new horn/strobes and detectors as specified in electrical drawings and Section 16721 of the Project Specifications.

60. Provide two (2) new portable fire extinguishers as located on the plans or as required by authority having jurisdiction.

End of Scope of Work

COMcheck Software Version 4.0.0

Envelope Compliance Certificate

Project Information

Energy Code:	90.1 (2013) Standard
Project Title:	
Location:	La Junta, Colorado
Climate Zone:	4b
Project Type:	Alteration
Pct. Window and Glass Door Area Replaced:	16%

Construction Site: Owner/Agent: Designer/Contractor:

Building Area	Floor Area
1-Office : Nonresidential	1971

Envelope Assemblies

Post-Alteration Assembly	R-Value		Proposed		Max. Allowed	
	Cavity	Cont.	U-Factor	SHGC	U-Factor	SHGC
Roof 1: Metal Building, Standing Seam, [Bldg. Use 1 - Office]	25.0	0.0	0.082	---	0.082	---
Floor 1: Slab-On-Grade:Unheated, [Bldg. Use 1 - Office]	---	---	1.000	---	0.520	---
NORTH						
Exterior Wall 1: Steel-Framed, 16" o.c., [Bldg. Use 1 - Office]	13.0	10.0	0.055	---	0.064	---
Window 2: Metal Frame:Operable, Clear, [Bldg. Use 1 - Office], Exemption: Less than 25% fenestration area alteration. Pre-alteration: U-Factor = 0.900, SHGC = 0.680	---	---	0.900	---	---	---
Window 3: Metal Frame:Operable, Clear, [Bldg. Use 1 - Office], Exemption: Less than 25% fenestration area alteration. Pre-alteration: U-Factor = 0.900, SHGC = 0.680	---	---	0.900	---	---	---
EAST						
Exterior Wall 2: Steel-Framed, 16" o.c., [Bldg. Use 1 - Office]	13.0	10.0	0.055	---	0.064	---
Door 2: Insulated Metal, Swinging, [Bldg. Use 1 - Office]	---	---	0.091	---	0.500	---
Door 3: Insulated Metal, Swinging, [Bldg. Use 1 - Office]	---	---	0.091	---	0.500	---
SOUTH						
Exterior Wall 4: Steel-Framed, 16" o.c., [Bldg. Use 1 - Office]	13.0	10.0	0.055	---	0.064	---
Window 4: Metal Frame:Operable, Clear, [Bldg. Use 1 - Office], Exemption: Less than 25% fenestration area alteration. Pre-alteration: U-Factor = 0.900, SHGC = 0.680	---	---	0.900	---	---	---
Window 5: Metal Frame:Operable, Clear, [Bldg. Use 1 - Office], Exemption: Less than 25% fenestration area alteration. Pre-alteration: U-Factor = 0.900, SHGC = 0.680	---	---	0.900	---	---	---
WEST						
Exterior Wall 3: Steel-Framed, 16" o.c., [Bldg. Use 1 - Office]	13.0	10.0	0.055	---	0.064	---
Window 1: Metal Frame:Operable, Clear, [Bldg. Use 1 - Office], Exemption: Less than 25% fenestration area alteration. Pre-	---	---	0.900	---	---	---

Post-Alteration Assembly	R-Value		Proposed		Max. Allowed	
	Cavity	Cont.	U-Factor	SHGC	U-Factor	SHGC
alteration: U-Factor = 0.900, SHGC = 0.680						
Door 1: Insulated Metal, Swinging, [Bldg. Use 1 - Office]	---	---	0.091	---	0.500	---

(a) Slab-On-Grade proposed and budget U-factors shown in table are F-factors.

(b) Thermal spacer block with minimum R-3.5 must be installed above the purlin/batt, and the roof deck secured to the purlins.

Envelope PASSES

Envelope Compliance Statement

Compliance Statement: The proposed envelope alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed envelope systems have been designed to meet the 90.1 (2013) Standard requirements in COM*check* Version 4.0.0 and to comply with the mandatory requirements listed in the Inspection Checklist.

