STATE OF COLORADO

DEPARTMENT OF TRANSPORTATION

Office of the Chief Engineer
Property Management Section
2829 W. Howard Place, 4th Floor
Denver, CO 80204

RANGELY OFFICE REMODEL

SAP #23364

SPECIFICATIONS

100% SET 09/23/2020

STATE OF COLORADO
9/23/2020
ERIN K LUCERO
401302
LICENSED ARCHITECT

COLORADO LICENSED
TAYLOR J. REESE
52516
9/23/2020
PROFESSIONAL ENGINEER

COLORADO REGISTERED
JON BROOKS
35717
09/28/2020
PROFESSIONAL ENGINEER

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09/23/2020 100%
CDOT # 23364

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Rangely Office Remodel
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CDOT # 23364

SECTION 01 11 00
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 PROJECT INFORMATION

A. The Project Information and Contacts are:

1.	Project Title:	RANGELY OFFICE REMODEL CDOT Project Number #23364
2.	Project Location:	Colorado Department of Transportation 2829 E Shale Dr Rangely, CO 81648
3.	Owner: (Denver)	Colorado Department of Transportation Property Management 2829 W. Howard Pl. Denver, CO 80204
4.	CDOT Representative:	Rob Levinson 2829 W. Howard Pl. Denver, CO 80204 (P) 720-737-6591; (F) 303-512-5550 email: robert.levinson@state.co.us
5.	Geotechnical Engineer:	N/A
6.	Architect:	Erin Lucero 2829 W. Howard Pl. Denver, CO 80204 (P) 720-737-6591; (F) 303-512-5550 email: erin.lucero@state.co.us
7.	Civil Engineer	N/A
8.	Structural Engineer:	N/A
9.	Mechanical, Electrical, Plumbing Engineer:	360 Engineering, Inc. Joe Wittenberg 751 Pine Ridge Rd #360 Golden, CO 80403 (P) 303-940-2050 email: jwittenberg@360eng.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, Water and Communications 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. Geotechnical Report: N/A

D. 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 limited use of the premises during the construction period. The existing maintenance facility on site needs to continue to function during construction. 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. Allow for Owner occupancy and use.

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. Full Owner Occupancy: The Owner will occupy and use the site during construction. Cooperate with the Owner to minimize conflicts and facilitate Owner usage. 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. Traffic Permits
3. Use Fees

4. Fire Department Review by local jurisdiction, including fire alarm design review and permit if required.
5. Colorado Department of Public Health and Environment Permits required for construction.

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)

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SECTION 01 23 00
ADD ALTERNATES

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.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
   2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A schedule of alternates is included at the end of the Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Add. Alternate No. 1: TITLE OF ALTERNATE
   1. Base Bid: INSERT BRIEF DESCRIPTION OF BASE-BID REQUIREMENT, AS INDICATED ON SHEET NUMBER AND AS SPECIFIED IN SECTION NUMBER.
   2. Add. Alternate: INSERT BRIEF DESCRIPTION OF BASE-BID REQUIREMENT, AS INDICATED ON SHEET NUMBER AND AS SPECIFIED IN SECTION NUMBER.

END OF SECTION

SECTION 01 31 19
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. Environmental Preconstruction Conference: Prior to construction or any earthwork being performed, an on-site Environmental Preconstruction Conference shall be held. The time of the environmental preconstruction conference is to be determined by the CDOT Representative. This conference can be held concurrently with the preconstruction conference.
   1. The conference shall be attended by:
      a. The CDOT Representative
      b. The CDOT Region Water Pollution Control Manager (RWPCM)

c. The CDOT Personnel (e.g. CDOT Landscape Architect) who prepared or reviewed the Stormwater Management Plan (SWMP)
d. The Contractor's Superintendent
e. The Contractor's SWMP Administrator
f. Supervisors or Foremen of subcontractors working on the project

2. Agenda: At this conference, the attendees shall discuss the SWMP, the Colorado Department of Public Safety Stormwater Construction Permit (CDPS – SCP), sensitive habitats on site, wetlands, other vegetation to be protected, individual's responsibilities, required inspections and the enforcement mechanisms for not meeting the requirements of this specification.

C. 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

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SECTION 01 33 00
SUBMITTAL PROCEDURES

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 acceptable for all submittals except in the case where engineer-stamped drawings are required or color selection or material selection 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. 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 21 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 01 78 23 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. Coordination Drawings: General Contractor is required to prepare Coordination Drawings incorporating approved product and system submittal information to include: Floor plans, reflected ceiling plans and/or building sections and details as appropriate, drawn to scale and dimensioned, and coordinating penetrations, mounting, clearances, embeds for the following, as identified by Systems:

1. System 1: Piping penetrations through approved foundation system and slab; piping below slab including invert elevations and slop of piping, slope of floor, incorporating drain and grate elevations.
2. System 2: Metal building structure and framing, concrete curbs, foundations, and column bases; Steel stair system, insulation system meeting the requirements of IECC 2015; Track mounting clearance and attachment for overhead door system including concrete curbs and column bases and adjacency to metal building structure and framing.
3. System 3: Lighting and fans, and clerestory glazing to ensure required clearance at overhead door openings; Ceiling-mounted items including lighting fixtures, ceiling fans, diffusers, grilles, speakers, sprinklers (if required), radiant heat system, exhaust and ventilation system, access panels, vents, compressed air piping.
4. General Contractor shall provide the anticipated delivery dates of Coordination Drawings Systems to be reviewed, and verify the content of the Coordination Drawings package or packages.
5. General Contractor shall advise the CDOT Representative of conflicts in the system engineering and coordination within five (5) days after discovery of the conflict.
6. General Contractor shall identify the subcontractor responsible for producing the Coordination Drawings within the first 30 days of the project, including the anticipated schedule for completion of each System.
7. Coordination drawings that have been produced in a standard CADD or Revit drawing format will be provided to the CDOT Representative, Architect and Engineer as PDF files.
8. CDOT Representative, Architect and Engineers will provide comments within five (5) days of receipt of Coordination Drawing package.
9. Coordination Drawing System packages are each a one-time submittal, reviewed by the CDOT Representative, Architect and Engineers for compliance with design intent.

M. 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 for review if 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.

N. 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.

O. 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.

P. 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.

Q. 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)

END OF SECTION

SECTION 01 42 19
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 2004 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) and other state authorities. These minimum requirements are to be applied to all construction at state agencies and institutions of higher education owned facilities including capital construction and controlled maintenance construction projects:

The 2018 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 2018 edition of the International Existing Building Code (IEBC)
(As adopted by the Colorado State Buildings Program as follows: Chapters 2-16, Appendices A-C and Resource A)

The 2018 edition of the International Mechanical Code (IMC)
(As adopted by the Colorado State Buildings Program as follows: Chapters 2-15 and Appendix A)

The 2018 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 – 2016 in accordance with Section C401.2.1 of the 2018 IECC.

The 2017 edition of the National Electrical Code (NEC)
(National Fire Protection Association Standard 70) (As adopted by the Colorado State Electrical Board)

The 2018 edition of the International Plumbing Code (IPC)
(As adopted by the Colorado Examining Board of Plumbers)

The 2018 edition of the International Fuel Gas Code (IFGC)
(As adopted by the Colorado Examining Board of Plumbers)

The National Fire Protection Association Standards (NFPA)
(as adopted by the Department of Public Safety/Division of Fire Prevention and Control)

The 2018 edition of the International Fire Code (IFC)
(The 2015 edition continues to be adopted by the Department of Public Safety/Division of Fire Prevention and Control (DFPC). Projects requiring DFPC review should be designed with the most restrictive requirements)

The 2015 edition of the ASME Boiler and Pressure Vessel Code
(As adopted by the Department of Labor and Employment/Boiler Inspection Section)

The 2017 edition of the National Boiler Inspection Code (NBIC)
(As adopted by the Department of Labor and Employment/Boiler Inspection Section)

The 2015 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 2015 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)

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)

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)

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 2017 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 2018 edition of the IBC became effective on July 1, 2019. 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 2018 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 2018 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 Standards

1. 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 01 77 00
CLOSEOUT PROCEDURES

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 AND SURVEY

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. Provide an as-built survey completed by a certified surveyor indicating final location of all underground utilities as well as the as-built construction of all permanent Storm Water Management structures.

C. Upon completion of Project, one (1) paper copy, and two (2) electronic PDF versions on a USB storage drive, of final, accurate as-built drawings and survey shall be delivered to the CDOT Representative. This complete submittal shall include all drawings, including architectural, structural, civil, mechanical, electrical, plumbing and fire.

1.5 SYSTEM COMMISSIONING

A. Prior to Project Closeout, HVAC testing, adjusting and balancing and lighting system functional testing must be completed in accordance with the IECC Section C408 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 provided by the contractor at the Contractor's cost in accordance with Section 23 05 93 Testing, Adjusting and Balancing.
2. Lighting System Function Testing 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 01 78 23, Operations & Maintenance Data, for further information on O & M specifics.

1.7 START-UP, OPERATING AND MAINTENANCE TRAINING AND INSTRUCTION

A. Unless directed otherwise in Divisions 11, 13, 22, 23 or 26, 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

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SECTION 01 78 23
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 01 33 00: "Submittal Procedures" for submitting copies of operation and maintenance manuals.
2. Section 01 77 00: “Closeout Procedures” 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 USB storage drive 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 USB storage drive 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 11, 13, 22, 23 and 26 specifications concerning the O & M manuals for devices germane to Divisions 11, 13, 22, 23 and 26. 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 USB storage drive 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 06 00 00
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 RELATED SECTIONS

A. See Section 06 10 00 Rough Carpentry for structural lumber and plywood.

1.3 SUBMITTALS

A. Product Data for each type of product listing in this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plywood siding for built-in shelves: A-C Exposure 1 plywood, 3/4 inch thick sheets, cover entire area with single sheet. Expose “A” side. Paint white per Division 9 with 1 coat of primer and 2 coats of fire-resistant premium latex paint.

B. Wood trim at built-in shelves: Provide new 1” wide, 1/4” thick pine bead window and door casing around built-in shelves, modern style. Paint white per Division 9 with 1 coat of primer and 2 coats of premium latex paint.

2.2 ADJUSTING AND CLEANING

A. Repair damaged and defective wood trim to eliminate functional and visual defects. Adjust joinery for uniform appearance.

B. Clean wood trim on exposed and semi-exposed surfaces. Touch up applied finish to restore damaged or soiled areas.

END OF SECTION

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SECTION 06100
ROUGH CARPENTRY

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. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Wood blocking and nailers.
4. Wood furring
5. Wood sleepers.
6. Plywood backing panels.

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

C. Timber: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.

D. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fasteners.
3. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. STANDARDS: Comply with the following grading and quality standards:

1. Lumber:
   a. ANSI PS 20 “American Softwood Lumber Standard”
   b. WWPA Grading Rules
   c. Applicable grading rules of other inspection agencies certified by American Lumber Standards Committee’s (ALSC) Board of Review, as specified herein.
2. Plywood and Construction Panels:
   a. ANSI PS 1 “U.S. Product Standard for Construction and Industrial Plywood” for plywood construction panels.
   b. APA PRP-108 for products not manufactured under PS 1 provision.

