



KUENY ARCHITECTS, L.L.C.

SPECIFICATION FOR

PROJECT:

**#2310 Public Safety Building - North Employee  
Washroom Remodel**

PROJECT LOCATION:

Kenosha County – Public Safety Building  
1000 55th Street  
Kenosha, WI 53140

OWNER:

Kenosha County Facilities  
19600 75th Street  
Bristol, WI 53104

SPECIFICATION DATE:

March 16, 2023 – BID SET

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## SECTION 01 10 00 SUMMARY OF WORK

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section

**INDEX**

1.1 Work Covered by Contract Documents	1.4 Work Sequence
1.2 Contracts	1.5 Contractors use of Premises
1.3 Work by Others	

### PART 1 GENERAL

#### 1.1 Work Covered by Contract Documents

- A. The project consists of the following: The remodeling of a 225 square foot Men's Restroom and a 200 square foot Women's Restroom. The project area is located in the Northwest side of the PSB building located at 1000 55th Street Kenosha, WI 53140. Both restrooms will be a complete remodel with the existing lockers to remain as is. The remodeling of both areas consists of existing finish, fixture, bathroom accessory, partition, and ceiling demolition. New construction includes, but is not limited to finishes, partitions, doors, plumbing fixtures, miscellaneous mechanical work, lighting, acoustical ceiling, and paint. The project is to also include finish upgrades in the adjacent vestibule and corridor.
- B. All work is to be done in strict compliance with the plans and specifications prepared by Kueny Architects, L.L.C., of Pleasant Prairie, Wisconsin.
- C. Bids under the **GENERAL CONTRACTOR** will include plumbing, mechanical, and the electrical work.
- D. Related Requirements Specified Elsewhere: The Conditions of the Contract – General and Supplementary, and these General Requirements shall apply with equal force and effect to all Contractors engaged in this Work.
- E. Contractor's Duties
1. Except as specifically noted, provide and pay for:
    - a. Labor and materials, tools and equipment. (See General Conditions).
    - b. Water, heat and utilities required for construction.
    - c. Other facilities and services necessary for proper execution and completion of Work.
  2. Taxes: No sales taxes required
  3. Permits, fees licenses, notices: the Contractor is required to obtain all permits.
  4. Comply with codes, ordinances, rules, regulations, orders and other requirements of public authorities which bear on performance of Work.
  5. Promptly submit written notice to Architect of observed variance of Contract Documents from legal requirements. It is not the Contractor's responsibility to make certain that Drawings and Specifications comply with codes and regulations:
    - a. Appropriate modifications to Contract Documents will adjust necessary changes.
    - b. Assume responsibility for work known to be contrary to such requirements, without notice.
  6. Enforce strict discipline and good order among employees. Do not employ Work of:
    - a. Unfit persons.

- b. Persons not skilled in assigned tasks.

**1.2 Contracts: (See General Conditions)**

- A. Construct Work under one single prime Contract:
  - 1. General Construction

**1.3 Work by Owner**

- A. Various toilet accessories and miscellaneous specialties.

**1.4 Work Sequence**

- A. Construct Work in stages: Phases are indicated on plans and in project summary. The General Contractor will determine the schedule. All Contractor's will be required to keep up with General Contractor's schedule.

**1.5 Contractor's use of Premises**

- A. Confine operations at site to areas permitted by:
  - 1. Law
  - 2. Ordinances
  - 3. Permits
  - 4. Contract Documents
- B. Do not unreasonably encumber site with materials or equipment. Do not interfere with other projects underway during the same time period.
- C. Do not load structure with weight that will endanger structure.
- D. Assume full responsibility for protection and safe keeping of products stored on premises.
- E. Move any stored products which interfere with operations of Owner or other Contractors.
- F. Obtain and pay for use of additional storage or work areas needed for operations.

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## **SECTION 01 30 00 PROJECT COORDINATION**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

**INDEX**

- 1.1 Description
- 2.1 Project Manager
- 3.1 General Duties of Project Managers
- 3.2 Coordination between Contractors at the Project Site

### **PART 1 GENERAL**

#### **1.1 Description**

- A. Work Included
  - 1. General Contractor will coordinate the Work of the entire Project.
  - 2. The General Contractor shall:
    - a. Coordinate work of their own employees and subcontractors.
    - b. Expedite their work to assure compliance with schedules.
    - c. Coordinate their work with that of other prime contractors and work by Owner.
    - d. Comply with orders and instructions of the Owner.
- B. Related Work Specified Elsewhere: Division 1.

### **PART 2 PERSONNEL**

#### **2.1 Project Manager**

- A. The General Contractor and each of the Mechanical and Electrical sub-contractors shall designate a qualified project manager for the duration of the construction work.
  - 1. Qualification:
    - a. Experienced in field work of the type required for this Project.
  - 2. Submit name to Architect.
- B. General Contractors: A qualified project superintendent must be present on the job during performance of the work.

### **PART 3 EXECUTION**

#### **3.1 General Duties of Project Managers**

- A. Construction Organization and Start-up
  - 1. Project Managers shall establish on-site lines of authority and communications:
    - a. Establish procedures for intra-project communication:
      - (1) Submittals
      - (2) Reports and records
      - (3) Recommendations
      - (4) Coordination drawings
      - (5) Schedules
      - (6) Resolution of conflicts.

- b. Interpret Contract Documents:
    - (1) Consult with Architect to obtain interpretations.
    - (2) Assist in resolution of questions or conflicts which may arise.
    - (3) Transmit written interpretations to Prime Contractors, and to other concerned parties.
  - c. Assist in obtaining permits and approvals:
    - (1) Building permits and special permits required for Work or for temporary facilities.
    - (2) Verify that contractors and subcontractors have obtained inspections for Work and for temporary facilities.
- B. Project Manager Duties
- 1. Prepare Coordination Drawings as required to resolve conflicts and to assure coordination of the Work of, or affected by, mechanical and electrical trades, or by special equipment requirements.
    - a. Submit to Architect.
    - b. Reproduce and distribute copies to concerned parties after Architect review.
  - 2. Inspection and Testing:
    - a. Inspect Work to assure performance in accord with requirements of Contract Documents.
    - b. Administer special testing and inspections of suspect Work.
    - c. Reject Work which does not comply with requirements of Contract Documents.
    - d. Coordinate Testing Laboratory Services:
      - (1) Verify that required laboratory personnel are present.
      - (2) Verify that tests are made in accord with specified standards.
      - (3) Review test reports for compliance with specified criteria.
      - (4) Recommend and administer any required retesting.
  - 3. Monitor the use of temporary utilities:
    - a. Verify that adequate services are provided and maintained.
    - b. Coordinate installation, operation and maintenance, to verify compliance with project requirements and with Contract Documents.
    - c. Coordinate use of Owner's facilities.
  - 4. Monitor Contractor's periodic cleaning:
    - a. Enforce compliance with Specification.
    - b. Resolve any conflicts.
  - 5. Arrange for delivery of Owner-furnished products.
    - a. Inspect for condition at delivery.
    - b. Turn over to appropriate Contractor, obtain receipt.
  - 6. Changes and Substitutions:
    - a. Recommend necessary or desirable changes to Owner and to Architect.
    - b. Review subcontractors' requests for changes and substitutions; submit recommendations to Owner and to Architect.
    - c. Assist Architect in negotiating Change Orders.
    - d. Promptly notify all subcontractors of pending changes or substitutions.
  - 7. Provide cost control for Project:
    - a. Revise and refine the approved estimate of construction cost periodically:
      - (1) Record actual costs and estimates for uncompleted work.
      - (2) Incorporate approved changes as they occur.
      - (3) Develop cash flow reports and projections.

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- b. Maintain cost accounting records for authorized work performed under:
  - (1) Unit costs.
  - (2) Actual costs for labor and materials.
  - (3) Other basis requiring accounting records.
- c. Implement procedures for review and processing of Contractor's applications for progress payments and for final payments;
  - (1) Review each application for payment, submit recommendations to Architect.
- 8. Maintain Reports and Records at Job Site, available to Architect and Owner.
  - a. Daily log of progress of Work.
  - b. Records:
    - (1) Contracts
    - (2) Purchase orders.
    - (3) Materials and equipment records.
    - (4) Applicable handbooks, codes and standards.
  - c. Obtain information from subcontractors and maintain file of record documents.
  - d. Assemble documentation for handling of claims and disputes.
- 9. Coordinate the work schedules of the subcontractors:
  - a. For temporary utilities.
  - b. Among the work of the trades specified in Division 23 and 26.
  - c. With the work of trades specified in Division 2 through 26.
- 10. Coordinate the schedules of subcontractors.
  - a. Verify timely deliveries of Products for installation by other trades.
  - b. Verify that labor and materials are adequate to maintain schedules.
- 11. Conduct conferences among subcontractors and other concerned parties as necessary to:
  - a. Maintain coordination and schedules.
  - b. Resolve matters in dispute.
- 12. Participate in Project Meetings:
  - a. Report progress of Work.
  - b. Recommend needed changes in schedules.
  - c. Transmit minutes of meetings to trades, as appropriate.
- 13. Temporary Utilities:
  - a. General Contractor can use existing site power.
- 14. Shop Drawings, Product Data Samples:
  - a. Prior to submittal, review for compliance with Contract Documents.
    - (1) Check field dimensions and clearance dimensions.
    - (2) Check relation to available space.
    - (3) Check anchor bolt settings.
    - (4) Review the effect of any changes on the work of other contracts or trades.
    - (5) Check compatibility with equipment and work of other trades.
    - (6) Check motor voltages and control characteristics.
    - (7) Coordinate controls and interlocks:
      - (a) Voltages
      - (b) Wiring of pneumatic electric switches or relays.
    - (8) Coordinate wiring and control diagrams.
- 15. Job Site Visits:
  - a. Project Managers shall visit site monthly until work of their contract begins.
  - b. Visit site weekly after Contractor has begun.
- 16. Verify that subcontractors maintain accurate record documents.
- 17. Observe Work for compliance with requirements of Contract Documents.