Erin K Lucero, Architect II — Name - Title

Erin K Lucero — Signature

5/15/17 — Date

COM*check* Software Version 4.0.0

Inspection Checklist

Energy Code: 90.1 (2013) Standard

Requirements: 100.0% were addressed directly in the COM*check* software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

90.1 (2013) Standard	Plan Review	Complies?	Comments/Assumptions
4.2.2, 5.4.3.1.1, 5.7 [PR1][1]	Plans and/or specifications provide all information with which compliance can be determined for the building envelope and document where exceptions to the standard are claimed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
4.2.2, 8.4.1.1, 8.4.1.2, 8.7 [PR6][2]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the electrical systems and equipment and document where exceptions are claimed. Feeder connectors sized in accordance with approved plans and branch circuits sized for maximum drop of 3%.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Footing / Foundation Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
5.5.3.3 [FO1][2]	Below-grade wall insulation R-value.	R-____	R-____	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
5.5.3.5 [FO3][2]	Slab edge insulation R-value.	R-____ ☐ Unheated ☐ Heated	R-____ ☐ Unheated ☐ Heated	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
5.8.1.2 [FO4][2]	Slab edge insulation installed per manufacturer's instructions.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Not Applicable
5.5.3.5 [FO5][2]	Slab edge insulation depth/length.	____ ft	____ ft	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
5.8.1.7 [FO6][1]	Exterior insulation protected against damage, sunlight, moisture, wind, landscaping and equipment maintenance activities.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.8.1.7.3 [FO7][1]	Insulation in contact with the ground has <=0.3% water absorption rate per ASTM C272.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Not Applicable
6.4.4.1.5 [FO11][3]	Bottom surface of floor structures incorporating radiant heating insulated to >=R-3.5.	R-____	R-____	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Envelope Assemblies table for values.*

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Framing / Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
5.4.3.2 [FR1][3]	Factory-built and site-assembled fenestration and doors are labeled or certified as meeting air leakage requirements.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.5.4.3a [FR8][1]	Vertical fenestration U-Factor.	U-____	U-____	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
5.5.4.3b [FR9][1]	Skylight fenestration U-Factor.	U-____	U-____	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
5.5.4.4.1 [FR10][1]	Vertical fenestration SHGC value.	SHGC:____	SHGC:____	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
5.5.4.4.2 [FR11][1]	Skylight SHGC value.	SHGC:____	SHGC:____	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
5.8.2.1, 5.8.2.3, 5.8.2.4, 5.8.2.5 [FR12][2]	Fenestration products rated (U-factor, SHGC, and VT) in accordance with NFRC or energy code defaults are used.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.8.2.2 [FR13][1]	Fenestration and door products are labeled, or a signed and dated certificate listing the U-factor, SHGC, VT, and air leakage rate has been provided by the manufacturer.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.5.3.6 [FR14][2]	U-factor of opaque doors associated with the building thermal envelope meets requirements.	U-____ ☐ Swinging ☐ Nonswinging	U-____ ☐ Swinging ☐ Nonswinging	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
5.4.3.1 [FR15][1]	Continuous air barrier is wrapped, sealed, caulked, gasketed, and/or taped in an approved manner, except in semiheated spaces in climate zones 1-6.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

90.1 (2013) Standard	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
8.4.2 [EL10][2]	At least 50% of all 125 volt 15- and 20-Amp receptacles are controlled by an automatic control device.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

Section # & Req.ID	Insulation Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
5.5.3.1 [IN2][1]	Roof R-value. For some ceiling systems, verification may need to occur during Framing Inspection.	R-_____ ☐ Above deck ☐ Metal ☐ Attic	R-_____ ☐ Above deck ☐ Metal ☐ Attic	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
5.8.1.2, 5.8.1.3 [IN3][1]	Roof insulation installed per manufacturer's instructions. Blown or poured loose-fill insulation is installed only where the roof slope is <=3 in 12.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.5.3.2 [IN6][1]	Above-grade wall insulation R-value.	R-_____ ☐ Mass ☐ Metal ☐ Steel ☐ Wood	R-_____ ☐ Mass ☐ Metal ☐ Steel ☐ Wood	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
5.8.1.2 [IN7][1]	Above-grade wall insulation installed per manufacturer's instructions.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.5.3.4 [IN8][2]	Floor insulation R-value.	R-_____ ☐ Mass ☐ Steel ☐ Wood	R-_____ ☐ Mass ☐ Steel ☐ Wood	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Envelope Assemblies table for values.*
5.8.1.1 [IN10][2]	Building envelope insulation is labeled with R-value or insulation certificate has been provided listing R-value and other relevant data.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.8.1.9 [IN18][2]	Building envelope insulation extends over the full area of the component at the proposed rated R or U value.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.8.1.4 [IN11][2]	Eaves are baffled to deflect air to above the insulation.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.8.1.5 [IN12][2]	Insulation is installed in substantial contact with the inside surface separating conditioned space from unconditional space.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.8.1.6 [IN13][2]	Recessed equipment installed in building envelope assemblies does not compress the adjacent insulation.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.8.1.7.1 [IN15][2]	Attics and mechanical rooms have insulation protected where adjacent to attic or equipment access.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Insulation Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
5.8.1.7.2 [IN16][2]	Foundation vents do not interfere with insulation.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
5.8.1.8 [IN17][3]	Insulation intended to meet the roof insulation requirements cannot be installed on top of a suspended ceiling. Mark this requirement compliant if insulation is installed accordingly.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