B. GRADE STAMPS:

1. Each piece of lumber and plywood specified by grade shall bear the grade stamp and trademark of the agency under which it is produced.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship**."**

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

C. Moisture Content of Lumber: Construction grade or better, minimum Fb-650, unless otherwise indicated surfaced dry, S4S, with 19% maximum and 12% minimum moisture content at time of installation.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.

B. Load-Bearing Partitions: No. 2 grade.

1. Application: Exterior walls and interior load-bearing partitions.
2. Species:
    a. Douglas fir-larch; WCLIB or WWPA.
    b. Douglas fir-south; WWPA.
    c. Douglas fir-larch (north); NLGA.

C. Joists, Rafters, and Other Framing Not Listed Above: No. 2 grade.

1. Species:
    a. Douglas fir-larch; WCLIB or WWPA.
    b. Douglas fir-larch (north); NLGA.

D. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Application: Exposed exterior framing indicated to receive a stained or natural finish.
2. Species and Grade: As indicated above for load-bearing construction of same type.

2.4 PLYWOOD PANELS

A. B-C Exposure 1 plywood, 4 foot x 4 foot x 5/8 inch sheets. Expose “B” side.

1. Where exposed, paint white per Division 9 with 1 coat of primer and 2 coats of fire-resistant premium latex paint.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated on the Drawings but not of size or spacing less than required by local building code.

2.6 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for wood-preservative-treated lumber and where indicated.

E. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth.

1. Thickness: [0.050 inch (1.3 mm)] [0.062 inch (1.6 mm)].

F. I-Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.

1. Thickness: [0.050 inch (1.3 mm)] [0.062 inch (1.6 mm)].

G. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.

1. Strap Width: [1-1/2 inches (38 mm)] [2 inches (50 mm)].
2. Thickness: [0.050 inch (1.3 mm)] [0.062 inch (1.6 mm)].

H. Bridging: Rigid, V-section, nailless type, 0.050 inch (1.3 mm) thick, length to suit joist size and spacing.

I. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm) above base and with 2-inch- (50-mm-) minimum side cover, socket 0.062 inch (1.6 mm) thick, and standoff and adjustment plates 0.108 inch (2.8 mm) thick.

J. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

1. Width: [3/4 inch (19 mm)] [1-1/4 inches (32 mm)].
2. Thickness: [0.050 inch (1.3 mm)] [0.062 inch (1.6 mm)].
3. Length: [16 inches (400 mm)] [24 inches (600 mm)] [As indicated].

K. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches (38 mm) wide by 0.050 inch (1.3 mm) thick.[Tie fastens to side of rafter or truss, face of top plates, and side of stud below.]

L. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches (57 mm) wide by 0.062 inch (1.6 mm) thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

M. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches (32 mm) wide by 0.050 inch (1.3 mm) thick by 36 inches (914 mm) long.

N. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.

1. Bolt Diameter: [5/8 inch (15.8 mm)] [3/4 inch (19 mm)].
2. Width: [2-1/2 inches (64 mm)] [3-3/16 inches (81 mm)].
3. Body Thickness: [0.108 inch (2.8 mm)] [0.138 inch (3.5 mm)].
4. Base Reinforcement Thickness: [0.108 inch (2.8 mm)] [0.239 inch (6.1 mm)].

O. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches (29 mm) wide by 9/16 inch (14 mm) deep by 0.034 inch (0.85 mm) thick with hemmed edges.

P. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch (24 by 24 by 1 mm) thick with hemmed edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Plywood: Unless otherwise indicated, install with long dimension perpendicular to framing members; butt joints true and square. Except where adhesive application may be noted, secure plywood to framing at maximum 6” o.c. at sides, ends, and edges, and 10” o.c. in field of panels. Use nails at wood framing and bolts or screws at metal framing.

C. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Fasteners: Unless otherwise indicated or required by fastener type, install fasteners with heads flush on wood surface. Provide suitable washer for all nuts.

E. Do not splice structural members between supports unless otherwise indicated.

F. Blocking and Nailers: Provide all necessary special framing, furring, blocking, nailers, and other construction necessary for the installation, anchoring, or bracing of the work of other trades, whether specifically indicated or not.

G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

J. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

3.2 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs for all load bearing partitions. Provide slip plate bottom plate at all interior non load-bearing partitions as indicated. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide 2-by-6-inch nominal size wood studs spaced 24 inches o.c. unless otherwise indicated.
2. For interior partitions and walls, provide 2-by-4-inch nominal size wood studs spaced 16 inches o.c. unless otherwise indicated.

3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

D. Provide diagonal bracing in walls, at locations indicated at 45-degree angle, full-story height unless otherwise indicated.

3.3 INSPECTION

A. Discard lumber of plywood pieces with defects which might impair quality of work

B. Examine completed work to ensure that fasteners and connections are secure. Perform additional nailing or boiling when required. Determine that nail heads and bolt heads are flush with wood surface and correct.

C. Leave surfaces clean, free from dirt or debris, ready for application or installation of finish materials or subsequent work.

END OF SECTION

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SECTION 06 41 00
ARCHITECTURAL 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 and shelving 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 01 33 00.

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.

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
3. Work Area Work Surface: AWI Section 400, Custom Grade
4. Plastic Laminate Window Sills: AWI Standards for Paneling and Trim, Custom Grade.

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 and window sill laminate 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.
    f. Black melamine for exposed shelves at desks and storage areas

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.

B. Plastic Laminate Window Sill: AWI Section 300, “Custom“ Grade single piece construction with half bullnose edge.

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. Shelving: 3/4 inch thick melamine face particle board with applied PVC front edge.

D. 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.

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

F. Door and Drawer Silencers: BHMA A156.16, L03011

G. Grommets: Standard 2 inch black plastic grommet

2.7 SHELVING

A. Exposed shelving made from the following materials, 3/4 inch thick.
1. Melamine faces particle board with applied PVC front edge

B. Provide adjustable shelf brackets in accordance with Section 10 56 17.

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

SECTION 06 64 00
PLASTIC PANELING

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 07 21 00: Thermal Insulation
2. Section 09 90 00: Painting and Coating

1.2 SUMMARY

A. Section includes composite glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

1.3 SUBMITTALS

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

B. Samples: furnish two (2) 12 inch x 12 inch samples of each color in the specified profile for each FRP type unless providng the basis of design indicated in this section.

C. Details: Fully detail to graphically show all panel dimensions and vertical and horizontal termination and transitions. Key to floor plan

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 200 or less.
2. Smoke-Developed Index: 450 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store material(s) in accordance with manufacturer’s instructions, with seals and labels intact and legible.

B. Store butyl tape in accordance with manufacturer’s instructions, maintaining temperatures above freezing at all times prior to installation.

PART 2 - PRODUCTS

2.1 FRP1 – FIBERGLASS REINFORCED PANELS

A. General: Gelcoat-finished, composite glass-fiber reinforced plastic panels, field adhered and cut FRP to moisture resistant plywood complying with ASTM D 5319.

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. Nudo Products, Inc.
2. Basis-of-Design Product: Subject to compliance with requirements, provide Nudo Products, Inc NuFiber panels mounted to .625 inch plywood backing or equal.
3. Substrate: Field adhere and cut to moisture resistant Plywood
4. Nominal Thickness: Not less than 0.675 inch
5. Surface Finish: Smooth texture
6. Fire Rating: Class C: non-structural
7. Width: 4 foot-0 inches
8. Length: Longest available length avoiding horizontal joints, 8 foot-0 inches high.
9. Color: White

2.2 ACCESSORIES

A. FRP1 Accessories: 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 FRP panels
2. Edge to Edge Trim: 2 inch inch “T” bar (V-45), set in receiver for Two-Piece Division bar (V-55)
3. Edge to alternate material: Manufacturer’s standard vinyl trim with minimum one inch face overlapping FRP panel.
4. Inside Corner: Manufacturer’s standard vinyl trim with minimum of one inch face overlapping each surface.
5. Outside Corner: Manufacturer’s standard vinyl trim with minimum of one inch face overlapping in each direction.
6. Mechanical Edge Fasteners: Manufacturer’s recommended stainless steel self tapping and countersunk screws.
7. Mechanical Field Fasteners: Manufacturer’s standard stainless steel self tapping rivet or screw with exposed vinyl head.
8. Strapping: Provide 4 inch 20 gauge metal straps for bracing between girts at pre-engineered metal building applications.

B. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 - Joint Sealants.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

B. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

C. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

3.2 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions, with manufacturer's standard mounting rivets, hardware and trim. Provide a full bed of sealant at all overlapping vertical wall joints. Place a full bed of sealant at the overlapping horizontal joints in the wash bay ceiling. Panel overlaps to meet manufacturer's recommendations.

B. FRP1 –FRP Paneling

1. FRP panels to be field cut and adhered to moisture resistant 5/8" plywood. At pre-engineered metal building applications, mount directly to engineered buildings wind girt system and vertical metal stud sub framing coordinated to occur at vertical joint of FRP composite panels and a maximum vertical dimension of 4 foot-0 inches. Horizontal sub framing to be provided as required limiting vertical span of panels to maximum 4 foot-0 inches o.c. At conventional metal framing systems mount directly to metal studs.
2. Install panels in a bed of adhesive at horizontal and vertical framing. In addition, mechanically anchor panels to metal stud sub framing at every 4 feet. Predrill and use grommet type washer for anchors.
3. Panels to be installed without horizontal joints unless vertical application extends beyond the available length of composite panel.
4. Mechanical edge fasteners to be countersunk and concealed by manufacturer's vinyl trim.
5. At metal buildings, install vertical metal straps behind frp panels for bracing every 2 feet on center between metal girts.
6. Mechanical field fasteners permitted as recommended by panel manufacturer for span of rating of FRP composite panel. When required field fasteners to be manufacturer's standard through fastener with vinyl head.
7. Install trim accessories with adhesive and full bed of sealant. All exposed plywood edges to have manufacturer's trim and full bed of sealant.
8. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
9. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

10. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

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. 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 07 21 00
THERMAL 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. Foundation wall insulation (supporting backfill)
2. Concealed building insulation
3. Sound-attenuating insulation

B. Related Sections

1. Section 06 64 00 – Plastic Paneling
2. Section 08 11 00 – Metal Doors and Frames
3. Section 09 21 16 – 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 (2010 / 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, building Com Check and Section 13 34 19-Metal Building Systems.

   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.
   2. At roofs install a two layer system where the first layer of insulation is draped over the purlins and then compressed when the metal roof panels are attached. Install the second layer parallel to the purlins and use fall protection as required by code and the metal building manufacturer.

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 07 62 00
FLASHING AND 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 include the following:

1. Section 06 64 00: Plastic Paneling
2. Section 07 92 00: Joint Sealants
3. Section 08 11 00: Metal Doors and Frames
4. Section 08 51 13: Aluminum Windows

1.2 SUMMARY

A. Section Includes:

1. Brake metal flashing and trim

1.3 ACTION SUBMITTALS

A. Product Data: For each location.

B. Shop Drawings: Include sections, fabrication details and connections to supporting structure and other adjoining work.