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- a. Maintain list of observed deficiencies and discrepancies.
  - b. Promptly report deficiencies or discrepancies to Architect.
  - c. Record results including time and date of start-up.
18. Equipment Startup:
- a. Check to assure that utilities and specified connections are complete and that equipment is in operable condition.
  - b. Observe test adjust and balance.
  - c. Record results including time and date of start-up.
19. Inspection and Acceptance of Equipment:
- a. Prior to inspection, check that equipment is clean, repainted as required, tested and operational.
  - b. Assist inspector; prepare list of items to be completed or corrected.
  - c. Should acceptance and operation of equipment constitute the beginning of the specified warranty period, prepare and transmit written notice to Architect for the Owner.
20. Assemble Record Documents from subcontractors and transmit to Architect.
- C. Project Manager's Close-out Duties
1. Mechanical and Electrical equipment start-up:
    - a. Coordinate check-out of utilities, operational systems and equipment.
    - b. Assist in initial start-up and testing.
    - c. Record dates of start of operation of systems and equipment.
    - d. Submit to Owner written notice of beginning of warranty period for equipment put into service.
  2. At completion of Work of each Contract, conduct an inspection to assure that:
    - a. Specified cleaning has been accomplished.
    - b. Temporary facilities have been removed from site.
  3. Substantial Completion:
    - a. Conduct an inspection to confirm or supplement Contractor's list of work to be completed or corrected.
    - b. Assist Architect in inspection.
    - c. Supervise correction and completion of work as established in Certificate of Substantial Completion.
  4. When Owner occupies a portion of Project prior to final completion, coordinate established responsibilities of Contractor and Owner.
  5. Final Completion:
    - a. When each Contractor determines the Work is finally complete, conduct an inspection to verify completion of Work.
    - b. Assist Architect in inspection.
  6. Administration of Contract Closeout:
    - a. Receive and review subcontractors' final submittals.
    - b. Transmit to Architect with recommendations for action.
- D. Additional Duties of General Contractor's Project Manager
1. Control the use of Site:
    - a. Supervise field engineering and site layout.
    - b. Allocate space for each Prime Contractor's use for field offices, sheds and work and storage areas.
    - c. Allocate field office and storage space, and work and storage areas, for use of each Prime Contractor.

- d. Establish access, traffic and parking allocations and regulations.
  - e. Monitor use of site during construction.
2. Construction Schedules:
- a. Coordinate schedules of the several Prime Contractors.
  - b. Prepare a detailed schedule of basic operations for all Prime Contractors.
    - (1) Each Prime Contractor shall prepare sub-schedules to comply with critical phases.
  - c. Monitor schedules as work progresses:
    - (1) Identify potential variances between scheduled and probable completion dates for each phase.
    - (2) Recommend to Owner adjustments in schedule to meet required completion dates.
    - (3) Adjust schedules of Contractors as required.
    - (4) Document changes in schedule, submit to Owner, Architect and to involved Contractors.
  - d. Observe work of each Contractor to monitor compliance with schedule.
    - (1) Verify that labor and equipment are adequate for the Work and the schedule.
    - (2) Verify that product procurement schedules are adequate.
    - (3) Verify that product deliveries are adequate to maintain schedule.
    - (4) Report noncompliance to Owner with recommendation for changes.
3. Daily Reports: Establish a procedure for the General Contractor's job superintendent to write a daily report on the progress of the job. These reports will be sent to the Architect at the end of each week. The report will include date, weather conditions, temperatures, manpower for all prime Contractor's and subcontractor's work being done by all prime contractors, problems and delays, extra work done or materials purchased.

### **3.2 Coordination between Contractors at the Project Site**

- A. All Contractors and all subcontractors shall coordinate their work with adjacent work and shall cooperate with all other trades so as to facilitate the general progress of the Work. Each trade shall afford all other trades every reasonable opportunity for the installation of their work and for the storage of their material. In no case will any Contractor be permitted to exclude from the premises or Work, any other Contractor or their employees, or interfere with any Contractor in the execution or installation of their work.
- B. Each trade shall perform its work in proper sequence in relation to that of other contractors or trades and as approved by the Architect. Any cost caused by defective or ill-timed work shall be borne by the trade responsible therefore.
- C. Each Contractor shall arrange its Work and dispose of its materials so as not to interfere with the Work or storage of materials of other Contractors and each shall join their work to that of others in accord with the intent of the Drawings and Specifications.
- D. All mechanical and electrical contractors shall work in cooperation with the General Contractor and with each other, and fit their piping, ductwork, conduit, etc., into the structure as job conditions may demand.  
All final decisions as to the right-of-way and run of pipe, ducts etc., shall be made by the Architect or his/her representative at prearranged meetings with responsible

representatives of the mechanical and electrical contractors.

- E. Each Contractor shall give due notice and proper information to other Contractors of any special provisions necessary for the placing or setting of their work coming in contact with work of other Contractors.  
Failing to do so in proper time, they will be held responsible and shall pay for any and all alterations and repairs necessitated by such neglect.
- F. It shall be the responsibility of all Contractors and all subcontractors to keep constant check on the progress of the Work so that the particular trade can ensure proper preparation for installation of that trade's work and not cause delay in the progress of the Work. It shall be the responsibility of each contractor to periodically make inspections of Work in progress and to notify the Architect when Work is complete in compliance with Specifications and Drawings.
- G. Contractors for Fire Protection, Plumbing, Heating and Ventilating and Electrical Work shall check and cross check the Drawings and Specifications of other trades to inform themselves of the work interrelated with their work.
- H. Any voluntary effort on the part of the Architect to expedite the notice to other Contractors shall not relieve any Contractor of their primary responsibility to give such notice.
- I. Contractors shall determine as far in advance as possible the exact size of openings and guarantee them to the General Contractor.

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## SECTION 01 31 19 PROJECT MEETINGS

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

**INDEX**

1.1 Description	2.3 Completion Inspection Meeting
2.1 Pre-Construction Meetings	2.4 One Year Warranty Review Meetings
2.2 Progress Meetings	3.1 Representatives List
	3.2 Meetings

### PART 1 GENERAL

#### 1.1 Description

- A. Work Included: Throughout the course of the Work, in order to provide coordination of the Project, the Architect will schedule meetings which will include but are not limited to:
1. Preconstruction Conference
  2. Progress Meetings
  3. Completion Inspection Meeting
- B. Related Requirements Specified in Other Sections
- |   |                  |
|---|------------------|
| 1. Summary of Work                      | Section 01 10 00 |
| 2. Construction Schedules               | Section 01 30 00 |
| 3. Submittals Shop Drawings and Samples | Section 01 33 00 |
| 4. Quality Control                      | Section 01 45 00 |
| 5. Project Record Documents             | Section 01 70 00 |
| 6. Operating and Maintenance Data       | Section 01 70 00 |
- C. Related Requirements in Other Parts of the Project Manual
1. Pre-Bid Conference: Instruction to Bidders
- D. Definitions: See General Conditions

### PART 2 PRODUCTS

#### 2.1 Preconstruction Meeting

- A. Schedule within fifteen (15) days after date of Notice to Proceed.
- B. Location: The Architect will designate a central site convenient for all parties.
- C. Attendance
1. All persons named on the Representatives List described in Part 3 of this Section.
  2. Major subcontractors.
  3. Major suppliers.
  4. Others as appropriate.
- D. Suggested Agendum
1. Distribution and discussion of:
    - a. List of major subcontractors and suppliers

- b. Projected construction schedules.
2. Critical work sequencing.
3. Major equipment deliveries and priorities.
4. Project coordination; designation or responsible personnel.
5. Procedures and processing of:
  - a. Field decisions
  - b. Proposal requests
  - c. Submittals
  - d. Change orders
  - e. Application for payment
6. Adequacy of distribution of Contract Documents.
7. Procedures for maintaining Record Documents.
8. Use of premises:
  - a. Office, work and storage areas.
  - b. Owner's requirements.
9. Construction facilities, controls and construction aids.
10. Temporary utilities.
11. Safety and first-aid procedures.
12. Security procedures.
13. Housekeeping procedures.

## **2.2 Progress Meetings**

- A. Schedule regular periodic meetings, as required.
- B. Hold called meetings as required by progress of the Work.
- C. Location of the Meetings: The project field office.
- D. Attendance
  1. Architect's, Owner's and Contractor's representatives as shown on Representatives List in Part 3 of this Section.
  2. Subcontractors as appropriate to the agenda.
  3. Suppliers as appropriate to the agenda.
  4. Others.
- E. Suggested Agendum
  1. Review, approval of minutes of previous meeting.
  2. Review of Work progress since previous meeting.
  3. Field observations, problems, conflicts.
  4. Problems which impede Construction Schedule
  5. Review of off-site fabrication; delivery schedules.
  6. Corrective measures and procedures to regain projected schedule.
  7. Revisions to Construction Schedule.
  8. Plan progress schedule, during succeeding work period.
  9. Coordination of schedule.
  10. Review submittal schedules; expedite as required.
  11. Maintenance of quality standards.
  12. Review proposed changes for:
    - a. Effect on Construction Schedule and on completion date.
    - b. Effect on other contracts of the Project.



13. Perform business.

**2.3 Completion Inspection Meeting**

- A. Schedule after Punch List has been returned to Architect and before final payment.
- B. Location: A walk-through of the entire project.
- C. Attendance
  - 1. Architect
  - 2. Owner’s Representatives
  - 3. Field Superintendent for each prime Contractor.
  - 4. Subcontractors as requested.
  - 5. Engineers
- D. Suggested Agendum
  - 1. Review of Punch List items not completed.
  - 2. Review of Project requirements for determination of final payment.