90.1 (2013) Standard	Final Inspection	Complies?	Comments/Assumptions
5.4.3.3 [FI1][1]	Weatherseals installed on all loading dock cargo doors in Climate Zones 4-8.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

COMcheck Software Version 4.0.4.1

Interior Lighting Compliance Certificate

Project Information

Energy Code:	2015 IECC
Project Title:	La Junta Training Room
Project Type:	Alteration

Construction Site:
28201 West Highway 50
La Junta, CO 81020

Owner/Agent:
Colorado Department of Transportation
15285 South Golden Road
Building 47
Golden, CO 80401
303-512-5505

Designer/Contractor:
MEP Engineering Inc.
6402 South Troy Circle
Suite 100
Centennial, CO 80111
303-936-1633
ernest@mep-eng.com

Allowed Interior Lighting Power

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B X C)
1-Training Room (Common Space Types:Classroom/Lecture/Training)	1075	1 .24	1333
2-Vestibul (Common Space Types:Atrium) (Ceiling Height 0 ft.)(wattage exempt for this area)	59	0	0
3-Break/Admin (Common Space Types:Lounge/Breakroom)	354	0 .73	258
4-Restrooms (Common Space Types:Restrooms)	186	0 .98	182
5-Mech/Janitor (Common Space Types:Electrical/Mechanical)	81	0 .95	77
6-Hallway (Common Space Types:Corridor/Transition <8 ft wide)	42	0 .66	28
		Total Allowed Watts =	1878

Proposed Interior Lighting Power

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Training Room (Common Space Types:Classroom/Lecture/Training 1075 sq.ft.)				
F4 LED 2 X 4 Troffer: Other:	1	12	48	576
Vestibul (Common Space Types:Atrium 59 sq.ft.)				
F4 LED 2 X 4 Troffer: Other:	1	1	48	48
Break/Admin (Common Space Types:Lounge/Breakroom 354 sq.ft.)				
F2 LED 2' Vanity Light: Other:	1	1	21	21
F4 LED 2 X 4 Troffer: Other:	1	6	48	288
Restrooms (Common Space Types:Restrooms 186 sq.ft.)				
F3 Recessed Can: Other:	1	4	26	104
F2 LED 2' Vanity Light: Other:	1	2	21	42
Mech/Janitor (Common Space Types:Electrical/Mechanical 81 sq.ft.)				
F6 LED Linear: Other:	1	2	42	84
Hallway (Common Space Types:Corridor/Transition <8 ft wide 42 sq.ft.)				
F4 LED 2 X 4 Troffer: Other:	1	1	48	48
			Total Proposed Watts =	1163

Interior Lighting PASSES

Interior Lighting Compliance Statement

Compliance Statement: The proposed interior lighting alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed interior lighting systems have been designed to meet the 2015 IECC requirements in COM*check* Version 4.0.4.1 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Ernest L. Rodriguez - Project Electrical Designer		05-31-17
Name - Title	Signature	Date

COM*check* Software Version 4.0.4.1

Exterior Lighting Compliance Certificate

Project Information

Energy Code:	2015 IECC
Project Title:	La Junta Training Room
Project Type:	Alteration
Exterior Lighting Zone	2 (Light industrial area with limited nighttime use)

Construction Site:
28201 West Highway 50
La Junta, CO 81020

Owner/Agent:
Colorado Department of Transportation
15285 South Golden Road
Building 47
Golden, CO 80401
303-512-5505