1. Submit Shop Drawings showing flashing and trim, and attachment devices:
   a. Flashing at Concrete Unit Masonry
   b. Flashing at bottom of Plastic Paneling
   c. Flashing at Aluminum window systems
   d. Flashing at head of Overhead Doors
   e. Flashing at Canopy
   f. Other locations as identified on project documents.
   g. Attachment devices

C. Samples : Submit 8 inch square samples of specified sheet materials to be exposed as finished surfaces. Submit 12 inch-long, completely finished units of specified factory-fabricated products.

D. Product Schedule: For Plastic Paneling, Overhead Door head, window systems, and metal wall panel at concrete curb.

1.4 REFERENCES

A. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc- Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. SMACNA – Architectural Sheet Metal manual.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Sheet Metal Flashing and Trim

1. Aluminum Sheet: Commercial quality, ASTM B209, 6063-T5 alloy, mill finish, shop precoated, 0.032 inch thick (minimum) except as otherwise indicated.
2. Galvanized Steel: ASTM A653, Grade A, G90 zinc coating; 24-gauge core steel.

B. Finish

1. Aluminum flashing and trim shall be mill finish or as otherwise called out on the contract drawings.

C. Reglets and Counter-flashings:

1. Shall be prefabricated, 24-gauge with factory mitered corners.
   a. Provide continuous foam backer rod and sealant where shown.

D. Miscellaneous Materials and Accessories:

1. Solder: Provide approved sheet metal compatible lead free solder with resin flux.
2. Fasteners: Stainless Steel or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
3. Bituminous Coating: FS TT-C-494 or SSPC-Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
4. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed and adjacent systems, non-corrosive, size and gauge required for performance.
5. Roofing Cement: ASTM D4586 with no asbestos.
6. Master Sealant: For slipping joints in flashings shall be polyisobutylene and be nonhardening, non-migrating, non-skinning, and non-drying.
7. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15-mil.

2.2 FABRICATION

A. Shop-fabricate work to greatest extent possible and to comply with details shown and with applicable requirements of SMACNA Architectural Sheet Metal Manual.

B. Form the work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material.

C. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated with exposed edges folded back to form hems.

D. Fabricate non-moving seams in sheet metal with flat-lock seams.

1. For metal other than aluminum, on seamed tin edges form seams and solder.
2. After soldering, remove flux and wash joints clean.

E. When movable expansion type joints indicated on plans or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA Architectural Sheet Metal Manual.

B. Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners and set units true to line and level as indicated.

C. Install work with laps, joints and seams that will be permanently watertight and weatherproof. Drip edge flashing shall be provided with concealed splice plates for joints 10 feet, o.c.

D. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproofing performance.

E. Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contract, with bituminous coating to other permanent separation as recommended by manufacturer/fabricator.

F. Install reglets to receive counter-flashing in manner and by methods recommended by manufacturer.

G. Install counter-flashing in reglets by snap-in seal arrangement.

H. Install elastic flashing in accordance with manufacturers’ recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.

3.2 PROTECTION

A. Provide for surveillance and protection of flashings and sheet metal work during construction to ensure ensure the work will be without damage or deterioration, other than natural weathering at time of substantial completion.

3.3 CLEANING

A. Clean exposed metal surfaces, removing substances that might cause corrosion or metal or deterioration of finishes.

END OF SECTION

SECTION 07 92 00
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.
2. Section 06 64 00: Plastic Paneling
3. Section 08 10 00: Metal Doors and Frames
4. Section 08 51 13: Aluminum Windows
5. Section 08 80 00: Glazing for glazing sealants
6. Section 09 21 16: 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.

3. Perimeter Draft Stopping System at Mezzanine Floor

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.

2.5 PERIMETER DRAFT STOPPING JOINT SYSTEM

A. General: Provide perimeter joint protection system at mezzanine floor for draft stopping in accordance with manufacturers installation instructions

B. Provide product and accessories in accordance with the following approved system or approved equal
   1. Hilti Firestop System No. CEJ 421 P Perimeter Fire Barrier System Application 3 Perimeter Joint Protection
      a. Hilti CP 672 Firestop Joint Spray

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.

3.4 Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.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)

D. Multicomponent Pourable Urethane Sealant: At interior and exterior horizontal joints, provide products complying with the following:

1. Products: Provide one of the following
   a. Chem-Calk 550; Bostik Inc.
   b. Vulkem 245; Mameco International
   c. Pourthane; W.R. Meadows, Inc.
   d. NR-200 Urexpan; Pecora Corporation
   e. Sikaflex - 2c SL; Sika Corporation
   f. SL 2; BASF Construction
   g. Vulkem 445; Tremco
2. Type and Grade: M (multicomponent) and P (pourable)
3. Class: 25
4. Use Related to Exposure: T (traffic)

END OF SECTION

SECTION 08 11 00
METAL 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

B. Related Sections include the following:

1. Section 07 92 00: Joint Sealants
2. Section 08 31 13: Access Doors and Frames
3. Section 08 71 00: Door Hardware
4. Section 08 80 00: Glazing
5. Section 09 21 16: Gypsum Board Assemblies
6. Section 09 90 00: Painting and Coating

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
7. Coordination of glazing frames and stops with glass and glazing requirements

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.

E. Interior Windows: Refer to glazing section for glazing requirements.

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.

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.
3. Provide at least two anchors per side on interior window frames

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.

D. Window installations: Comply with industry standards for commercial window installation.

3.2 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

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SECTION 08 31 13
ACCESS 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. 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 07 92 00: “Joint Sealants”
2. Section 08 11 00: “Metal Doors and Frames”
3. Section 09 21 16: "Gypsum Board Assemblies" for gypsum board walls and ceilings.
4. Section 09 30 13: "Ceramic Tiling" for ceramic tile walls.
5. Section 23 05 00: “Common Work Results for HVAC”

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.

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SECTION 08 51 13
ALUMINUM WINDOWS

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 07 92 00: Joint Sealants
2. Section 08 80 00: Glazing

1.2 SUMMARY

A. This Section includes Commercial Grade exterior, horizontal sliding aluminum windows and fixed aluminum windows in mulled units, double glazed with insulating glass, designed for metal buildings, of the performance class indicated.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows engineered, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading without failure, as demonstrated by testing manufacturer's standard window assemblies representing types, grades, classes, and sizes required for Project according to test methods indicated. Thermal performance of windows is to comply with the requirements of ANSI/ASHRAE/IES Standard 90.1-2013 and the Building Envelope Comcheck that is part of the Contract Documents.

B. Performance Requirements: Testing shall demonstrate compliance with requirements indicated in AAMA 101 for air infiltration, water penetration, and structural performance for type, grade, and performance class of window units required. Where required design pressure exceeds the minimum for the specified window grade, comply with requirements of AAMA 101, Section 3, "Optional Performance Classes," for higher than minimum performance class.
1. Air-Infiltration Rate for Operating Units: Not more than 0.37 cfm/ft. of operable sash joint for an inward test pressure of 6.24 lbf/sq. ft. Water Penetration: No water penetration as defined in the test method at an inward test pressure of 20 percent of the design pressure.
2. Uniform Load Deflection: No deflection in excess of 1/175 of any member's span during the imposed load, for a positive (inward) and negative (outward) test pressure of 60 lbf/sq. ft.
3. Structural Performance: No failure or permanent deflection in excess of 0.4 percent of any member's span after removing the imposed load, for a positive (inward) and negative (outward) test pressure of 30 lbf/sq. ft.
4. Condensation Resistance: Provide units tested for thermal performance according to AAMA 1503.1 showing a condensation resistance factor (CRF) of 45.
5. Thermal Transmittance Test (Conductive U-Factor): Conductive thermal transmittance (U-Factor) shall not be more than 0.62 BTU/hr X sq.ft. X deg F when glazed with 0.47 center of glass U-Factor.

1.4 SUBMITTALS

A. Product Data for each type of window specified, including the following:

1. Construction details and fabrication methods
2. Profiles and dimensions of individual components
3. Data on hardware, accessories, and finishes

B. Shop Drawings showing fabrication and installation of each type of window required including information not fully detailed in manufacturer's standard Product Data and the following:

1. Layout and installation details, including anchors
2. Elevations at 1/4 inch = 1 foot scale and typical window unit elevations at 3/4 inch = 1 foot scale
3. Full-size section details of typical composite members, including reinforcement and stiffeners
4. Location of weep holes
5. Panning details
6. Hardware, including operators
7. Glazing details

C. Test reports from a qualified independent testing agency indicating that each type, grade, and size of window unit complies with performance requirements indicated based on comprehensive testing of current window units within the last 5 years. Test results based on use of down-sized test units will not be accepted.

D. Test Report of Air-Infiltration Testing performed by qualified Testing Agency in accordance with Section 3 of this Specification

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

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed installation of aluminum windows similar in material, design, and extent to those required for this Project and with a record of successful in-service performance.

B. Single-Source Responsibility: Obtain aluminum windows from one source and by a single manufacturer.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check window openings by field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

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:

a. Horizontal-Sliding Windows:
   a. Dominion Building Products
   b. EFCO Corporation
   c. Kawneer
   d. Manko

2.2 MATERIALS

A. Aluminum Extrusions: Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength and not less than 0.062 inch thick at any location for main frame and sash members.

B. Fasteners: Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.

1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Window Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with requirements of ASTMs B 633; provide sufficient strength to withstand design pressure indicated.

D. Compression-Type Glazing Strips and Weatherstripping: Unless otherwise indicated, and at manufacturer's option, provide compressible stripping for glazing and weatherstripping such as molded EPDM or neoprene gaskets complying with ASTM D 2000 Designation 2BC415 to 3BC620, or molded PVC gaskets complying with ASTM D 2287, or molded expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.

E. Sliding-Type Weatherstripping: Provide woven-pile weatherstripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701.2.

1. Provide stripping with integral centerline barrier fin of semirigid plastic sheet of polypropylene.

F. Sealant: For sealants required within fabricated window units, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating. Comply with Division 7 Section 07 92 00 "Joint Sealants" of these Specifications for selection and installation of sealants.

G. Wire-Fabric Insect Screen: 18-by-18, 18-by-16, or 18-by-14 mesh of 0.011-inch- diameter, coated aluminum wire, complying with FS RR-W-365, Type VII.

2.3 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessories that comply with indicated standards.

B. Insect Screens: Provide insect screens for each operable exterior sash or ventilator. Locate screens on inside or outside of window sash or ventilator, depending on window type. Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches.

1. Wickets: Provide sliding or hinged-type wickets, framed and trimmed for a tight fit and durability during handling. Screen Frames: Fabricate frames of aluminum members of 0.020-mil- minimum wall thickness, with mitered or coped joints and concealed mechanical fasteners. Finish to match window units.
2. Provide removable PVC spline-anchor concealing edge of screen frame.

C. Weatherstripping: Provide sliding-type weatherstripping where sash rails slide horizontally or vertically along unit frame. Provide compression-type weatherstripping at perimeter of each operating sash where sliding type is inappropriate.