**2.4 One Year Warranty Review Meeting:** Approximately eleven (11) months after the date of substantial completion the Architect, Owner and Contractor will inspect the project and develop a list of items to be corrected under the provisions of the One-Year Warranty division of the General Conditions.

**PART 3 EXECUTION**

**3.1 Representative List:** After Contracts are awarded, each Contractor will submit to the Architect the names of the Project Manager and Field Superintendent. The Architect will then compile a list of all the representatives of the Owner, Architect, Engineers and Contractors who are authorized to make decisions about the Project and distribute this list to all interested parties.

**3.2 Meetings**

- A. The General Contractor shall schedule and administer pre-construction meeting, periodic progress meetings and specially called meetings throughout the progress of the Work.
  - 1. Prepare agenda for meetings.
  - 2. Distribute written notice of each meeting four (4) days in advance of meeting date.
  - 3. Make physical arrangements for meetings.
  - 4. Preside at meetings.
  - 5. Record the minutes; include all significant proceedings and decision.
  - 6. Reproduce and distribute copies of minutes within three (3) days after each meeting.
    - a. To all participants in the meeting.
    - b. To all parties affected by decisions made at the meeting.
- B. Representatives of Contractors, Subcontractors and suppliers attending the meeting shall be qualified and authorized to act on behalf of the entity each represents.

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## SECTION 01 33 00 SUBMITTALS

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

**INDEX**

1.1 Description	2.2 Product Data
1.2 Submittals	2.3 Samples
2.1 Shop Drawings	3.1 Shop Drawings, Product Data and Samples

### PART 1 GENERAL

#### 1.1 Description

A. Work Included

1. To ensure that the specified products are furnished and installed in accord with design intent, procedures have been established for advance submittal of design data and for its review by the Architect.
2. Construction Schedule
3. Progress Reports
4. Shop Drawings
5. Product Data
6. Samples
7. Layout Data
8. Schedule of Values
9. Instruction Manuals

B. Related Requirements Specified Elsewhere

1. General Conditions
  - a. Progress Schedule
  - b. Shop Drawings, Product Data and samples
  - c. Schedule of Values
2. Instructions to Bidders Section 00 21 13
3. Project Meetings Section 00 31 21
4. Quality Control Section 01 45 00
5. Material and Equipment Section 01 60 00
6. Project Closeout Section 01 70 00

C. Definitions

1. Shop Drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor or any subcontractor, manufacturer, supplier or distributor and which illustrate some portion of the Work.
2. Samples are physical examples furnished by the Contractor to illustrate materials, equipment or workmanship and to assist in the establishment of standards by which the work will be judged.

#### 1.2 Submittals

A. Construction Schedule

1. Submit initial schedules within fifteen (15) days after date of Award of Contract.

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- a. Architect will review schedules and return review copy within ten (10) days after receipt.
    - b. If required, resubmit within seven (7) days after return of review copy.
  2. Submit periodically updated schedules accurately depicting progress on first day of each month.
- B. Shop Drawings, Product Data and Samples
  1. Schedule submissions at least fourteen (14) days before dates reviewed submittals will be needed.
  2. Submit number of copies of Shop Drawings, Product Data and Samples which Contractor required for distribution plus two copies which will be retained by the Architect. An additional copy shall be submitted for mechanical engineers as required.
  3. Accompany submittals with transmittal letter, in duplicate, containing:
    - a. Date
    - b. Project title and number
    - c. Contractor's name and address
    - d. The number of each Shop Drawing, Product Data and Sample submitted.
  4. Submittals shall include:
    - a. Date and revision dates.
    - b. Project title and number.
    - c. The names of:
      - (1) Architect or Engineer
      - (2) Contractor
      - (3) Subcontractor
      - (4) Supplier
      - (5) Manufacturer
      - (6) Separate detailer when pertinent.
    - d. Identification of product or material.
    - e. Relation to adjacent structure or materials.
    - f. Field dimensions clearly identified as such.
    - g. Specification Section number.
    - h. Applicable standards, such as ASTM number.
    - i. Identification of deviations from Contract Documents.
    - j. Contractor's stamp, initialed or signed, certifying to review of submittals, verification of field measurements and compliance with Contract Documents.
  5. Resubmission Requirements:
    - a. Shop Drawings:
      - (1) Revise initial drawings as required and resubmit as specified for initial submittal.
      - (2) Indicate on drawings any changes which have been made other than those requested by Architect.
      - (3) Product Data and Samples: Submit new data and samples as required for initial submittal.
  6. Distribution of submittals after review:
    - a. Distribute copies of Shop Drawings and Product Data which carry Architect's stamp to:
      - (1) Contractor's file
      - (2) Job-site file
      - (3) Record document file
      - (4) Other prime contractors

- (5) Affected subcontractors
- (6) Suppliers
- (7) Fabricator
- (8) Erector
- b. Distribute samples as directed.
- 7. Note: Architect will not accept any drawing or data that has been transmitted by means of telephone or facsimile. Submittals may be transmitted via electronic mail or using a project management web application.
- 8. Provide sufficient space for both Contractor's and Architect's Review Stamp.

## **PART 2 PRODUCTS**

### **2.1 Shop Drawings**

- A. Original drawings, prepared by Contractor, subcontractor, supplier or distributor, which illustrate some portion of the Work; showing fabrication, layout, setting or erection details.
- B. Prepared by a qualified detailer.
- C. Identify details by reference to sheet, room schedule, detail numbers or other identification for coordinating with Contract Drawings.
- D. Reproductions for Submittals: Submittals made on paper should be provided with five copies in blue or black line on white background.
- E. Unless otherwise specifically directed by the Architect, make all Shop Drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.
- F. One set of corrected drawings used for fabrication will be made available on the Owner's request.

### **2.2 Product Data**

- A. Manufacturer's Standard Schematic Drawings:
  - 1. Modify drawings to delete information which is not applicable to project.
  - 2. Supplement standard information to provide additional information applicable to Project.
- B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.
  - 1. Clearly mark each copy to identify pertinent materials, products or models.
  - 2. Show dimensions and clearances required.
  - 3. Show performance characteristics and capacities.
  - 4. Show wiring diagrams and controls.

## **2.3 Samples**

- A. Physical examples to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged.
- B. Office Samples: Of sufficient size and quantity to clearly illustrate:
  - 1. Functional characteristics of product or material with integrally related parts and attachment devices.
  - 2. Colors: Submit accurate color charts and pattern charts to the Architect for review and selection as required. Indicate any cost differential between samples.
  - 3. After review, samples may be used in construction of Project.
- C. Field Samples and Mock-ups: Erect at Project site at location acceptable to the Architect.

## **PART 3 EXECUTION**

### **3.1 Shop Drawings, Product Data and Samples**

- A. Contractor Responsibilities
  - 1. Review Shop Drawings, Product Data and Samples prior to submission. The Contractor will be responsible to submit samples which are to be available during the period of construction.
  - 2. Verify
    - a. Field measurements
    - b. Field construction criteria
    - c. Catalog numbers and similar data.
  - 3. Secure all necessary approvals from public agencies and others and signify by stamp, or other means that they have been secured.
  - 4. Coordinate each submittal with requirements of Work, Contract Documents, all trades, and public agencies involved.
  - 5. Contractor's responsibility for errors and omissions in submittals is not relieved by Architect's review of submittals.
  - 6. Begin no work which requires submittals until return of submittals with Architect's stamp and initials or signature indicating review. The Architect takes no responsibility for items delivered to the site and will reject if no Shop Drawings were submitted.
  - 7. Notify Architect, in writing, at time of submission, of deviations in submittals from requirements of Contract Documents.
  - 8. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Architect's review of submittals, unless Architect gives written acceptance of specific deviations. Corrections required in the field due to failure to submit the required documents for review shall be made at no cost to the Owner or Architect.
  - 9. Work started or materials released for production prior to receiving returned submittals indicating "Reviewed" or "Reviewed as Noted" shall be at the Contractor's sole risk.
  - 10. Begin no work related to submittals returned as "Rejected" or "Revise and Resubmit" unless specifically noted on the review by the Architect. Immediately work with the supplier to provide corrected or revised documents for resubmittal as noted on the returned submittal.

11. After Architect reviews indicating either “Reviewed” or “Reviewed as Noted”, distribute copies.
- B. Architect’s Duties (General Conditions)
1. Review submittals with reasonable promptness.
  2. Review for:
    - a. Design concept of Project.
    - b. Information given in Contract Documents.
  3. Review of separate item does not constitute review of an assembly in which item functions.
  4. Affix stamp and initials or signature certifying to review of submittal.
  5. Return submittals to Contractor for distribution.
  6. Review of Shop Drawings by Architect/Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory.

Review of such drawings will not relieve Contractor of responsibility for any error which may exist in the submittals as Contractor shall be responsible for dimensions and design of adequate connections, details and satisfactory construction of all work.
  7. The Architect will only check those submittals which have been prepared by the Contractor or subcontractor that is actually supplying, fabricating or installing the product to be reviewed. Any evidence that the submittal was prepared by a prime contractor for a subcontractor without the subcontractor’s knowledge will result in the submittal being returned marked Rejected/Resubmit.
  8. The Architect’s stamp, affixed to the Shop Drawing, means only what it says; that the submittal has been reviewed and is released for fabrication “as is” or “as noted,” must be resubmitted or has been rejected. The stamp does not represent a Change Order Authorization. The Contractor will bear all increased costs for reviewed products that have not been previously approved by the Architect for use on this Project.
- C. Timing
1. General
    - a. Make all submittals far enough in advance of scheduled dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.
    - b. In scheduling, allow at least ten (10) full working days for the Architect’s review following receipt of the submittal.
    - c. Mechanical and Electrical submittals should be allowed additional lead time for Engineer’s review.
    - d. Submittals pertaining to color selection are interdependent. No colors will be selected without all samples.
  2. Delays: Costs of delays occasioned by tardiness of submittals maybe back charged as necessary and shall not be borne by the Owner. Such costs will include the purchase, installation and removal of temporary materials, equipment and fixtures, as required, in writing, by the Owner to allow the Project to be used or occupied until the permanent materials, equipment and fixtures can be installed. The Owner will not be forced to accept alternate materials, equipment, fixtures or colors because of the failure of the Contractor’s to make timely submission of Shop Drawings and product data.