Designer/Contractor:
MEP Engineering Inc.
6402 South Troy Circle
Suite 100
Centennial, CO 80111
303-936-1633
ernest@mep-eng.com

Allowed Exterior Lighting Power

A Area/Surface Category	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (B X C)
Illuminated area of facade wall or surface	19710 ft2	0.1	No	1971
			Total Tradable Watts (a) =	0
			Total Allowed Watts =	1971
			Total Allowed Supplemental Watts (b) =	600

(a) Wattage tradeoffs are only allowed between tradable areas/surfaces.
(b) A supplemental allowance equal to 600 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Proposed Exterior Lighting Power

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Illuminated area of facade wall or surface (19710 ft2): Non-tradable Wattage				
LED 1: Other:	1	2	20	40
			Total Tradable Proposed Watts =	0

Exterior Lighting PASSES: Design 0.0% better than code

Exterior Lighting Compliance Statement

Compliance Statement: The proposed exterior lighting alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed exterior lighting systems have been designed to meet the 2015 IECC requirements in COM*check* Version 4.0.4.1 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Ernest L. Rodriguez - Project Electrical Designer — Name - Title
Signature
05-31-17 — Date

Inspection Checklist

Energy Code: 2015 IECC

Requirements: 0.0% were addressed directly in the COM*check* software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C103.2 [PR4][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the interior lighting and electrical systems and equipment and document where exceptions to the standard are claimed. Information provided should include interior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.	●Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C103.2 [PR8][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the exterior lighting and electrical systems and equipment and document where exceptions to the standard are claimed. Information provided should include exterior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.	●Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.2.1 [EL15][1]	Lighting controls installed to uniformly reduce the lighting load by at least 50%.	●Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C405.2.1 [EL18][1]	Occupancy sensors installed in required spaces.	●Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C405.2.1, C405.2.3 [EL23][2]	Independent lighting controls installed per approved lighting plans and all manual controls readily accessible and visible to occupants.	●Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C405.2.2.1 [EL22][2]	Automatic controls to shut off all building lighting installed in all buildings.	●Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C405.2.3 [EL16][2]	Daylight zones provided with individual controls that control the lights independent of general area lighting.	☐Complies ☐Does Not ☐Not Observable ●Not Applicable	
C405.2.3, C405.2.3.1, C405.2.3.2 [EL20][1]	Primary sidelighted areas are equipped with required lighting controls.	☐Complies ☐Does Not ☐Not Observable ●Not Applicable	
C405.2.3, C405.2.3.1, C405.2.3.3 [EL21][1]	Enclosed spaces with daylight area under skylights and rooftop monitors are equipped with required lighting controls.	☐Complies ☐Does Not ☐Not Observable ●Not Applicable	
C405.2.4 [EL4][1]	Separate lighting control devices for specific uses installed per approved lighting plans.	●Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C405.2.4 [EL8][1]	Additional interior lighting power allowed for special functions per the approved lighting plans and is automatically controlled and separated from general lighting.	●Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C405.2.5 [EL25][null]	Automatic lighting controls for exterior lighting installed. Controls will be daylight controlled, set based on business operation time-of-day, or reduce connected lighting > 30%.	●Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C405.3 [EL6][1]	Exit signs do not exceed 5 watts per face.	●Complies ☐Does Not ☐Not Observable ☐Not Applicable	

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.6, C405.6.1 [EL24][1]	Exterior grounds lighting meets exterior lighting power requirements.	☐Complies ☐Does Not ☐Not Observable ●Not Applicable	

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C303.3, C408.2.5.2 [FI17][3]	Furnished O&M instructions for systems and equipment to the building owner or designated representative.	☐Complies ☐Does Not ●Not Observable ☐Not Applicable	
C405.4.1 [FI18][1]	Interior installed lamp and fixture lighting power is consistent with what is shown on the approved lighting plans, demonstrating proposed watts are less than or equal to allowed watts.	☐Complies ☐Does Not ●Not Observable ☐Not Applicable	*See the Interior Lighting fixture schedule for values.*
C405.5.1 [FI19][1]	Exterior lighting power is consistent with what is shown on the approved lighting plans, demonstrating proposed watts are less than or equal to allowed watts.	☐Complies ☐Does Not ●Not Observable ☐Not Applicable	*See the Exterior Lighting fixture schedule for values.*
C408.2.5.1 [FI16][3]	Furnished as-built drawings for electric power systems within 90 days of system acceptance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C408.3 [FI33][1]	Lighting systems have been tested to ensure proper calibration, adjustment, programming, and operation.	☐Complies ☐Does Not ●Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