1. Provide weatherstripping locked into extruded grooves in sash.

2.5 HORIZONTAL-SLIDING WINDOWS

A. Window Grade and Class: Comply with requirements of AAMA Grade and Performance Class HS-CW50. Window units shall successfully pass operating force test performance requirements specified in AAMA 101.
1. Basis of Design: Manko 3 1/2 inch 2135xpt Ultra Thermal Slider

B. NFRC Rating for Window Thermal Performance: Provide window with NFRC rating for whole window thermal transmittance not to exceed 0.54

C. Operating Force: Where operable windows are provided in an accessible room or space, at least one shall comply with the following requirements. Where operable windows are required to provide natural ventilation or an emergency escape, that window shall comply with the following requirements.
1. Operating force for opening and closing operable windows: 8.5 pounds max for horizontal sliding windows.

D. Hardware: Provide the following operating hardware:

1. Sweep Latch
2. Pull

2.6 FABRICATION

A. General: Fabricate aluminum window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.

1. Provide units that are reglazable without dismantling sash or ventilator framing.
2. Prepare window sash or ventilators for glazing, except where preglazing at the factory is indicated.

B. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance, thermal barrier, located between exterior materials and window members exposed on interior, in a manner that eliminates direct metal-to-metal contact.

1. Provide thermal-break construction that has been in use for not less than 3 years, has been tested to demonstrate resistance to thermal conductance and condensation, and has been tested to show adequate strength and security of glass retention.
2. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.
3. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
4. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.
5. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units.
6. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated.
7. Glazing Stops: Provide screw-applied or snap-on glazing stops, coordinated with glass selection and glazing system indicated. Finish to match window units.

C. Preglazed Fabrication: Preglaze window units at the factory where possible and practical for applications indicated. Comply with glass and glazing requirements of Division 8 Section "Glazing" of these Specifications and AAMA 101.

2.7 FINISHES

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect openings before installation. Verify that rough or masonry opening is correct and sill

plate is level.

3.2 INSTALLATION

A. Comply with manufacturer's specifications and recommendations for installing window units, hardware, operators, and other components of the Work.

B. Set window units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place.

1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified under "Dissimilar Materials" Paragraph in appendix to AAMA 101.

C. Set sill members and other members in a bed of sealant or with joint fillers or gaskets, as shown on Shop Drawings, to provide weathertight construction. Refer to Division 7 Section 07 92 00 "Joint Sealants" for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the Work.

1. Sealants, joint fillers, and gaskets to be installed after installation of window units are specified in another Division 7 Section 07 92 00.

2. Provide sealant at head, sill, and jambs at both the interior and exterior walls.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections. Testing Agency is required to be an AAMA Accredited Laboratory.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Air-Infiltration Testing:
   a. Test Pressure: That required to determine compliance with AMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
   b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
3. Water-Resistance Testing:
   a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/ WDMA/CSA 101/I.S.2/A440 performance grade indicated.
   b. Allowable Water Infiltration: No water penetration through or around assembly.
4. Testing Extent: Three windows of each type as selected by Owner Representative and inspecting agency. Windows shall be tested after perimeter sealants have cured.
5. Test Reports: Prepared according to AAMA 502.

C. Noncomplying windows shall be fixed, removed, or replaced and retested as specified above.

D. Additional testing and inspecting, at Contractor’s expense, will be performed to determine compliance of additional work with specified requirements.

E. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust operating sash and hardware to provide a tight fit at contact points and at weatherstripping for smooth operation and a weathertight closure.

3.5 CLEANING

A. Clean aluminum surfaces promptly after installing windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

B. Clean glass of preglazed units promptly after installing windows. Comply with requirements of Division 8 Section "Glazing" for cleaning and maintenance.

3.6 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to aluminum window manufacturer, that ensure window units are without damage or deterioration at the time of Substantial Completion.

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SECTION 08 71 00
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
2. Card Reader system for Doors

B. Related Sections include the following:

1. Section 08 11 00: Metal Doors and Frames
2. Section 08 80 00: Glazing
3. Section 13 34 19: Metal Building Systems

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 for Door Hardware: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

E. Source Limitations for Card Reader System:
1. Vendors for the Velocity Card Reader system must be an approved vendor authorized by the manufacturer
2. Vendor must be trained and certified by the manufacturer in the Velocity 3.5 equipment installation

F. 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.

G. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section 01 31 19 "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. Stainless Steel Screws: At doors in wash bay provide all stainless steel fasteners and screws at metal door and frames.

2.3 LOCKS AND LATCHES

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

1. 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.

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 (IVE)
   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 (IVE)
   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 KICK PLATES

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

1. Ives; an Ingersoll-Rand Company (IVE)
2. Rockwood Manufacturing; An ASSA ABLOY Group Company (RO)
3. McKinney
4. Stanley

B. Standard: Comply with NFPA 80.

C. Materials: Fabricate protection plates from the following:

1. Stainless steel: .050 inch thick.

D. Fasteners: Provide manufacturer’s standard exposed sheet metal screws.

E. Size: Provide protection pates of sizes that follow:

1. Height: 12 inches
2. Width: 2 inches less than door width

2.11 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.
5. At wash bay doors provide stainless steel screws at doors and frames.

2.12 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, VSF bay, wash bay and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section 07 92 00 "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
(STI) Safety Technology International	no substitutions
(IVE) Ives	McKinney, Stanley
(LCN) LCN	Sargent
(NGP) National Guard Products	Pemko, Zero
(SCH) Schlage	Sargent

(VON) Von Duprin
Ives, Rockwood
(TR) Trine
(IDENTIV) Identiv, Inc

Precision (GJ) Glynn Johnson

Security, Von Duprin
no substitutions

HARDWARE GROUP NO. 06: RESTROOM/CREW 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	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
1	EA	DOOR SWEEP	198NA	AL	NGP

HARDWARE GROUP NO. 07: ADMIN OFFICE DOORS
DOOR NUMBER: 02, 03

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	OFFICE/ENTRY LOCK	L9056P 07A L583-363	630	SCH
2	EA	KICK PLATE	8400 12" X 34” LDW B4E	630	IVE
1	EA	WALL STOP	WS407CVX	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE

END OF SECTION

SECTION 08 80 00
GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows
2. Man Doors

B. Related Sections include the following:

1. Section 07 92 00: Joint Sealants
2. Section 08 11 00: Metal Doors and Frames
3. Section 08 51 13: Aluminum Windows
4. Section 08 71 00: Door Hardware

1.3 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

B. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other system or material defects.

B. Provide glazing that complies with the ASHRAE 90.1 (2013) Energy Standard requirements for fenestration and as indicated in the glazing schedule.

C. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the site location requirements.

D. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

D. Samples: For each type of insulated glazing system specified, provide a 12 inch square sample.

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

1.6 QUALITY ASSURANCE

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

B. Source Limitations for Glass: Obtain each type of glass from the same primary-glass manufacturer.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."

E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:

1. Insulating Glass Certification Council
2. Associated Laboratories, Inc.
3. National Accreditation and Management Institute

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Glass Schedule at the end of Part 3.

B. Products: Subject to compliance with requirements, provide one of the products indicated in the Glass Schedule at the end of Part 3.

2.2 PRIMARY FLOAT GLASS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); class as indicated in the Glass Schedule at the end of Part 3.

2.3 INSULATING GLASS

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. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

C. Sealing System: Dual seal, with primary and secondary sealants as follows:

1. Manufacturer's standard sealants
2. Polyisobutylene and polysulfide
3. Polyisobutylene and silicone
4. Polyisobutylene and hot-melt butyl
5. Polyisobutylene and polyurethane

D. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

1. Aluminum with mill or clear-anodized finish.

2.4 ELASTOMERIC GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations.

B. Elastomeric Glazing Sealant Standard: Comply with ASTM C 920 for type, grade, class, and uses.

1. Additional Movement Capability: Where additional movement capability is required, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

C. Glazing Sealant for Fire-Resistive Glazing Products: Identical to product used in test assembly to obtain fire-protection rating.

2.5 GLAZING TAPES

A. 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 for products indicated below:

1. AAMA 804.3 tape, where indicated.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.7 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

C. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

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

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.7 GLASS SCHEDULE

A. Where glass is designated on the Drawings, provide the following:

1. GL-2: Uncoated Clear Safety Glass: Where glass of this designation is indicated, primarily for interior windows and 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

2. GL-6: Tinted Insulating Low-E Glass: Where glass of this designation is indicated, primarily for exterior administration windows, provide tinted insulating glass unity complying with the following:
   a. Overall Unit Thickness: 1 inch
   b. Thickness of each Glass Lite: 1/4 inch
   c. Outdoor Lite: Tinted, Fully Tempered Glass with Low E Coating
      (1 Basis of Design Color: SolarGray by PPG or equal.
      (2 Basis of Design Coating: Solarban 70XL
      (3 Submit manufacturer's standard colors for architect selection.
   d. Interspace Content: Air
   e. Indoor Lite: Clear Fully tempered float glass.
   f. Performance Values
      (1 Visible Light Transmission: 30% - 40%
      (2 U-Value Winter: Maximum of .28
      (3 SHGC: Maximum of .20
      (4 Outdoor Visible Light Reflectance: 5% - 10%
   g. Outdoor Appearance: Tinted, Low-E low-reflective glass product

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

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

B. Related Sections include the following:

1. Section 06 64 00: Plastic Paneling
2. Section 07 21 00: Thermal Insulation
3. Section 07 92 00: Joint Sealants
4. Section 08 11 00: Metal Doors and Frames
5. Section 08 31 13: Access Doors and Frames
6. Section 09 30 13: Ceramic Tiling
7. Section 09 90 00: Painting and Coating
8. Section 10 28 00: Toilet and Bath Accessories
9.

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.

B. Certified Asbestos Free: All gypsum board and joint compounds used in project shall be certified asbestos free.

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

2. 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 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. See Section 06 64 00 Plastic Paneling for detail on interior plywood wainscot.

2.3 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 Board: 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 Product
   2. DomCrete Cementitious Tile-Backer Board: Domtar Gypsum
   3. Util-A-Crete Concrete Backer Board: FinPan, Inc.
   4. Durock Cement Board: United States Gypsum
   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.

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

3.3 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.

3.4 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.

3.5 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.

3.6 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.

3.7 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

END OF SECTION

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SECTION 09 30 13
CERAMIC TILING

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 09 21 16: "Gypsum Board Assemblies" for water resistant cement backer board installed in gypsum wallboard assemblies.
2. Section 07 92 00: “Joint Sealants”
3. Section 08 31 13: “Access Doors and Frames”

1.3 SUBMITTALS

A. Product Data: For each type of tile, mortar, grout, sealant and other products specified.

A. 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 unless providing basis of design per finish schedule on the drawings. Include samples of accessories involving color selection.

B. Grout Samples: Furnish two (2) sections of grout showing the color for each scheduled grout type and color indicated unless providing basis of design per finish schedule on the drawings.

C. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.