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	<b>Work</b>	<b>Field Approval</b>	<b>Shop Drawings</b>	<b>Samples</b>	<b>Color Selections</b>	<b>Manuals</b>	<b>Instruction Methods</b>	<b>Product Data</b>
01 70 00	Contract Close-out Items		X					
06 10 00	Rough Carpentry / FRP Paneling		X		X			
06 40 00	Architectural Woodwork		X	X	X			X
06 61 00	Solid Polymer Fabrications		X	X	X	X	X	X
07 21 00	Insulation			X		X	X	X
07 92 00	Caulking			X	X			X
08 11 00	Metal Doors		X	X	X			
08 71 00	Hardware		X		X			X
09 29 00	Gypsum Wallboard		X					X
09 31 00	Ceramic Tile	X		X	X		X	x
09 51 00	Acoustical Ceilings		X	X	X			X
09 91 00	Painting			X	X			X
10 21 13	Toilet Compartments		X		X			X
10 28 13	Toilet & Bath Accessories	X		X	X		X	X



## SECTION 01 45 00 QUALITY CONTROL

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

**INDEX**

1.1 Description	2.2 Inspections
1.2 Quality Assurance	2.3 Documents
1.3 Submittals	3.1 Contractor's Inspections
1.4 Product Handling	3.2 Architect's Inspections
2.1 Testing	

### PART 1 GENERAL

#### **1.1 Description**

- A. Work Included: During the course of the Work, the Contractors will maintain a means of ensuring quality control of the Project. Such means of control shall include:
  - 1. On-site construction.
  - 2. Off-site operations.
  - 3. Reports
  - 4. Updated documents.
- B. Related Work Specified Elsewhere: Requirements for quality controls, certification and tests may be described in various Sections of these Specifications and the General Conditions.

#### **1.2 Quality Assurance**

- A. Qualifications of Inspectors: Quality control personnel shall be familiar with all aspects of the Work and experienced in controlling the finished quality of the Work.

**1.3 Submittals:** Test reports, inspection reports and other documents will be submitted to all interested parties.

**1.4 Product Handling:** Promptly process and distribute all required copies of reports and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the Work.

### PART 2 PRODUCTS

#### **2.1 Testing**

- A. Code Compliance Testing: Inspections and tests, required by codes or ordinances, or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.
- B. Contractor's Convenience Testing: Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

**2.2 Inspections**

- A. On-Site: The Contractor will provide the necessary personnel to maintain continuous inspection of the Work to ensure compliance with all the requirements of the Contract Documents, all applicable Codes and Manufacturer's recommendations.
- B. Off-Site Construction: The Contractor will provide the necessary inspections to ensure the adequacy of all items manufactured off site and delivered to the job ready for installation.

**2.3 Documents:** The Contractor will prepare all documents necessary to comply with the requirements of this Section and deliver same to all interested parties.

**PART 3 EXECUTION**

**3.1 Contractor's Inspections:** The Contractor will continuously monitor the quality of the Work. Any work found to be inadequate will be corrected immediately. Any work found inadequate but requiring the consultation of the Architect will be reported to the Architect and then corrected immediately after clarification. Proper inspection procedures by the Contractor will eliminate the need for a Punch List at the completion of the Project.

**3.2 Architect's Inspections**

- A. The Architect will perform a periodic inspection of the Project as required by his/her agreement with the Owner. The Contractor will immediately carry out the Architect's instructions based on these inspections. The Architect will not assume the role of a full-time inspector because of the inadequacies of the inspection procedures of the Contractor.
- B. As part of the Architect's inspections, the Contractor will provide the necessary tools and instruments to allow for the on-site verification of all dimensions, grades and elevations.

\* \* \* \* \*

## **SECTION 01 50 00 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	2.3 Temporary Controls
	1.2 Requirements of Regulatory Agencies	2.4 Field Offices
	2.1 Utilities	2.5 Owner Occupancy
	2.2 Construction Aids	3.1 Removal

### **PART 1 GENERAL**

#### **1.1 Description**

- A. Work Included: Temporary facilities and controls required for this Work include, but are not necessarily limited to:
1. Field offices
  2. Enclosures such as tarpaulins, barricades and canopies.
  3. Signs.
  4. Barriers.
  5. Security.
  6. Special controls such as noise, dust and water.
  7. Fire protection.
  8. Traffic.

**1.2 Requirements of Regulatory Agencies:** Comply with Federal, State and Local codes and regulations.

### **PART 2 PRODUCTS**

#### **2.1 Utilities**

- A. Temporary Fire Protection: The General Contractor shall provide and maintain, in working order, during the entire construction period, a minimum of three (3) fire extinguishers one in temporary office and such other fire protective equipment and devices as is deems necessary and suitable for any possible class of type of fires. They shall be non-freeze type such as A-B-C rated dry chemical extinguishers of not less than 10-pound capacity each. In addition, each contractor who maintains an enclosed shed on the premises shall install and maintain in an accessible location one or more similar non-freezing type of fire extinguisher in each shed. Provisions of Local, State or Federal requirements, where more restrictive, shall comply.

#### **2.2 Construction Aids**

- A. General: Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

B. Construction Aids

1. Provide construction aids and equipment required by personnel to facilitate the execution of the Work; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such facilities and equipment.
2. When permanent stair framing is in place, provide temporary treads, platforms and railings, for use by construction personnel.

**2.3 Temporary Controls**

A. Dust Control: All Contractors will provide positive methods and apply dust control materials to minimize raising dust from construction operations, and provide positive means to prevent air-borne dust from dispersing into the atmosphere.

B. Pollution Control

1. All Contractors will provide methods, means and facilities required to prevent contamination of water or atmosphere by discharge of noxious substances from construction operations.
2. Provide systems for control of atmospheric pollutants.
  - a. Prevent toxic concentration of chemicals.
  - b. Prevent harmful dispersal of pollutants into the atmosphere.

**2.4 Field Office** – Space provided within or near construction area.

**2.5 Owner Occupancy:** As portions of the work are completed the space should be made so the Owner can set up their equipment, if so requested. In those areas occupied, the General Contractor will take the necessary precautions to protect Owner’s equipment against damage and dust.

**PART 3 EXECUTION**

**3.1 Removal:** Maintain all temporary facilities and controls as long as needed for the safe and proper completion of the Work; remove all such temporary facilities and controls as rapidly as progress of the Work will permit or as directed by the Architect.

\* \* \* \* \*

## SECTION 01 60 00 MATERIALS AND EQUIPMENT

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

<b>INDEX</b>	1.1 Description	2.3 Storage and Protection
	1.2 Submittals	2.4 Substitution and Product Options
	2.1 Materials and Equipment	3.1 Storage of Materials
	2.2 Transportation and Handling	3.2 Protection

### PART 1 GENERAL

#### 1.1 Description

- A. Work Included: The Work under this Section will ensure the proper handling and protection of materials and establish methods for product approval and shall include but is not limited to:
1. Transportation and handling
  2. Storage and protection
  3. Installation requirements
  4. Identifying markings
  5. Product approval standards
  6. Substitutions and product options
- B. Related Work Specified Elsewhere
- |   |                        |
|---|------------------------|
| 1. Substitutions during bidding         | Instruction to Bidders |
| 2. Coordination                         | Section 01 30 00       |
| 3. Schedule of Values                   | Section 01 30 00       |
| 4. Shop Drawings, Project Data, Samples | Section 01 30 00       |
| 5. Quality Control                      | Section 01 45 00       |
- C. Definitions
1. "Or Equal" Clause: Whenever the Contract Documents designate any article, material or equipment by describing a propriety product or by using the name of a Manufacturer or vendor, the term "or equal" shall apply. The article, material or equipment so named shall be understood to define a type, function, minimum standard of design, efficiency and quality desired, and is not intended to eliminate competition. The Contractor may, by complying with the requirements of Article E of the Instruction to Bidders, use authorized substitutions in the Bid. Determination of "or equal" products is the responsibility of the Architect. The burden is on the Manufacturer, who has not been specified by name, to convince the Architect that the product is equal.

#### 1.2 Submittals

- A. Product Approval
1. Within fifteen (15) days after date of Contract, submit to Architect five (5) copies of complete list of all products which are proposed for installation.
  2. Tabulate list by each Specification Section.
  3. For products specified under reference standards, include with listing of each product.

- a. Name and address of Manufacturer
  - b. Trade name.
  - c. Model or catalog designation.
  - d. Manufacturer's data.
    - (1) Performance and test data.
    - (2) Reference standards.
- B. Substitutions
1. Architect will consider substitutions quoted with Base bid, and requests submitted with Bid.
  2. Within 15 days after date of Contract, Architect will consider formal requests from Contractor for substitution of products in place of those specified.