COM*check* Software Version 4.0.5.3

Mechanical Compliance Certificate

Project Information

Energy Code:	2015 IECC
Project Title:	La Junta Training Room
Location:	La Junta, Colorado
Climate Zone:	4b
Project Type:	Alteration

Construction Site:
28201 West Highway 90
La Junta, CO 81020

Owner/Agent:
Colorado Department of
Transportation
15285 South Golden Road
Golden, Colorado, CO 80401

Designer/Contractor:
MEP Engineering Inc.
6402 S. Troy Circle
Suite 100
Centennial, CO 80111

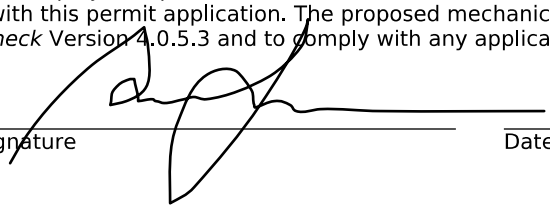
Mechanical Systems List

Quantity	System Type & Description
1	F-1, CU-1 (Single Zone): Heating: 1 each - Duct Furnace, Gas, Capacity = 120 kBtu/h Proposed Efficiency = 95.00% Ec, Required Efficiency = 80.00% Ec Cooling: 1 each - Split System, Capacity = 60 kBtu/h, Air-Cooled Condenser, Air Economizer Proposed Efficiency = 16.00 SEER, Required Efficiency: 13.00 SEER Fan System: FAN SYSTEM 1 -- Compliance (Motor nameplate HP method) : Passes Fans: FAN 1 Supply, Constant Volume, 2100 CFM, 0.8 motor nameplate hp, 0.8 fan efficiency
2	EUH -1, 2 (Unknown): Heating: 1 each - Unit Heater, Electric, Capacity = 5 kBtu/h No minimum efficiency requirement applies Fan System: FAN SYSTEM 2 -- Compliance (Motor nameplate HP method) : Passes Fans: FAN 2 Supply, Constant Volume, 100 CFM, 0.0 motor nameplate hp, 0.8 fan efficiency
2	EBBR-1, 2 (Single Zone): Heating: 1 each - Radiant Heater, Electric, Capacity = 2 kBtu/h No minimum efficiency requirement applies Fan System: None
1	WH-1: Electric Storage Water Heater, Capacity: 10 gallons No minimum efficiency requirement applies

Mechanical Compliance Statement

Compliance Statement: The proposed mechanical alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2015 IECC requirements in COM*check* Version 4.0.5.3 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Anastasia Flanegin -Mechanical Project Engineer — Name - Title