D. 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 Color Wheel Collection 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 by 12 inch 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 07 92 00 "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.7 TILE BACKER BOARDS

A. Provide cementitious backer units or fiberglass mat-faced tile backer boards 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 09 21 16 “Gypsum Board Assemblies” for 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 09 65 13
RESILIENT 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 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. 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.
2. 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 RESILIENT ACCESSORIES

A. Rubber Wall Base:

B. 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.

2.3 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 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.

3.4 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 09 65 19
RESILIENT TILE FLOORING

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. Section Includes:
   1. Vinyl Composition Tile
   2. Transition Edges

1.3 SUBMITTALS

A. Submit a sample in accordance with Section 01 33 00 and the following:
   1. Submit color as selected by Architect, including accessories, for type of resilient flooring required.

B. Test Results:
   1. Calcium Chloride Moisture Test in compliance with CRI 104, 6.2.1.
   2. Subfloor Alkalinity Test

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility for Flooring: Obtain each type of flooring and accessories from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver tiles and installation accessories to Project site in original manufacturer’s unopened cartons and containers each bearing names of product and manufacturer, project identification, and shipping and handling instructions.

B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50 degrees F and 90 degrees F. Store tile flooring materials on flat surfaces. Move resilient flooring and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.6 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70 degrees F in spaces to receive tiles for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 degrees F.

B. Do not install resilient flooring until they are at the same temperature as the space where they are to be installed. Close spaces to traffic during resilient flooring installation.

1.7 SEQUENCING AND SCHEDULING

A. Do not install resilient flooring materials over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by tile manufacturer's recommended bond and moisture test.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents to owner at completion of work. Furnish not less than 10 square feet for each 500 square feet or fraction thereof of each VCT type specified.

PART 2 PRODUCTS

2.1 VINYL COMPOSITION TILES

A. Approved Manufacturers:
   1. Armstrong World Industries, Inc. (800-442-4212 x 2)
   2. Mannington, Mannington Commercial (800-241-2262)
   3. Tandus Centiva (800-248-2878)
   4. Tarkett, a Tarkett Sommer Company (800-777-8275)

B. All vinyl composition tile shall be the maximum extent possible of a single batch number. Tile should have uniform disbursement of color and texture throughout the thickness of the tile. Comply with ASTM F 1066, Composition 1 (non asbestos formulated).

C. Product, Size and Color:
   1. Basis of Design: Armstrong Standard Excelon Imperial Texture
   2. Size: 12 inch x 12 inch
   3. Color: as shown on drawings.

2.2 TRANSITION EDGES

A. Basis of Design: Schluter®-DILEX-EKSB Movement joint transition strip
   1. Description: profile with integrated roll-formed stainless steel with trapezoid-perforated anchoring legs, connected by a 1/4 inch (6 mm) wide thermoplastic rubber movement

zone, which together form the visible surface.
2. Anchoring Legs Material:
   E - Stainless Steel Type 304 = V2A
3. Movement Zone Color:
   PG - Classic Grey
4. Height as required

B. Furnish transition edges at the following locations:

1. Vinyl Composition Tile to Vinyl Composition Tile at joints
2. Vinyl Composition Tile to Existing Concrete

2.3 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by tile manufacturer for applications indicated.

C. Resilient Flooring Adhesives to be Non-Toxic, Low Odor, and Solvent Free with no alcohol, glycol, or ammonia. Adhesive shall be antimicrobial with no hazardous vapors and contain no carcinogenic materials, per OSHA Regulation 29 CFR 1910-1200. All containers shall contain material safety data sheets (MSDS) and be available at job site for inspection. Provide product as manufactured by W.F. Taylor Co., Inc. (800-397-4583) recommended for intended installation, as approved by resilient base manufacturer, or approved substitution.

D. Other materials, including edge strips not specifically described, but required for a complete and proper installation of resilient flooring, shall be only as recommended by the manufacturer of material to which it is applied.

PART 3 EXECUTION

3.1 INSPECTION

A. Installer must examine the areas and conditions under which resilient flooring and accessories are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
   1. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
   2. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.2 CONCRETE SUBFLOORS

A. Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, residual

adhesives, adhesive removers, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by manufacturer.

2. Finishes of subfloors comply with tolerances and other requirements specified in Division 3 Section, "Cast-In-Place Concrete" for slabs receiving resilient flooring.
3. Subfloor Moisture Conditions: Before installing flooring Contractor shall verify that Moisture emission rate of not more than 3 lb/1000 sq. ft./24 hours when tested by calcium chloride moisture test in compliance with CRI 104, 6.2.1, with subfloor temperatures not less than 55 deg F, or as recommended by manufacturer.
4. Subfloor Alkalinity Conditions: Before installing flooring Contractor shall verify that a pH range of 5 to 9 when subfloor is wetted with potable water and pHydrion paper is applied

3.3 PREPARATION

A. General: Comply with manufacturer's installation specifications for preparing substrates to receive products indicated.

B. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

C. This Contractor to remove coatings, including curing compounds, adhesives, plastics, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush. Surface to receive new flooring shall be prepared, including removal of existing materials not acceptable for proper installation of new materials, as required by manufacturer. Do not use solvents.

D. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors.

E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.4 INSTALLATION - GENERAL

A. Install flooring after finishing operations, including painting, have been completed. Moisture content of concrete slabs, building air temperature, and relative humidity must be within limits recommended by flooring manufacturer's directions.

B. Patch and repair floors and walls to receive flooring for proper installation of flooring, stair accessories, and base.

C. Place flooring with adhesive cement in strict compliance with manufacturer's recommendations. Butt tightly to vertical surfaces and edgings. Scribe around obstructions and to produce neat joints, laid tight, even, and straight. Extend flooring into toe spaces.

D. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-

permanent marking device.

E. Install flooring on covers for telephone and electrical ducts and other such items as occur within finished floor areas.

F. Maintain overall continuity of color and pattern with pieces of flooring installed in these covers. Tightly cement edges to perimeter of floor around covers and to covers.

G. Tightly cement flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections.

3.5 INSTALLATION – VINYL COMPOSITION TILE FLOORS

A. Lay tile from center marks established from center of area so that tile at opposite edges of the area are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at edge perimeters. Lay tile square to room axis unless otherwise indicated.

B. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged. Cut tile neatly in and around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable. Lay tile with grain in tile running in same direction.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.6 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing resilient floor coverings:
   1. Remove adhesive and other surface blemishes using cleaner recommended by floor covering manufacturer.
   2. Sweep or vacuum floor thoroughly.
   3. Do not wash floor covering until after time period recommended by floor covering manufacturer.
   4. Damp-mop floor to remove marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by manufacturer of resilient product

involved.

C. Clean products specified in this Section not more than four days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products using method recommended by manufacturer. Strip protective floor polish that was applied after completing installation, prior to cleaning.

D. Do not move heavy and sharp objects directly over resilient floor coverings. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

3.7 FINISHING

A. After completion of project and just prior to final inspection of work, thoroughly clean floors and accessories. For resilient tile, apply wax and buff with type of wax, number of coats, and buffing procedures in compliance with flooring manufacturer's instructions.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

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 06 64 00: Plastic Paneling
2. Section 08 11 00: Metal Doors and Frames
3. Division 22, 23, and 26: Painting of Plumbing, Mechanical and Electrical work is specified in Divisions 22, 23 and 26, respectively

1.2 SUMMARY

A. 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. Hollow Metal Door and Frames
5. Exposed Steel trim

B. 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.

C. 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 4 samples of each color and each type of finish – coat material indicated.

C. Prior to execution, provide 24 inch by 24 inch Mockups of specified CMU for Interior Masonry Paint system application for review by Owner to verify fill and finish of paint system for approval.

D. 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).

C. Acceptable Manufacturer for High Performance Coatings for Metal Bollards:

1. Tnemec Company, Inc.

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 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 (except at wash bay). Ferrous metal items to be painted include but are not limited to hollow metal doors, metal door frames, exposed structural steel, steel stairs, and steel railings:

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. .

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 10 14 00
SIGNAGE

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 23 05 00: Common Work Results for HVAC
2. Section 26 05 00: Common Work Results for Electrical
3. Section 26 50 00: Lighting

1.2 SUMMARY

A. This Section includes the following types of signs:

1. Restroom Signage
2. Exit Signage
3. Dimensional letters and numbers
4. 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. Panel Signs: Material and color sample chips from manufacturer's full line for submitted products.

C. ADA signage: Color chart identifying approved color combinations.

D. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.

1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.

E. 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. Manufacturers of Dimensional Letters:

a. Andco Industries Corp.
b. A.R.K. Ramos Manufacturing Company, Inc.
c. ASI Sign Systems, Inc.
d. Gemini
e. Metal Arts
f. Metallic Arts, Inc.
g. The Southwell Company
h. Spanjer Brothers, Inc.
i. 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. Unisex Restroom:
   a. Provide one 9 inch x 6 inch ADA compliant identification sign at each Unisex restroom
   b. Basis of Design: ComplianceSigns.com RRE-120 or approved equal.
   c. Sign Material: Acrylic
   d. Color: White Lettering on Blue

2. Exit Sign:
   a. Provide one sign stating EXIT in raised characters and Braille at each accessible exit door
   b. Basis of Design: ComplianceSigns.com RRE-655 6 inch x 4 inch or approved equal
   c. Sign Material: Acrylic
   d. Color: White Lettering on Blue

3. Accessible Exit Directional Sign:
   a. At any exits that are not an accessible exit provide an accessible exit directional sign in raised characters and braille indicating the closest accessible exit
   b. Basis of Design: Compliancesigns.com ADA Acessible Braille Sign RRE-14757
   c. Color: White Lettering on Blue

4. Occupancy Sign
    a. At Second Floor provide one sign stating “Maximum Occupancy Not to Exceed 5 Persons”
    b. Basis of Design: Compliancesigns.com NHE-15663
    c. Color: Black Letters on White Field
    d. Size: 14 inches x 10 inches

5. Other Identification Graphics: Provide signs with written name, raised braille lettering, graphic symbol, and contrasting color that is compliant with ADA requirements

E. Exterior Identification Signs shall be as follows:

1. Parking Signs (Accessible Parking Space):
    a. Size: 12 inch X 18 inch Accessible Handicap Parking Sign mounted on post at Accessible parking spaces or on building when space is adjacent to building. Mounted a minimum of 60 inches above pavement.
    b. Van Accessible Space Sign: Compliancedesigns.com PKE-16771 or approved equal
    c. Standard Accessible Space Sign: Compliance Design PKE-20875 or approved equal
    d. CDOT M&S Standards S-614-1 and S-614-2
    e. Sign Material: Aluminum metal sheet.
    f. Color: White with Green and Blue Lettering

2.4 DIMENSIONAL LETTERS AND NUMBERS – BUILDING ADDRESS

A. Building Address Signage: Fabricate letters and numbers to required sizes and styles, using metals and thicknesses indicated. Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories.