## **PART 2 PRODUCTS**

### **2.1 Materials and Equipment**

- A. General
1. Materials and equipment incorporated into the Work
    - a. Conform to applicable Specifications and Standards.
    - b. Comply with size, make, type and quality specified, or as specifically approved in writing by the Architect.
    - c. Manufactured and Fabricated Products:
      - (1) Design, fabricate and assemble in accord with the best engineering and shop practices.
      - (2) Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
      - (3) Two or more items of the same kind shall be identical, by the same Manufacturer.
      - (4) Products shall be suitable for service conditions.
      - (5) Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
    - d. Do not use material or equipment for any purpose other than that for which it is designed or is specified.
- B. Manufacturer's Instructions
1. When Contract Documents require that installation of Work shall comply with Manufacturer's printed instructions, obtain and distribute copies of such instructions, obtain and distribute copies of such instructions to parties involved in the installation and until completion;
    - a. Maintain one set of complete instructions at the Project site during installation and until completion.
  2. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements;
    - a. Should Project conditions or specified requirements conflict with Manufacturer's instructions, consult with Architect for further instructions.
  3. Perform work in accord with Manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

- C. Identifying Markings: Nameplates and markings required by codes or regulations or as required for proper operation of equipment shall be affixed for ready access but shall not be placed on exposed surfaces unless required otherwise.

## **2.2 Transportation and Handling**

### **A. Delivery**

1. Arrange deliveries of products in accord with construction schedules and in ample time to facilitate inspection prior to installation.
2. Coordinate deliveries to avoid conflict with Work and conditions at site:
  - a. Work of other Contractors or Owner.
  - b. Limitations of storage space.
  - c. Availability of equipment and personnel for handling products.
  - d. Owner's use of premises.
3. Deliver products in undamaged condition in original containers or packaging with identifying labels intact and legible.
4. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of parts and to facilitate assembly.
5. Immediately on delivery, inspect shipment to ensure:
  - a. Product complies with requirements of Contract Documents and reviewed submittals.
  - b. Quantities are correct.
  - c. Containers and packages are intact, labels are legible.
  - d. Products are properly protected and undamaged.

### **B. Product Handling**

1. Provide equipment and personnel necessary to handle products, including those provided by Owner by methods to prevent soiling or damage to products or packaging.
2. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.
3. Handle products by methods to prevent bending or overstressing.
4. Lift heavy components only at designated lifting points.

## **2.3 Storage and Protection**

### **A. Storage**

1. Store products immediately on delivery, and protect until installed in the Work;
  - a. Store in accord with Manufacturer's instructions, with seals and labels intact and legible.
2. Store products subject to damage by elements in substantial weathertight enclosures.
3. Exterior Storage:
  - a. Provide substantial platforms, blocking or skids to support fabricated products above ground, prevent soiling or staining;
    - (1) Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
  - b. Store loose granular materials on solid surfaces such as paved areas, or provide plywood or sheet materials to prevent mixing with foreign matter.
    - (1) Provide surface drainage to prevent flow or ponding of rain water.
    - (2) Prevent mixing of refuse or chemically injurious materials with liquids.

4. Arrange storage in manner to provide easy access for inspection.

B. Maintenance of Storage

1. Maintain periodic system of inspection of stored products on scheduled basis to ensure that:
  - a. State of storage facilities is adequate to provide required conditions.
  - b. Required environmental conditions are maintained on continuing basis.
  - c. Surfaces of products exposed to elements are not adversely affected;
    - (1) Any weathering of products, coating and finishes is acceptable under requirements of Contract Documents.
2. Mechanical and electrical equipment which requires servicing during long term storage shall have complete Manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.
  - a. Comply with Manufacturer's instructions on scheduled basis.
  - b. Space heaters which are part of electrical equipment shall be connected and operated continuously until equipment is placed in service.

C. Protection After Installation

1. Provide protection of installed products to prevent damage from subsequent operations. Remove when no longer needed, prior to completion of Work.
2. Control traffic to prevent damage to equipment and surfaces.
3. Provide coverings to protect finished surfaces from damage.
  - a. Cover projections, wall corners and jambs, sills and soffits of openings in areas used for traffic and for passage of products in subsequent work.
  - b. Protect finished doors and stairs from dirt and damage:
    - (1) In areas subject to foot traffic, secure heavy paper, sheet goods or other materials in place.
    - (2) For movement of heavy products, lay planking or similar materials in place.
    - (3) For storage of products, lay tight wood sheathing in place.
    - (4) Cover walls and floor of elevator cars, and surfaces of elevator car doors used by construction personnel.

## **2.4 Substitution and Product Options**

A. Product Approval Standard

1. Definitions:
  - a. The term "**product**" shall include material, equipment, assembly methods, Manufacturer, brand, trade name, or other description.
  - b. References to "approved equal" or similar terms mean that approval of the Architect is required.
2. Contractor's Options:
  - a. For products specified only by reference standards, select any product meeting standards, by any Manufacturer.
    - (1) Proof of Compliance: Whenever the Contract Documents require that a product be in accord with Federal Specifications, ASTM designation, ANSI Specifications or other association standards, the Contractor shall present an affidavit from the Manufacturer certifying that the product complies therewith. Where requested or specified, submit supporting test data to substantiate compliance.



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- b. For products specified by naming several products or Manufacturers, select any product and Manufacturer named.
  - c. For products specified by naming one or more products but indicating the option of selecting equivalent products by stating “or equal” after specified product, Contractor must submit request, as required for substitution, for any product not specifically named.
  - d. For products specified by naming only one product and Manufacturer, there is no option, and no substitution will be allowed.
- B. Availability of Specified Items: Verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the Work. In the event specified item or items will not be available, notify the Architect prior to receipt of Bids. Costs or delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back charged as necessary and shall not be borne by the Owner.
- C. Substitutions
1. For a period of 30 days after Contract Date, Architect will consider written requests from Contractor for substitutions of Products.
  2. Submit five copies of request for substitution. Include in request:
    - a. Complete data substantiating compliance of proposed substitution with Contract Documents.
    - b. For products:
      - (1) Product identification, including Manufacturer’s name and address.
      - (2) Manufacturer’s literature:
        - (a) Product description.
        - (b) Performance and test data.
        - (c) Reference standards.
      - (3) Samples
      - (4) Name and address of similar projects on which product was used, and date of installation.
    - c. For construction methods:
      - (1) Detailed description of proposed method.
      - (2) Drawings illustrating methods.
    - d. Itemized comparison of proposed substitution with product or method specified.
    - e. Data relating to changes in construction schedule.
    - f. Relation to separate contracts.
    - g. Accurate cost data on proposed substitution in comparison with product or method specified.
  2. In making request for substitution, Contractor represents:
    - a. They have personally investigated proposed product or method, and determined that it is equal or superior in all respects to that specified.
    - b. They will provide the same warranty for substitution as for product or method specified.
    - c. They will coordinate installation of accepted substitution into Work, making such changes as may be required for Work to be complete in all respects.
    - d. They waive all claims for additional costs related to substitution which consequently becomes apparent.
    - e. Cost data is complete and includes all related costs under the Contract, but excludes:
      - (1) Costs under separate Contracts.

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- (2) Architects or Engineer's redesign.
3. Substitutions will not be considered if:
  - a. The substitutions will result in any increased cost for the Owner over the cost of the item as it was originally specified.
  - b. They are indicated or implied on Shop Drawings or project data submittals without a formal request submitted to the Architect.
  - c. Acceptance will require substantial revision of Contract Documents.

## **PART 3 EXECUTION**

### **3.1 Storage of Materials**

- A. General
  1. All Contractors shall confine their equipment, apparatus, storage of materials and operations to limits indicated and shall not bring materials onto the site until needed for the progress of the Work.
  2. Storage of materials within the building shall at no time exceed the design carrying capacity of the structural system.
  3. The General Contractor shall slot space to other Contractors and subcontractors for storage of their materials, erection of their sheds.
  4. The Owner assumes no responsibility for materials stored in building or on the Site. The Contractors assumes full responsibility for damage due to the storing of material.

### **3.2 Protection**

- A. General
  1. Precaution shall be exercised at all times for the protection of persons, including employees, and property. The safety provisions of applicable laws, building and construction codes shall be observed. Machinery equipment and all hazards shall be guarded or eliminated.
  2. Notify Owners of corporate or private property if their property interferes with the Work so the arrangements for proper protection can be made.
  3. Provide and maintain proper shoring and bracing to prevent earth from caving or washing into the building excavation. Provide temporary protection around openings through floors and roofs, including elevator openings, stairwells and edge of slabs.
- B. Finish Construction
  1. Each Contractor shall assume the responsibility for the protection of all finished construction under this Contract and shall repair and restore any and all damage of finished Work to its original state.
  2. Where responsibility can be fixed, the cost shall be charged to the party responsible. If responsibility cannot be fixed, the cost shall be pro-rated among all Contractors in proportion to their activities at the building at the time the damage was done.
  3. No wheeling of any loads over finished floors, either with or without plank protection will be permitted in anything except rubber tired wheelbarrows, buggies, trucks or dollies. This applies to all finished floors and to all concrete floors exposed as well as those covered with composition tile or other applied surfacing, and shall apply to all Contractors and subcontractors.
  4. Where structural concrete is also the finished surface, care must be taken to avoid marking or damaging those surfaces.