Signature

05.11.2017 — Date

Inspection Checklist

Energy Code: 2015 IECC

Requirements: 100.0% were addressed directly in the COMcheck software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C103.2 [PR2][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical systems and equipment and document where exceptions to the standard are claimed. Load calculations per acceptable engineering standards and handbooks.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C103.2 [PR3][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the service water heating systems and equipment and document where exceptions to the standard are claimed. Hot water system sized per manufacturer's sizing guide.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C406 [PR9][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the additional energy efficiency package options.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C403.2.4.5, C403.2.4.6 [FO9][3]	Snow/ice melting system sensors for future connection to controls. Freeze protection systems have automatic controls installed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.5, C404.5.1, C404.5.2 [PL6][3]	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.5, C404.5.1, C404.5.2 [PL6][3]	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.5, C404.5.1, C404.5.2 [PL6][3]	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.5, C404.5.1, C404.5.2 [PL6][3]	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C404.6.3 [PL7][3]	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.6.3 [PL7][3]	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.6.3 [PL7][3]	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.6.3 [PL7][3]	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C404.7 [PL8][3]	Water distribution system that pumps water from a heated-water supply pipe back to the heated-water source through a cold-water supply pipe is a demand recirculation water system. Pumps within this system have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.7 [PL8][3]	Water distribution system that pumps water from a heated-water supply pipe back to the heated-water source through a cold-water supply pipe is a demand recirculation water system. Pumps within this system have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.7 [PL8][3]	Water distribution system that pumps water from a heated-water supply pipe back to the heated-water source through a cold-water supply pipe is a demand recirculation water system. Pumps within this system have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.7 [PL8][3]	Water distribution system that pumps water from a heated-water supply pipe back to the heated-water source through a cold-water supply pipe is a demand recirculation water system. Pumps within this system have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.2.6 [ME41][3]	Thermally ineffective panel surfaces of sensible heating panels have insulation >= R-3.5.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.12 .1 [ME65][3]	HVAC fan systems at design conditions do not exceed allowable fan system motor nameplate hp or fan system bhp.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
C403.2.12 .3 [ME117][2]	Fans have efficiency grade (FEG) >= 67. The total efficiency of the fan at the design point of operation <= 15% of maximum total efficiency of the fan.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Fans included in equipment having certified seal for air or energy performance of the equipment package.
C403.2.13 [ME71][2]	Unenclosed spaces that are heated use only radiant heat.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.3 [ME55][2]	HVAC equipment efficiency verified.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Mechanical Systems list for values.*
C403.2.4. 7 [ME113][2]	Fault detection and diagnostics installed with air-cooled unitary DX units having economizers.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.6. 1 [ME59][1]	Demand control ventilation provided for spaces >500 ft2 and >25 people/1000 ft2 occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow >3,000 cfm.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.6. 2 [ME115][3]	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.7 [ME57][1]	Exhaust air energy recovery on systems meeting Table C403.2.7(1) and C403.2.7(2).	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.8 [ME116][3]	Kitchen exhaust systems comply with replacement air and conditioned supply air limitations, and satisfy hood rating requirements and maximum exhaust rate criteria.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.9 [ME60][2]	HVAC ducts and plenums insulated. Where ducts or plenums are installed in or under a slab, verification may need to occur during Foundation Inspection.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.9 [ME10][2]	Ducts and plenums sealed based on static pressure and location.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.2.9.1.3 [ME11][3]	Ductwork operating >3 in. water column requires air leakage testing.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.9.1.3 [ME11][3]	Ductwork operating >3 in. water column requires air leakage testing.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.9.1.3 [ME11][3]	Ductwork operating >3 in. water column requires air leakage testing.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.3 [ME62][1]	Air economizers provided where required, meet the requirements for design capacity, control signal, ventilation controls, high-limit shut-off, integrated economizer control, and provide a means to relieve excess outside air during operation.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.4.4.6 [ME110][3]	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
C403.4.4.6 [ME110][3]	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
C403.4.4.6 [ME110][3]	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
C408.2.2.1 [ME53][3]	Air outlets and zone terminal devices have means for air balancing.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C303.3, C408.2.5.3 [FI8][3]	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.2 [FI27][3]	HVAC systems and equipment capacity does not exceed calculated loads.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.1 [FI47][3]	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.1 [FI47][3]	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.1 [FI47][3]	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.1.2 [FI38][3]	Thermostatic controls have a 5 °F deadband.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.1.3 [FI20][3]	Temperature controls have setpoint overlap restrictions.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.2 [FI39][3]	Each zone equipped with setback controls using automatic time clock or programmable control system.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.4.2.1, C403.2.4.2.2 [FI40][3]	Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock, 2-hour occupant override, 10-hour backup	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.2.3 [FI41][3]	Systems include optimum start controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.2.3 [FI41][3]	Systems include optimum start controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.3 [FI11][3]	Heat traps installed on supply and discharge piping of non-circulating systems.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C404.4 [FI25][2]	All piping insulated in accordance with section details and Table C403.2.10.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.1 [FI28][1]	Commissioning plan developed by registered design professional or approved agency.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.3.1 [FI31][1]	HVAC equipment has been tested to ensure proper operation.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.3.2 [FI10][1]	HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.3.3 [FI32][1]	Economizers have been tested to ensure proper operation.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.4 [FI29][1]	Preliminary commissioning report completed and certified by registered design professional or approved agency.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.5.1 [FI7][3]	Furnished HVAC as-built drawings submitted within 90 days of system acceptance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.5.3 [FI43][1]	An air and/or hydronic system balancing report is provided for HVAC systems.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.5.4 [FI30][1]	Final commissioning report due to building owner within 90 days of receipt of certificate of occupancy.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)