1. Provide exterior signage to indicate street address number of building, assuming a maximum of five numbers.
2. Aluminum Sheet: Not less than 0.090 inch thick. Fabricate by the heliarc welding process Into ½ inch thick letter and number
3. Letter Height: 6 inches
4. Letter Style: Helvetica
5. Color: Numbers to be silver or a contrasting color to the building as approved by the Fire Marshal. The background plate shall match the color of the building. Numbers shall contrast the background.
6. Mounting Location to be determined by Fire Marshal by contractor prior to installation

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. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated.

1. Projected Mounting: Mount letters projection from the wall surface using a bracket-type of mounting to the exterior surface of the building.

D. 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. If there is a window at the latch side of the door, provide a back plate for the sign and mount at the window.

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

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SECTION 10 28 00
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 22 40 00: Plumbing Fixtures

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. 0347 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

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SECTION 22 00 00
PLUMBING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract 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 07 92 00: Joint Sealants
2. Section 22 05 00: Common Work Results for Plumbing
3. Section 22 40 00: Plumbing Fixtures
4. Section 22 45 00: Emergency Plumbing Fixtures

1.2 SUBMITTALS

A. Shop Drawings and Product Data: Submit for the following in accordance with Section 01 33 00.

1. Plumbing Fixtures (Refer to 22 40 00) and plans
2. Water Heater and Accessories
3. Drinking Fountain (EWC-1)

B. Operating Instructions and Maintenance Data: Submit for the following in accordance with Section 01 78 23.

1. Plumbing Fixtures
2. Water Heater
3. Plumbing Specialties
4. Drinking Fountain (EWC)

1.3 COORDINATION

A. Refer to project-specific Submittal Log provided at Pre-Bid Meeting.

B. Piping shall have adequate anchoring at connection to the main and at all vertical and horizontal bends. Provide concrete thrust blocks as required.

C. Provide sleeve for water service entry through foundation wall, make entry watertight.

D. Water service shall be a minimum of 5 feet 0 inches below grade.

E. Immediately complete alterations to water service, provide temporary (frost proof) outlet with hose valve outside building for construction purposes.

F. 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.

G. 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.

1.4 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.

1.5 SANITARY DRAINAGE SYSTEM

A. Obtain permit from agency having jurisdiction, connect to sanitary sewer as shown, provide building sewer, and connect to building drains as shown. System development fees and similar charges, if any, shall be paid by owner.

B. Provide a complete sanitary system, including all fixtures, traps, vents, waste piping, rough-ins, and connections as shown or specified.

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. 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.

C. 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.

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 WATER METER

A. Approved Manufacturers: Badger, Census, Hersey Co., Neptune.

B. Displacement or compound type, to meet all requirements of water department.

2.5 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.

2.6 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.

2.7 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.

2.8 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.

2.9 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.

2.10 DRAINAGE SPECIALTIES

A. Approved Manufacturers: Josam, J.R. Smith, Zurn and ACO or CDOT-approved-equals. See Architectural and Mechanical Plans for Locations.

2.11 CLEANOUTS

A. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

B. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.

2.12 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.

2.13 DOMESTIC WATER HEATERS

A. Approved Manufacturers: A.O. Smith, Bradford White, Lochinvar, Rheem, Ruud and Inc, and State.

B. Provide full size ball valve in cold and hot water inlet line to heater.

C. Provide dielectric unions at heater inlet connections.

2.14 FIXTURES

A. Approved Manufacturers: See Section 22 40 00, 2.1 “Plumbing Fixtures”.

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 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.

3.2 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 Section 22 05 00 "Common Work Results for Plumbing" 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 Section 07 92 00 "Joint Sealants" for sealant and installation requirements.

3.3 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.

3.4 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.

3.5 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.

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.

D. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drainpipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

E. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

F. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

H. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

I. Install underground PVC piping according to ASTM D 2321.

J. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
2. Install drains in sanitary waste gravity-flow piping.

K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

L. Install sleeves for piping penetrations of walls, ceilings, and floors.

M. Install sleeve seals for piping penetrations of concrete walls and slabs.

N. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.6 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.7 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

3.8 GAS PIPING SYSTEM

A. Gas piping shall be installed in strict accord with NFPA Pamphlet No. 54.

3.9 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.

3.10 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.

3.11 VACUUM BREAKERS

A. Provide line size vacuum breaker on all branch lines to all outlets with threaded outlets where a hose may be attached.

3.12 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.

D. Install thermometers on inlet and outlet piping from each water heater.

3.13 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.

3.14 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 to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. Set field-adjustable pressure set points of water pressure-reducing valves.

F. Set field-adjustable flow set points of balancing valves.

G. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

3.15 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.

B. Clean interior of piping. Remove dirt and debris as work progresses.

C. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.16 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.

3.17 PLUMBING SPECIALTIES INSTALLATION

A. Refer to Section 22 05 00 "Common Work Results for Plumbing" 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 receptor as shown on plans. 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 balancing valves in locations where they can easily be adjusted.

E. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve and pump.

F. Install water-hammer arresters in water piping according to PDI-WH 201.

G. Install supply-type, 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.

H. 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.

I. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

J. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

K. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

L. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

M. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

N. 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.

O. 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.

P. Fasten recessed-type plumbing specialties to reinforcement built into walls.

Q. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

R. 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 22 05 00 Subsection "Valves" for general-duty ball, butterfly, check, and globe valves.

S. Install air vents at piping high points. Include ball or globe valve in inlet and drain piping from outlet to floor drain.

T. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

U. 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.

V. Plumbing Specialty Connections

1. Piping installation requirements are specified in other Division 22 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 22 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 26 Sections.

3.18 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.

3.19 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 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract 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. Valves
8. Dielectric Connections
9. Copper Water Piping Joints
10. Welding
11. Access Doors
12. Freeze Protection Systems for Piping and Equipment
13. Excavating for Plumbing Work
14. Backfilling
15. Cutting and Patching
16. Concrete Bases
17. Drip Pans
18. Piping Installation
19. Tests
20. Identification Materials for Piping and Equipment

C. Related Sections

1. Section 08 31 13: Access Doors and Frames
2. Division 22 and 23 Sections

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 to the Structural Engineer for examination.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards:

1. Canadian Gas Association (CGA)
2. American Water Works Association (AWWA)
3. ANSI B31 Code for Pressure Piping
4. National Certified Pipe Welding Bureau (NCPWB)

5. National Fire Protection Association (NFPA)
6. Underwriters Laboratories (UL)

1.4 SUBMITTALS

A. Shop Drawings and Product Data: Submit for the following in accordance with Section 01 33 00 and 22 00 00.

1. Valves
2. Pipe Hangers and Supports

B. Operating Instructions and Maintenance Data: Submit for the following in accordance with section 01 78 23 and 22 00 00.

1. Valves

PART 2 - PRODUCTS

2.1 PIPE HANGERS, INSERTS AND SUPPORTS

A. General:

1. Study thoroughly all architectural, structural, 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 22 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.
9. Provide stainless steel hangers and supports at Wash Bays.

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° insert of high density, waterproofed calcium silicate, encased in a 360° 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 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 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 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 22 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.

2.7 ACCESS TO PLUMBING

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 plumbing, whether shown or not.

C. Access Doors: Where floors, walls and ceilings must be penetrated for access to plumbing, 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 08 31 13- Access Doors and Frames.

D. Where valves, control devices, cleanouts and similar plumbing elements 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 22 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.

2.8 CONCRETE BASES

A. Provide minimum 4 inch concrete pad (base) under base mounted pumps, boilers, water heaters, floor mounted expansion tanks, glycol tanks and other floor mounted equipment.

B. Establish the size and location of the various concrete bases required.

1. Water heaters, 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.

C. Furnish necessary anchor bolts and templates to Division 3 for locating and casting into concrete bases.

2.9 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.

2.10 IDENTIFICATION MATERIALS FOR PIPING

A. Materials for identification shall be as follows:

1. 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.

2. 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.

B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

D. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

F. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

G. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

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 PLUMBING WORK

A. General: Do not excavate for plumbing 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 plumbing and mechanical work has been tested and accepted, wherever testing is indicated.

3.8 CUTTING AND PATCHING

A. Openings in New Construction:

1. The Division 22 contractor shall verify all openings required in the new construction in connection with the work under Division 22 with the Architectural and Structural Drawings and shall then meet with and verify same with the General Contractor/Construction Manager 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 plumbing work.

B. Cutting in New Construction:

1. Failure on the part of the Division 22 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 Structural Engineer/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 Structural Engineer.

D. The Division 22 Contractor shall pay the appropriate Finishing Contractor as determined by the General Contractor for all patching resulting from cutting to accommodate plumbing.

3.9 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 22 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 plumbing 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. Install seismic restraints on piping.

Q. Select system components with pressure rating equal to or greater than system operating pressure.

R. Verify final equipment locations for roughing-in.

S. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and

calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

T. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

U. Install shutoff valve immediately upstream of each dielectric fitting.

V. Install water-pressure-reducing valves downstream from shutoff valves.

W. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

X. Install seismic restraints on piping.

Y. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

Z. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

AA. Install fittings for changes in direction and branch connections.

BB. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

CC. Install thermometers on inlet and outlet piping from each water heater.

3.10 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. For NPS 2 and Smaller: Use dielectric couplings or couplings or nipples or nipples or unions.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals. For NPS 2 and Smaller: Use dielectric couplings or couplings or nipples or nipples or unions.

3.11 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 by Structural Engineer, 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.

3.12 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.

3.13 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.

3.14 PIPE IDENTIFICATION

A. Identify system components.

B. Label pressure piping with system operating pressure.

C. 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.

D. 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.

E. 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 09 90 00.

F. Size of Color Field 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"

G. All pipe identification systems shall be visible from a normal observation position.

H. 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.

I. 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

J. 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.

3.15 CLEANING

A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING 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.

1.2 SUBMITTALS

A. Shop Drawings and Product Data: Submit for the following in accordance with Section 01 33 00.

1. Domestic Water Pipe Insulation
2. Underground Pipe Insulation

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, hot water recirculation 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 at 100 degrees F mean temperature.

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 UV Protective Jacketing for all above ground exterior piping.

2.4 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.5 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.6 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.7 SEALANTS

A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.8 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy or 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply or hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

C. Provide .016 inch Aluminum UV Protective Jacketing 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 Section 22 05 00 “Common Work Results for Plumbing" for insulation requirements at Pipe Hanger and Supports.

1. Seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
2. 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.

3. 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.
4. At contractor's option: Wrap pipe and hanger. Hangers sized for piping. Clamp may project through insulation.
5. 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.
6. Provide stainless steel hangers and supports at Wash bay.

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.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.
4. 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. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

R. Firestopping and fire-resistive joint sealers if applicable are specified in Section 07 84 00 "Firestopping."

S. Floor Penetrations: Apply insulation continuously through floor assembly.

1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

T. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

U. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

V. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

W. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

X. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

Y. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.2 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.4 PIPING AND PIPE FITTING INSULATION THICKNESS

A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Cold Water, Indirect Waste: Insulation shall be one of the following:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 0.5 inch thick.

END OF SECTION

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SECTION 22 10 00
PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section.