## SECTION 01 70 00 CONTRACT CLOSEOUT

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

<b>INDEX</b>	1.1 Description	3.6 Punch Lists
	1.2 Quality Assurance	3.7 Substantial Completion
	1.3 Submittals	3.8 Final Inspection
	2.1 Project Close Out	3.9 Reinspection Fees
	3.1 Damage Repair	3.10 Contractor's Closeout Submittals to Architect
	3.2 Tests and Adjustments	3.11 Final Adjustment for Accounts
	3.3 Project Record Documents	3.12 Final Application for Payment
	3.4 Operating and Maintenance Data	
	3.5 Warranties and Bonds	

### PART 1 GENERAL

#### 1.1 Description

- A. Work Included: Such work as will be necessary to turn the Project over to the Owner in a clean and usable condition. The Work shall include but is not limited to:
1. Damage repair
  2. Test and adjustments
  3. Punch lists
  4. Warranties
  5. Final waiver of lien
  6. Operation and maintenance instructions
  7. Project record documents
- B. Related Work Specified Elsewhere
- |  |                  |
|--|------------------|
| 1. Summary of Work                         | Section 01 10 00 |
| 2. Coordination                            | Section 01 30 00 |
| 3. Shop Drawings, Product Data and Samples | Section 01 30 00 |
| 4. Operation and Maintenance Data          | Section 01 30 00 |
| 5. Cleaning                                | Section 01 77 16 |
6. Closeout Submittals Required of Trades:  
The respective Sections of Specification
7. Various Sections of these Specifications describe procedures, for individual items, to make finished Construction ready for acceptance by Owner.
- C. Work by Owner:

#### 1.2 Quality Assurance

- A. The Contractor will promptly make any necessary corrections to the Work as directed by the Architect so as to expedite final payments.
- B. Preparation of operating and maintenance data shall be done by personnel:
1. Trained and experienced in maintenance and operation of the described products.
  2. Completely familiar with requirements of this Section.
  3. Skilled as a technical writer to the extent required to communicate essential data.

4. Skilled as a drafts person competent to prepare required Drawings.

**1.3 Submittals:** The Contractors will submit all warranties, manuals, Drawings, waivers and test reports as required by the various Sections of this Specification to the Owner at the close of the Project.

## **PART 2 PRODUCTS**

**2.1 Project Closeout:** The Contractors will provide the manpower to promptly close out the Project so that Owner may occupy the building on the date of completion.

## **PART 3 EXECUTION**

**3.1 Damage Repair:** The Contractors will make final resolution of the repairing of damaged Work.

**3.2 Tests and Adjustments:** Each Contractor will perform all tests and make all final adjustments under the actual working condition of each piece of equipment. Comply with Manufacturer's recommendations and turn over a complete and workable installation to the Owner.

### **3.3 Project Record Documents**

#### **A. Maintenance of Documents**

1. Maintain at jobsite, one copy of:
  - a. Contract Drawings.
  - b. Specifications
  - c. Addenda
  - d. Reviewed Shop Drawings
  - e. Change Orders
  - f. Other modifications to Contract
  - g. Field test records.
2. Store documents in field office, apart from documents used for construction.
3. Maintain documents in a clean, dry and legible condition.
4. Do not use record documents for construction purposes.
5. Make documents available at all times for inspection by the Architect and Owner.

#### **B. Recording**

1. Label each document "PROJECT RECORD".
2. Keep record documents current.
3. Do not permanently conceal any Work until required information has been recorded.
4. Contract Drawings: Legibly mark to record actual construction.
  - a. Depths of various elements of foundation in relation to Floor Level.
  - b. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
  - c. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
  - d. Field changes of dimension and detail.
  - e. Changes made by Change Order or Field order.
  - f. Details not on original Contract Drawings.
5. Specifications and Addenda: Legibly mark up each Section to record:

- a. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
- b. Changes made by Change Order or Field Order.
- c. Other matters not originally specified.
6. Shop Drawings: Maintain as Record Documents; legibly annotate following Drawings to record changes made after review.

C. Submittals

1. At completion of Project, deliver Record Documents to Architect.
2. Accompany submittal with transmittal letter, in duplicate, containing:
  - a. Data.
  - b. Project title and number.
  - c. Contractor's name and address.
  - d. Title and number of each record document.
  - e. Certification that each document is submitted is complete and accurate.
  - f. Signature of Contractor, or his authorized representative.

**3.4 Operating and Maintenance Data**

A. General

1. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.
  - a. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent Sections of Specifications.
2. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.
3. This portion of these Specifications will be strictly enforced. Final Payment will not be made until all data has been submitted to the Architect. Any money or time spent by the Architect to obtain information from manufacturer shall be deducted from Contractor's final payments.

B. Form of Submittal

1. Prepare data in the form of an instructional manual for use by Owner's personnel.
2. Format:
  - a. Size: 8-1/2 inch by 11 inch.
  - b. Text: Manufacturer's printed data, or neatly typewritten.
  - c. Drawings:
    - (1) Provide reinforced punched binder tab, bind in with text.
    - (2) Fold larger Drawings to the size of the text pages.
  - d. Provide fly-leaf for each separate product, or each piece of operating equipment.
    - (1) Provide typed description of product and major component parts of equipment.
    - (2) Provide indexed tabs.
  - e. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
    - (1) Title of Project
    - (2) Identity of general subject matter covered in the Manual.
  - f. In addition to (2) paper copies of O&M data, provide (3) electronic copies with all information in .pdf format. Each division with the .pdf file shall be bookmarked if multiple sections are included in one file.

3. Binders: (2) Commercial quality three-ring binders with durable and cleanable plastic covers.

C. Content of Manual

1. Neatly typewritten table of contents for each volume, arranged in a systematic order.
  - a. Contractor, name of responsible principal, address and telephone number.
  - b. A list of each product required to be included, indexed to the content of the volume.
  - c. List, with each product, the name, address and telephone number of:
    - (1) Subcontractor or installer.
    - (2) Maintenance contractor, as appropriate.
    - (3) Identify the area of responsibility of each.
    - (4) Local source of supply for parts and replacement.
  - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
  - a. Include only those sheets which are pertinent to the specific product.
  - b. Annotate each sheet to:
    - (1) Clearly identify the specific product or part installed.
    - (2) Clearly identify the data applicable to the installation.
    - (3) Delete references to inapplicable information.
3. Drawings:
  - a. Supplement product data with Drawings as necessary to clearly illustrate:
    - (1) Relations of component parts of equipment and systems.
    - (2) Control and flow diagrams.
  - b. Coordinate Drawings with information in Project Record Documents to assure correct illustration of completed installation.
  - c. Do not use Project Record Documents as maintenance Drawings.
4. Written text, as required, to supplement product data for the particular installation:
  - a. Organize in a consistent format under separate headings for different procedures.
  - b. Provide a logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued;
  - a. Provide information sheet for Owner's personnel, give:
    - (1) Proper procedures in the event of failure.
    - (2) Instances which might affect the validity of warranties or bonds.

D. Manual for Materials and Finishes

1. Submit two copies of complete manual in final form.
2. Content, for architectural products, applied materials and finishes.
  - a. Manufacturer's data, giving full information on products.
    - (1) Catalog number, size, and composition.
    - (2) Color and texture designations.
    - (3) Information required for re-ordering special-manufactured products.
  - b. Instructions for care and maintenance.
    - (1) Manufacturer's recommendation for types of cleaning agents and methods.
    - (2) Cautions against cleaning agents and methods which are detrimental to the product.
    - (3) Recommended schedule for cleaning and maintenance.

3. Content, for moisture-protection and weather-exposed products:
    - a. Manufacturer's data, giving full information on products.
      - (1) Applicable standards.
      - (2) Chemical composition.
      - (3) Details of installation.
    - b. Instructions for inspection, maintenance and repair.
  4. Additional requirements for maintenance data: The respective Sections of Specifications.
- E. Submittal Schedule: Submit specified number of copies or approved data in final form ten (10) days after final inspection or acceptance.
- F. Instruction of Owner's Personnel
1. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems.
  2. Operating and maintenance manual shall constitute the basis of instruction;
    - a. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

### **3.5 Warranties and Bonds**

- A. General
1. Compile specified warranties and bonds.
  2. Compile specified service and maintenance contracts.
  3. Co-execute submittals when so specified.
  4. Review submittals to verify compliance with Contract Documents.
  5. Submit to Architect for review and transmittal to Owner.
- B. Submittal Requirements
1. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.
  2. Number of original signed copies required: Two each.
  3. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.
    - a. Product or work item.
    - b. Firm, with name of principal, address and telephone number.
    - c. Scope.
    - d. Date of beginning of warranty, bond or service and maintenance contract.
    - e. Duration or warranty, bond or service maintenance contract.
    - f. Provide information for Owner's personnel:
      - (1) Proper procedure in case of failure.
      - (2) Instance which might affect the validity of warranty or bond.
    - g. Contractor, name of responsible principal, address and telephone number.
- C. Form of Submittals
1. Prepare in duplicate packets.
  2. Format:
    - a. Size 8-1/2 inches by 11 inches, punch sheets for 3-ring binder;
      - (1) Fold larger sheets to fit into binders.

- b. Cover: Identify each packet with typed or printed title “WARRANTIES AND BONDS”. List:
    - (1) Title of Project.
    - (2) Name of Contractor.
  - c. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.
  - d. CD/Flash drive three (3) of all documents.
- D. Time of Submittals
- 1. For equipment or component parts of equipment put into service during progress of construction:
    - a. Submit documents within ten (10) days after inspection and acceptance.
  - 2. Otherwise, make submittals within ten (10) days after Date of Substantial Completion prior to final request for payment.
  - 3. For items of Work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing the date of acceptance as the start of the warranty period.
- E. Submittals Required: Submit warranties, bonds, and service and maintenance contracts as specified in the respective Sections of Specifications.

### **3.6 Punch Lists**

- A. Prior to substantial completion, the Architect will inspect the project and publish all items of the Work found unacceptable in the form of a Punch List. The Work described should be done immediately and the Punch List returned to the Architect with each item initialed and dated. The Contractors should not use the Punch List as a final inspection service because of their own lack of quality control.
- B. Contractor will, within seven (7) days of issuance of Punch List by Architect, provide, in writing, to the Architect a Schedule of Completion for the Punch List items.

### **3.7 Substantial Completion**

- A. When Contractor considers the Work is substantially complete, they shall submit to Architect:
  - 1. A written notice that the Work, or designated portion thereof, is substantially complete.
  - 2. A list of items to be completed or corrected.
- B. Within a reasonable time after receipt of such notice, Architect will make an inspection to determine the status of completion.
- C. Should Architect determine that the Work is not substantially complete:
  - 1. Architect will promptly notify the Contractor, in writing, giving the reasons therefore.
  - 2. Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Architect.
  - 3. Architect will reinspect the Work.



### **3.8 Final Inspection**

- A. When Contractor considers the Work is complete, he shall submit written certification that:
  - 1. Contract Documents have been reviewed.
  - 2. Work has been inspected for compliance with Contract Documents.
  - 3. Work has been completed in accord with Contract Documents.
  - 4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
  - 5. Work is completed and ready for final inspection.
- B. Architect will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should Architect consider that the Work is incomplete or defective:
  - 1. Architect will promptly notify the Contractor in writing, listing the incomplete or defective work.
  - 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the Work is complete.
  - 3. Architect will reinspect the Work.
- D. When the Architect finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

### **3.9 Reinspection Fees**

- A. Should Architect perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:
  - 1. Owner will compensate Architect for such additional services.
  - 2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

### **3.10 Contractor's Closeout Submittals to Architect:** Documents required prior to Final Payment: Prior to final payment, and before the issuance of final certificate for payment the following items must be filed with the Architect:

- A. Evidence of compliance with requirements of governing authorities:
  - 1. Certificates of Inspection
    - a. Elevators
    - b. Mechanical
    - c. Electrical
- B. Project Record Documents: to requirements of Section 01 70 00.
- C. Operating and Maintenance Data, Instructions to Owner's Personnel: to requirements of Section 01 70 00.
- D. Warranties and Bonds: to requirements of Section 01 70 00.
- E. Keys and Keying Schedule: to requirements of Section 08 71 00, Finish Hardware.

- F. Spare Parts and Maintenance Materials.
- G. Final Waiver of Lien: To indicate that all debts and claims against this Project have been paid in full or otherwise satisfied, and to give final evidence of release of all liens against the Project and its Owner, the Contractors shall submit a certification to that effect.
- H. Provide the Architect with a written statement that the Owner's maintenance personnel have received operation and maintenance manuals and have received complete instructions on the operation of all equipment under every possible condition.
- I. Certificate of Insurance for Products and Completed Operations.

**3.11 Final Adjustment of Accounts**

- A. Submit a final statement of accounting to the Architect.
- B. Statement shall reflect all adjustments to the Contract Sum:
  - 1. The original Contract Sum.
  - 2. Additions and deductions resulting from:
    - a. Previous Change Orders.
    - b. Unit Prices.
    - c. Deductions for uncorrected work.
    - d. Deductions for reinspection payments.
    - e. Other adjustments.
  - 2. Total Contract Sum, as adjusted.
  - 3. Previous payments.
  - 4. Sum remaining due.
- C. Architect will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

**3.12 Final Application for Payment**

- A. Contractor shall submit the final Application for Payment in accord with procedures and requirements stated in the Conditions of the Contract.

## SECTION 01 73 29 CUTTING AND PATCHING

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

**INDEX**

1.1 Description	3.1 Inspection
1.2 Submittals	3.2 Preparation Prior to Cutting
1.3 Payment for Costs	3.3 Performance
2.1 Materials	

### PART 1 GENERAL

#### 1.1 Description

A. Related Requirements Specified Elsewhere

1. General Conditions
- a. Cutting and patching of Work
- b. Tests
- c. Uncovering and correction of Work
2. Summary of Work Section 01 10 00
3. Coordination Section 01 30 00

Execute Cutting Fitting or Patching of Work, required to:

2. Make several parts fit properly.
3. Uncover Work to provide for installation of ill-timed work.
4. Remove and replace defective Work.
5. Remove and replace work not conforming to requirements of Contract Documents.
6. Remove samples of installed Work as specified for testing.
7. Install specified Work in existing construction.
8. To receive the Work of other contractors as shown or reasonably implied by the Drawings or Specification

B. In addition to Contract requirements, upon written instructions of Architect:

1. Uncover work to provide for Architect's observation of covered work.
2. Remove samples of installed materials for testing.
3. Remove work to provide for alteration of existing work.

C. Do not endanger any Work by cutting or altering work or any part of it.

D. Do not cut or alter Work of another Contractor without written consent of Architect.

#### 1.2 Submittals

A. Prior to cutting which affects structural safety of Project, or Work of another Contractor, submit written notice to Architect, requesting consent to proceed with cutting, including:

1. Identification of project.
2. Description of affected Work.
3. Necessity for cutting.
4. Effect on other Work, on structural integrity of Project.
5. Description of proposed work – designate:
  - a. Scope of cutting and patching.

## #2310 KC PSB – North Employee Washroom Remodel

- b. Contractor and trades to execute work.
  - c. Products proposed to be used.
  - d. Extent of refinishing.
  6. Alternatives to cutting and patching.
  7. Designation of party responsible for cost of cutting and patching.
- B. Prior to cutting and patching done on instruction of Architect, submit cost estimate.
- C. Should conditions of work, or schedule, indicate change of materials or methods, submit written recommendation to Architect, including:
1. Conditions indicating change.
  2. Recommendations for alternative materials or methods.
  3. Submittals as required for Substitutions.
- D. Submit written notice to Architect, designating time Work will be uncovered, to provide for observation.

### **1.3 Payment for Costs**

- A. Costs caused by ill-timed or defective Work or Work not conforming to Contract Documents, including cost for additional services of Architect: Party responsible for ill-timed, rejected or nonconforming work.
- B. Work done on instructions of Architect, other than defective or nonconforming work: Owner.
- C. Work caused by the damage of a Contractor's installation or equipment by another Contractor: Contractor responsible for causing the damage.

## **PART 2 PRODUCTS**

- 2.1 Materials:** For replacement of Work removed, comply with Specifications for type Work to be done.

## **PART 3 EXECUTION**

### **3.1 Inspection**

- A. Inspect existing conditions of Work, including elements subject to movement or damage during:
1. Cutting and patching
- B. After uncovering Work, inspect conditions affecting installation of new products.

### **3.2 Preparation Prior to Cutting**

- A. Provide protection for other portions of Project.

**3.3 Performance**

- A. Each prime Contractor will arrange for all cutting and patching, for their portion of the Work. Hire only skilled workmen qualified in the type of work required.
- B. Each Prime Contractor will be expected to cut, bore, drill, etc. through all materials as required including concrete, steel and wood.
- C. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances, finishes.
- D. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation or repairs and new work.
- E. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of Contract Documents.
- F. Refinish entire surfaces as necessary to provide an even finish.
  - 1. Continuous Surfaces: to nearest intersections.
  - 2. Assembly: entire refinishing.
- G. The painting Contractor will be responsible for repairing all damage to their work under this Specification.

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## SECTION 01 77 16 PROGRESS CLEANING AND FINAL CLEANING

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

<b>INDEX</b>	1.1 Description	2.3 Containers
	1.2 Quality Assurance	3.1 Progress Cleaning
	2.1 Cleaning Materials & Equipment	3.2 Final Cleaning
	2.2 Compatibility	3.3 Cleaning During Owner's Occupancy

### PART 1 GENERAL

#### 1.1 Description

- A. Work Included
  - 1. Throughout the construction period, maintain the building, the site and adjacent private and public property in a standard of cleanliness as described in this Section.
  - 2. It shall be the duty of each Prime Contractor to keep the premises free of accumulations of surplus materials and rubbish caused by his operations and the operations of this subcontractors unless otherwise stated.
  
- B. Related Work Specified Elsewhere
  - 1. General Conditions
    - a. Cleaning up
    - b. Owner's right to clean-up
  - 2. Summary of Work Section 01 10 00
  - 3. Coordination Section 01 30 00
  - 4. Temporary Controls Section 01 50 00
  - 5. Project Closeout Section 01 70 00
  - 6. Cutting and Patching Section 01 73 29
  - 7. In addition to standards described in this Section, comply with all requirements for cleaning up as described in various other Sections of these Specifications.

#### 1.2 Quality Assurance

- A. Inspection: Conduct daily inspections, and more often if necessary, to verify that requirements of cleanliness are being met.
  
- B. Codes and Standards: In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

### PART 2 PRODUCTS

**2.1 Cleaning Materials and Equipment:** Provide all required personnel, equipment and materials needed to maintain the specified standards of cleanliness.

**2.2 Compatibility:** Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Architect.

- 2.3 Containers:** Each Contractor for the General Work will provide metal containers for storage of rubbish which will be used by all persons working for that contractor.

## **PART 3 EXECUTION**

### **3.1 Progress Cleaning**

#### **A. General**

1. Retain all stored items in an orderly arrangement allowing maximum, not impeding drainage or traffic, and providing the required protection of materials.
2. Do not allow the accumulation of scrap, debris, waste material and other items not required for construction of this work.
3. At least twice each month, and more often if necessary, completely remove all scrap, debris and waste material from the job site and legally dispose of at public or private dumping areas off Owner's propriety.
4. The General Contractor will assign adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.
5. No burning of rubbish or debris will be allowed at site. No rubbish shall be thrown through openings or from heights without proper protection.
6. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
7. The General Contractor will vacuum-clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as needed basis until building is ready for substantial completion or occupancy.
8. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
9. The General Contractor shall perform a broom cleaning of all appropriate surfaces, each Friday afternoon.

#### **B. Safety Requirements**

1. Hazards Control
  - a. Store volatile wastes in covered metal containers, and remove from premises daily.
  - b. Prevent accumulation of wastes which create hazardous conditions.
  - c. Provide adequate ventilation during use of volatile or noxious substances.
  - d. Keep work areas, passageways, ramps, stairs, free of debris and scrap.
  - e. Form and scrap lumber shall have nails withdrawn or bent over and lumber shall be stacked or removed.
  - f. Remove spills of oil, grease or other liquids immediately or sprinkle with sand.
2. Conduct cleaning and disposal operation to comply with local ordinances and anti-pollution laws.
  - a. Do not bury rubbish and waste materials on project site.
  - b. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.
  - c. Do not dispose of wastes into streams or waterways.