B. Related Sections:

1. Section 22 00 00: Plumbing General Requirements
2. Section 22 05 00: Common Work Results for 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 Sections 01 33 00 and 22 00 00.

1. Cast Iron Pipe
2. No Hub Couplings
3. Copper Pipe
4. Solder
5. Steel Pipe
6. PVC

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 feet plus or minus outside of building wall.

B. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.

C. Fittings: PVC, ASTM D2665 or ASTM D3034.

D. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.6 SANITARY WASTE AND VENT UNDERGROUND FROM 10 FEET OUTSIDE BUILDING LINE

A. Pipe: PVC Pipe, ASTM 2665.

B. Joints: Resilient joint with “O” ring seals, ASTM C-425-91, Type III

C. Fittings: Correspond to pipe in material, class and ASTM Designation.

D. Joints: Compression, rubber gasketed; install in accordance with ASTM D2321.

E. Where required and as indicated on the drawings (only applicable to off site, not paved areas)

1. Pipe: Schedule 80 PVC, ASTM D-2665-91B, SDR-35, Type PSM.

2.7 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.

B. Fittings: Cast iron no hub fittings shall be ASA Group 022 conforming to CISPI Standard 301, latest edition.

C. Joints: Hubless type using fittings, gaskets, clamp assembly complying with CISPI Standard 301, latest edition.

2.8 DOMESTIC HOT AND COLD WATER UNDERGROUND INSIDE BUILDING

A. Include 5 feet 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)
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 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.

3. Joints:

a. 2 inches and Under: Threaded using joint compound resistant to gas- air mixture, such as "gasolia".

4. Paint exposed metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating. Color to be yellow

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

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 22 00 00: Plumbing General Requirements
2. Section 22 45 00: Emergency Plumbing Fixtures

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. See plans for plumbing fixture models and requirements.

PART 3 -EXECUTION

3.1 GENERAL

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 07 92 00. 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

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SECTION 22 45 00
EMERGENCY PLUMBING FIXTURES

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. The work specified in this Section consists of furnishing and installing eye/face wash at the location indicated on the Drawings.

C. Related Sections:

1. Section 22 00 00: Plumbing General Requirements
2. Section 22 40 00: Plumbing Fixtures

1.2 QUALITY ASSURANCE

A. Model number indicated is to establish a minimum standard of quality only.

B. Fixture shall be certified by CSA to meet the ANSI Z358.1 Standards for Emergency Eyewash and Shower Equipment when properly installed.

C. Units with damaged or missing parts or components will be rejected.

1.3 SUBMITTALS

A. Submit the following for approval the following:

1. Product Data:

a. Submit manufacturer's published details indicating:

(1 Model Number
(2 Capacity
(3 Material Composition and Color
(4 Duration of flushing (minutes)
(5 Rate of flushing (gpm)
(6 Anchoring details
(7 Statement attesting to conformance with ANSI Z358.1

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

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Ship all equipment and accessories securely wrapped or packaged and labeled for safe handling to avoid damage.

B. Store in a dry area safe from damage.

PART 2 - PRODUCTS

2.1 COMBINATION EMERGENCY SHOWER & EYE/FACE WASH

A. Acceptable Manufacturers:

1. Products of the following manufacturer are specified herein as the standard of quality for the Combination Emergency Shower and Eye/Face Wash:

a. Haws Corporation or approved equal
1455 Kleppe Lane
P.O. Box 2070
Sparks, NV 89432-2070
Telephone: 1-775-359-4712
Fax 1-775-359-7424
e-mail: info@hawsco.com
www.hawsco.com

B. Features:

1. Floor mounted
2. 11” stainless steel bowl
3. 9102 Stainless Steel Dust Cover
4. Certified by CSA to meet the ANSI Z3581.1 Standard

C. Eye/Face Wash (EEW): Basis of Design: Model No. 7360BTWC as manufactured by Haws Corporation or approved equal with the above minimum requirements. This fixture is not required to meet tepid flow requirements of ANSI Z3581.1; the tempering valve only needs to ensure that the water at the fixture does not exceed 100 degrees F and does not provide water under 60 degrees F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units securely to walls in accordance with the directions and recommendations of the product manufacturers and local codes.

B. Install units at locations as shown on drawings.

C. Eye/Face Wash stations shall be installed to meet all code requirements, unless otherwise noted.

END OF SECTION

SECTION 23 00 00
HEATING, VENTILATING AND AIR CONDITIONING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract 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 23 includes but is not limited to:

1. Heating, Cooling and Ventilating
2. Temperature Control and Instrumentation
3. Testing, Adjusting & Balancing

D. Related Divisions:

1. Division 9 for painting except mechanical identification systems.
2. Division 26 for power wiring and disconnect switches which are not furnished as an integral part of mechanical equipment.

E. Inspection: GC to inspect work preceding or interfacing with work of Division 23 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 and structural 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 and / 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.

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 01 42 19.

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

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
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 26 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 23.

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 manufacturer’s 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 23 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 23 and other trades for installation under Division 23 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 23 05 48 - Vibration Controls for HVAC.

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. Location of internal utilities and appurtenances concealed in construction
b. Field changes of dimension and detail
c. Changes by change order or field order
d. Details not on original contract drawings
e. Record following information on Specifications
f. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed
g. Changes by change order or field order
h. Other matters not originally specified

E. Shop Drawings: Maintain Shop Drawings as record documents recording changes made after review as specified for drawings above.

F. Spec Box: As early as possible during construction process, Mechanical Contractor shall provide and install a sheet metal spec box in a conspicuous mounting location within the mechanical room where it will not interfere with ongoing construction or finished mechanical room layout.

1. As mechanical construction progresses, each mechanical equipment factory provided owners manual and warranties shall be removed from original packing carton and immediately placed in the spec box for future reference by Mechanical Contractor in preparing operation and maintenance manual.
2. At completion of construction, a copy of the operation and maintenance manual shall be located here for future use.
3. Spec box shall be constructed of sheet metal with hinged top and some form of latching device. Label front of spec box "Operating and Maintenance Data". Spec box shall be minimum 16 inch x 12 inch x 4 inch overall, secured to mechanical room wall in permanent manner.

G. Submittal: At completion of project, deliver Project Record Documents to General Contractor for delivery to CDOT Representative

1.20 OPERATION AND MAINTENANCE DATA

A. See Section 01 78 23 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.

B. 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

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

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SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract and Division 1 General Requirements and applicable provisions elsewhere in the contract documents apply to this Section

B. Work Included in This Section:

1. Plates and Collars
2. Flashings and Seals
3. Cutting and Patching
4. Heating System Used for Temporary Heat During Construction
5. Tests
6. Identification Materials for Equipment

C. Related Sections

1. Division 22 and 23 Sections

1.2 QUALITY ASSURANCE

A. 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 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 PLATES AND COLLARS

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.

2.2 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. 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.

D. 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.

2.3 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 CUTTING AND PATCHING

A. Openings in New Construction:

1. The Division 23 contractor shall verify all openings required in the new construction in connection with the work under Division 23 with the Architectural and Structural Drawings and shall then meet with and verify same with the General Contractor/Construction Manager 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 23 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 Structural Engineer/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 Structural Engineer.

D. The Division 23 Contractor shall pay the appropriate Finishing Contractor as determined by the General Contractor for all patching resulting from cutting to accommodate mechanical work.

3.2 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°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.

3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are 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.

3.4 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.

3.5 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.

3.6 EQUIPMENT IDENTIFICATION

A. 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.

B. Equipment Identification

1. Provide equipment identification for each piece of motor driven mechanical equipment. Identification shall indicate equipment tag and area served. Size of letters to be 2-1/2" min.

3.7 ADJUSTING

A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

3.8 CLEANING

A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION

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SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of The General Conditions of the Contract 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, Adjusting and Balancing 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, Adjusting and Balancing Firm to the CDOT Representative within 30 days of contract award to ensure that the Testing, Adjusting and Balancing Firm is on the project from the outset of construction. All Testing, Adjusting and Balancing 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, adjusting and balancing work. In addition, have report certified by Professional Engineer who is familiar with testing, adjusting and balancing 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.

D. The Test and Balance Report must be submitted prior to scheduling the Project Closeout (punchlist) meeting. The Report shall be submitted to and reviewed by the CDOT representative, the certified code reviewer and the MEP engineer for review and comment. All deficient items must be corrected prior to contract closeout.

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, adjusting and balancing 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, adjusting and balancing work required, of type precision, and capacity as recommended in the following Testing, Adjusting and Balancing standard:

1. NEBB's Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.6 GUARANTEE OF WORK

A. The Testing, Adjusting and Balancing 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, Adjusting and Balancing 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, Adjusting and Balancing 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 ductwork 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, adjusting and balancing 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% 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: 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.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or ASHRAE 11 or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.4 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses, close to the fan and prior to any outlets, to obtain total airflow.
    c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Architect and Owner for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

3.5 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.6 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.
    g. Sheave make, size in inches, and bore.
    h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Suction static pressure in inches wg.

E. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System and air-handling-unit number.
    b. Location and zone.
    c. Traverse air temperature in deg F.
    d. Duct static pressure in inches wg.
    e. Duct size in inches.
    f. Duct area in sq. ft.

g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

F. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

G. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.7 REPORT OF WORK

A. The Testing, Adjusting and Balancing Contractor shall submit six (6) bound copies of the final test and balance 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, adjusting 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.

3.8 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:

1. 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).
2. Static pressure across all components of the system.
3. Required and final balanced CFM at each system terminal. Include the terminal size, reading orifice size, and velocities read to attain the CFM.
4. 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.
5. 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.
6. The report shall include a sheet which shall report the method of balance, project altitude, all correction factors used in the calculations.

3.9 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect or Owner.

B. Architect or Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Owner or Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.10 OWNERS INSTRUCTIONS

A. 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, adjusting and balancing 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

SECTION 23 30 00
HVAC AIR DISTRIBUTION

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of The General Conditions of the Contract 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

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. Product Data: Submit for the following products in accordance with Section 01 78 23:

1. Exhaust Fans

PART 2 - PRODUCTS

2.1 EXHAUST FANS (GARAGE 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.

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.

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.

END OF SECTION

SECTION 23 31 13
METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract 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

A. Section Includes:

1. Single-wall round ducts and fittings.
2. Sheet metal materials.
3. Sealants and gaskets.
4. Hangers and supports.

B. Related Sections:

1. Section 230713 "Duct Insulation” for duct liner and other duct insulation requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Welding certificates.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. McGill AirFlow LLC.
c. Sheet Metal Connectors, Inc.
d. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

D. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.

E. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

O. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

P. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

A. Make connections to equipment with flexible connectors.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.4 DUCT SCHEDULE

A. Supply Ducts:

1. Ducts Connected to Fans:

a. Pressure Class: Positive 2-inch wg
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Round and Flat Oval: 12

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 2-inch wg
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Round and Flat Oval: 6
d. SMACNA Leakage Class for Round and Flat Oval: 6

B. Elbow Configuration:

1. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

C. Branch Configuration:

1. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees."

END OF SECTION

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SECTION 23 81 13.11
PACKAGED TERMINAL AIR-CONDITIONERS, THROUGH-WALL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract 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

A. Section includes packaged, terminal, through-the-wall air conditioners.

1.3 ACTION SUBMITTALS

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

B. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Description: Factory-assembled and -tested, self-contained, packaged, terminal air conditioner with room cabinet, electric refrigeration system, and temperature controls; fully charged with refrigerant and filled with oil; with hardwired chassis.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.

B. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."

C. Install and anchor wall sleeves to withstand, without damage to equipment and structure, seismic forces required by building code.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
2. After installing packaged, terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Through-wall air conditioners will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 23 82 36
FINNED-TUBE RADIATION HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of The General Conditions of the Contract 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

A. Section includes electric baseboard radiation heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 ELECTRIC BASEBOARD RADIATION HEATERS

A. Description: Factory-packaged units constructed according to UL 499, UL 1030, and UL 2021.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 BASEBOARD RADIATION HEATER INSTALLATION

A. Install units level and plumb.

B. Install enclosure continuously around corners, using outside and inside corner fittings.

C. Join sections with splice plates and filler pieces to provide continuous enclosure.

D. Install enclosure continuously from wall to wall.

E. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.

F. Install air-seal gasket between wall and recessed flanges or front cover of fully recessed unit.

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

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. Electricity-metering components
4. Service Entrance CT cabinet
5. Concrete equipment bases
6. Cutting and patching for electrical construction
7. 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. For electricity-metering equipment.
2. Conduit, fittings and supports
3. Boxes
4. Fire Seals where applicable

B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

D. 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. Access doors and panels are specified in Division 8 Section 08 31 13 "Access Doors and Frames."

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 FIRE SEALS

A. Fire seals for walls and floors shall be an intumescent material capable of expanding to fill voids when exposed to temperatures beginning at 250 degree F (121 degree C). The seal system shall be U.L. classified and have ICBO, BOCA, and SBCC ratings to 3 hours. The seal system fire rating shall equal or exceed the fire rating of the penetrated surface to comply with NEC Section 300-21.

2.11 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

B. Meter Sockets: Comply with requirements of electrical power utility company.

1. Housing: NEMA 250, Type 3R enclosure.

2.12 TOUCHUP PAINT

A. Refinish and touch up paint. Paint materials and application requirements are specified in Section 09 90 00 "Painting and Coating."

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 concealed spaces of office areas are permitted to be Flexible Metal Conduit.

I. 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.

E. Wash Bays – All equipment installed in the wash bays shall be rated NEMA 4X.

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. Conductors from outlet to incandescent luminaire sockets and where run in fluorescent luminaire channels shall be type THHN or as approved by the NEC.

F. Solid wire #10 and smaller shall be connected as specified herein and shall be made tight in conformance with manufacturers recommendations.

G. Stranded wire shall be connected as specified herein and thoroughly taped with "Scotch" #33 or acceptable substitution approved equal electrical tape.

H. 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.

I. 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

J. 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. Wall outlets in exposed block or masonry construction shall have extension and device mounting straps as required to provide only such wall openings as may be covered by device plates without the use of mortar or other filler material.

F. Sectional boxes shall not be used where outlet boxes occur in concrete.

G. 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.

H. Install additional straps or cross-bracing to ensure complete rigid installation in steel stud system, bracing prior to installation of wall finish material.

I. "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.

J. Outlet boxes on opposite sides of fire rated walls and partitions shall be separated by a horizontal distance of at least 24 inches (60.96 cm).

K. Unused knockouts in boxes shall be left sealed.

L. Provide luminaire outlets with 3/8 inch (0.95 cm) no bolt fixture stud where required.

M. Telephone outlets shall be mounted at the same height as adjacent receptacle outlets unless noted otherwise.

N. Refer to architectural and electrical plans for heights of outlets.

O. 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. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. 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 WASH BAY ELECTRICAL WORK, EQUIPMENT AND ALL ELECTRICAL DEVICES

A. NEMA 4X Watertight and Weatherproof rated devices and enclosures, junction boxes, switches, disconnect switches, equipment, wiring, fittings, fixtures and all associated branch circuit components, and all electrical work installed within the premises of the wash bays shall be provide and installed to withstand direct spray exposure in the wash bays.

3.13 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.

3.14 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly.

3.15 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.

3.16 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. Electricity-metering components
6. Concrete bases
7. Cutting and patching for electrical construction
8. 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.

3.17 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Section 09 90 00 "Painting and Coating."

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.

3.18 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

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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 26 27 26: 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. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

E. 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.

F. Water Heater: Install a separate equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

G. 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 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches (450 mm) below grade and 6 inches (150 mm) from the foundation.

3.6 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 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

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 26 05 00: "Common Work Results for Electrical" for supports, anchors, and identification products.
2. Section 26 27 26: "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. Shop Area – Concealed: EMT
3. Office Area – Concealed: FMC
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations
5. Damp Locations: Rigid steel conduit
6. Wash Bays: Rigid nonmetallic conduit (RNC)
7. 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 Section 26 05 00 "Common Work Results for Electrical."

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. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Run conduit larger than 1-inch trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
4. Change from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above the floor.

I. 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.

J. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

K. Tighten set screws of threadless fittings with suitable tools.

L. 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.

M. 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.

N. 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.

O. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used

6 inches (150 mm) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

P. 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.

Q. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

R. 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 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

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 26 05 00: Common Work Results for Electrical
2. Section 26 24 16: Panelboards
3. Section 26 27 26: Wiring Devices

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 26 24 16
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 26 05 53: Identification for Electrical Systems
2. Section 26 28 13: 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 Section 01 77 00 "Closeout Procedures," 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 26 05 53 " Identification for Electrical Systems."

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 26 27 26
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 26 05 00: Common Work Results for Electrical
2. Section 26 05 26: Grounding and Bonding for Electrical Systems
3. Section 26 05 33: Raceway and Boxes for Electrical Systems
4. Section 26 05 53: Identification for Electrical Systems
5. Section 26 28 16: Enclosed Switches and Circuit Breakers

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 10 44 00.

D. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.

1. Control: Continuously adjustable rotary knob; with single-pole or three-way switching to suit connections.
2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable rotary knob, toggle switch, or slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch (130-mm) wire connecting leads.
3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

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.

2.7 WASH BAY ELECTRICAL WORK, EQUIPMENT AND ALL ELECTRICAL DEVICES

A. NEMA 4X Watertight and Weatherproof rated devices and enclosures, junction boxes, switches, disconnect switches, equipment, wiring, fittings, fixtures, and all associated branch circuit components, and all electrical work installed within the premise of the wash bays shall be provided and installed to withstand direct spray exposure in the wash area.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.

C. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.

D. 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.

E. 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.

F. Remove wall plates and protect devices and assemblies during painting.

3.2 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."

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 26 05 26 "Grounding and Bonding for Electrical Systems."

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 26 28 16
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 26 27 26: "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
2. Section 26 28 13: "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 Section 01 77 00 "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. Wash Bay: NEMA 250, Type 4X
3. Kitchen Areas, Restrooms or 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 Section 26 05 53 “Identification for Electrical Systems."

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 26 50 00
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. Daylight Sensors
6. Occupancy sensors
7. Lighting Control Panel

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. Fluorescent and high-intensity-discharge ballasts
   4. 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 01 78 23 “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. Lamps: 10 lamps for every 100 of each type installed but not less than 1

B. Ballasts: 1 for every 100 of each type installed but not less than 1.

C. Lenses: 1 for every 100 of each type installed but not less than 1.

D. 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 ballasts unless otherwise noted. Ballasts 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. HID Fixtures: Comply with UL 1598. Where LER is specified test according to NEMA LE 5B.

D. Metal Parts: Free of burrs and sharp corners and edges.

E. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

F. 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.

G. 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.

H. 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.

I. Fixture Support Components

1. Comply with Section 26 05 00 "Common Work Results for Electrical" 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. X1: 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 : Lithonia LQM S 3 G 120/277 EL N M6
   b. Acceptable substitution: Dual-Lite LXUGBE

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.
4. At Sand Sheds X1 Fixture shall be the following:
   a. Product Dual-Lite SEWL SRWE – 4X w/ Heater Min. Operating Temp of -22 deg F

B. X1A: LED EXIT SIGNS: Comply with UL 924 Wet location listed/UL Type 504X rated; for sign colors and lettering size, comply with authorities having jurisdiction.

1. X1A: LED Emergency Exit Sign at wet location, universal mount.
   a. Basis of Design Product: Dual-Lite LN4XGW

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 INTERIOR FIXTURES (LED AND FLUORESCENT)

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. F4: Interior Office Fixture: 2 ft x 4 ft recessed parabolic reflector
1. Basis of Design Product: Pinnacle LU24A-835LO-G1-1-OL1-0-W
2. Alternate Product: Lithonia 2AV G 2 32 ADP MVOLT GEB10PS PWS1836 LP835

D. F4E: Interior Office Fixture: 2 ft x 4 ft recessed parabolic reflector emergency light
1. Basis of Design Product: Pinnacle LU24A-835LO-G1-1-OL1-1B-W
2. Alternate Product: Lithonia 2AV G 2 32 ADP 120 GEB10PS EL14 PWS1846 LP835

E. F5: Wall Bracket and Surface mounted interior 4 foot LED strip fixture. Wall mount and ceiling mount. Refer to drawings for fixtures that will require wall brackets.

1. Basis of Design Product: Lithonia WL4 40L EZB LP840

2.6 FINISHES

A. Fixtures: Manufacturers' standard, unless otherwise indicated.

1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
2. Metallic Finish: Corrosion resistant.

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: Refer to electrical drawings for different occupancy sensors.

2.8 LIGHT SWITCHES

A. Low Voltage Switches

1. Provide low voltage dimming switch for control of lights in all interior areas in compliance with the ASHRAE 90.1 Standards – 2013.
2. Products: Refer to electrical drawings for different light switches.

B. Line Voltage Switches
1. Products: Refer to electrical drawings for different light switches.

2.9 ACCESSORIES

A. Battery Pack Assemblies: Fluorescent 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 two lamps 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. Pendant mounted luminaires shall hang even regardless of uneven or sloping ceilings. Maximum pendant spacing shall be 4 feet where luminaires having 4 foot channels are used. "Twin" stem assemblies shall not be permitted.

K. Installation of luminaires in mechanical rooms shall be coordinated with the ductwork and other obstructions. Provide special hangers as required.

L. Luminaires shall be provided with new lamps prior to final acceptance of the project. Any lamps used for more than ninety (90) days as temporary lighting shall be replaced by the contractor.

M. Ballasts shall be integrally mounted in all luminaires unless otherwise noted.

N. 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. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. 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.

F. Coordinate final testing, inspection and commissioning of lighting and controls by electrical engineer as required by the 2015 International Energy Conservation Code. Inspections must be completed and passed prior to substantial completion. Re-inspection shall be at the contractor’s cost.

3.5 TRAINING

A. Provide 1 hour training for owner on usage of lighting control systems, time clocks and other controls prior to Project Closeout.

END OF SECTION