#### **C. Structures**

1. Weekly, and more often if necessary, each prime contractor will inspect the structures and pick up all their scrap, debris and waste material. Remove all such items to the place designated for their storage.



2. Weekly, and more often if necessary, the General Contractor will sweep all interior spaces clean. “Clean”, for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by reasonable diligence using a hand-held broom.
  3. As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.
  4. Following the installation of finished floor materials, the General Contractor will clean the finished floor daily (and more often if necessary) at all times while work is being performed in the space in which finish materials have been installed. “Clean”, for the purpose of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Architect, may be injurious to the finish floor material.
  5. Daily cleanup, within all Owner occupied areas in which work has occurred, will be the responsibility of the Contractor doing the work.
- D. Disputes Over Responsibility for Cleaning: If, during the course of construction, disputes should arise over which parties are responsible for cleaning all or a portion of the work, the Architect will require each prime contractor, working at the site, to supply one employee for a clean-up crew, which will be under the direction of the General Contractor.

### **3.2 Final Cleaning**

- A. Definition: Except as otherwise specifically provided, “Clean” (for the purpose of this Article) shall be interpreted as meaning the level of cleanliness generally provided by commercial quality building maintenance equipment and materials. Employ experienced workers, or professional cleaners, as approved by the Owner, for final cleaning.
- B. General: Prior to completion of the Work, all Contractors will remove from the job site all tools, surplus materials, equipment, scrap, debris and waste. Conduct final progress cleaning as described in Article 3.1 above.
- C. Structures
1. Interior: The General Contractor will visually inspect all interior surfaces and remove all traces of soil, waste material, smudges and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. Remove all paint droppings, spots, stains and dirt from finished surfaces. Use only the specified cleaning materials equipment. Stubborn stains will be removed by the responsible Contractor at the direction of the Architect.
  2. Window Washing: General Contractor shall wash all glass immediately prior to occupancy of this project. Work shall include the removal of labels, paint splattering, putty or compound, etc. Surfaces shall include both sides of all glass in windows, borrowed lights, partitions, doors. Include mirrors.
  3. Polished surfaces: To all surfaces requiring the routine application of buffed polish, apply the specified polish as recommended by the manufacturer of the material being polished.
  4. Electrical Fixtures (Electrical Contractor)
    - a. Lenses and louvers should be free of dirt and dust.

D. Timing

1. Schedule final cleaning as approved by the Architect to enable the Owner to accept a completely clean project.
2. The General Contractor will notify all prime contactors of the dates for the final cleaning of the building. After those dates, but prior to issuance of the prefinal inspection Punch List, any soiling of cleaned areas will be cleaned by the responsible Contractor or cleaned by the General Contractor and charged to the responsible Contractor.
3. After issuance of the pre-final inspection Punch List, re-cleaning will be done by the responsible Contractor or cleaned by the General Contractor or Owner and charged to the responsible Contractor.
4. Maintain cleaning until Project, or portion thereof, is occupied by Owner.

**3.3 Cleaning During Owner’s Occupancy:** Should the Owner occupy the work, or any portion thereof, prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning of the occupied spaces shall be determined by the Architect in accord with the General Conditions of Contract.

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## SECTION 02 41 16 BUILDING DEMOLITION

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

<b>INDEX</b>	1.1 Description	2.2 Dust Control Partitions
	1.2 Quality Assurance	3.1 Inspection
	1.3 Submittals	3.2 Preparation
	1.4 Job Conditions	3.3 Demolition
	2.1 Tools	3.4 Disposal

### PART 1 GENERAL

#### 1.1 Description

- A. Work Included: Demolition and rubbish removal for the Work includes but is not necessarily limited to:
1. Removal of noted millwork.
  2. Removal of existing sinks.
  3. Removal of existing plumbing fixtures.
  4. Removal of existing toilet partitions.
  5. Removal of all debris.
  6. Removal of miscellaneous items.
  7. Dust control.
- B. Related Work Specified Elsewhere
- |                              |                  |
|------------------------------|------------------|
| 1. Temporary utilities       | Section 01 50 00 |
| 2. Temporary enclosures      | Section 01 50 00 |
| 3. Barriers                  | Section 01 50 00 |
| 4. Guardrails and barricades | Section 01 50 00 |
| 5. Dust control              | Section 01 50 00 |
| 6. Pest control              | Section 01 50 00 |
| 7. Rodent control            | Section 01 50 00 |
| 8. Painting                  | Section 09 91 00 |
| 9. Waste material disposal   |                  |
- C. Definitions: The term "Demolition" as used herein, includes the removal of all existing objects (except for those objects designated to remain) plus such other Work as is described in this Section of these Specifications.
- D. Work by Owner: The Owner will provide personnel to move salvaged equipment from the project site to the Owner's storage areas. Give Owner two days notice of demolition work to allow for co-ordination of Owner's workmen.

#### 1.2 Quality Assurance

- A. Qualifications of Contractors
1. Minimum of five years experience in demolition of comparable structures.
  2. Provide continuous inspection by a Superintendent capable of immediately detecting any possible structural problems that may occur and to insure strict compliance with dust control procedures.
- B. In addition to complying with all pertinent codes and regulations, comply with the

requirements of all insurance carriers providing coverage for this Work.

### **1.3 Submittals**

- A. Permits and notices authorizing building demolition.
- B. Permit for transport and disposal of debris.
- C. Demolition procedures and operational sequence for review and acceptance by Architect.

### **1.4 Job Conditions**

- A. Protection
  - 1. Erect barriers, fences, guard rails, enclosures, chutes, and shoring to protect personnel, structures and utilities remaining intact.
  - 2. Use all means necessary to protect existing objects designated to remain and, in the event of damage, immediately make all repairs and replacements necessary to the requirements of the Architect and at no additional cost to the Owner.
- B. Dust Control
  - 1. Use all means necessary to prevent spread of dust during performance of the Work of this Section. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors and concurrent performance of other Work on the Site.
  - 2. Provide dust tight enclosures to isolate areas of demolition from the remainder of the building.
- C. Burning: On-site burning will not be permitted.
- D. Maintaining Traffic
  - 1. Ensure minimum interference with roads, streets, driveways, sidewalks and adjacent facilities.
  - 2. Do not close or obstruct streets, sidewalks, alleys or passageways without permission from authorities having jurisdiction.
  - 3. If required by governing authorities, provide alternate routes around closed or obstructed traffic ways.

## **PART 2 PRODUCTS**

**2.1 Tools:** Use only those tools which will not interrupt the Owner's operation by creating excessive noise, vibration or dust. Do not use tools that will emit carbon monoxide gas into occupied areas of the building.

**2.2 Dust Control Partitions:** Construct temporary partitions for dust control from plastic sheeting attached to wood stud frame work. Partitions shall run floor to ceiling and completely across all openings. Patch all tears in plastic. Loosely hung canvas tarpaulins or plastic will not be accepted.

## **PART 3 EXECUTION**

### **3.1 Inspection**

- A. Verify that structures to be demolished are unoccupied and discontinued in use.
- B. Do not commence Work until conditions are acceptable to Architect.
- C. Prior to all work of this Section, carefully inspect the entire site and all objects designated to be removed and to be preserved.
- D. Locate all existing lines and determine all requirements for disconnecting and capping.
- E. Locate all existing active utility lines traversing the site and determine the requirements for their protection.

### **3.2 Preparation**

- A. Notification: Notify the Architect at least two full working days prior to commencing the Work of this Section.
- B. Exterminate vermin and rodents in structures to be demolished.
- C. Remove items scheduled to be salvaged for Owner, and place in designated storage area.
- D. Clarification
  - 1. The Drawings do not purport to show all objects existing on the Site.
  - 2. Before commencing the Work of this Section, verify with the Architect all objects to be removed and all objects to be preserved.
- E. Scheduling
  - 1. Schedule all Work in a careful manner with all necessary consideration for neighbors and the public.
  - 2. Avoid interference with the use of, and passage to and from adjacent buildings and facilities.
- H. Take out and pay for all required fees and permits.

### **3.3 Demolition**

- A. Demolish structures in accord with demolition procedures submitted to and accepted by Architect.

### **3.4 Disposal**

- A. Remove demolition debris as soon as practicable. All combustible debris must be removed before the end of each working day.
- B. Do not store or burn materials on site.
- C. Transport demolition debris to disposal area.

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## SECTION 06 10 00 ROUGH CARPENTRY

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	3.1 Surface Conditions
	1.2 Quality Assurance	3.2 Workmanship
	1.3 Submittals	3.3 Installation
	1.4 Product Handling	3.4 Fastening
	2.1 Grade Stamps	3.5 Nailing Schedule
	2.2 Materials	3.6 Cleaning Up

### PART 1 GENERAL

#### **1.1 Description**

- A. Work Included: All wood, nails, bolts, screws, framing anchors and other rough hardware, and all other items needed for rough carpentry in this Work but not specifically described in other Sections of these Specifications; and the installation of all blocking Required for scope of work.
  
- B. Related Work Specified Elsewhere
  - 1. Architectural Woodwork Section 06 40 00
  - 2. Gypsum Wallboard Section 09 29 00
  - 3. Painting Section 09 91 00
  - 4. Specialties Section 10 28 13

#### **1.2 Quality Assurance**

- A. Qualifications of Workmen
  - 1. Provide sufficient skilled workmen and supervisors who shall be present at all times during execution of this portion of the Work and who shall be thoroughly familiar with the type of construction involved and the materials and techniques specified.
  - 2. Rejection: In the acceptance or rejection of rough carpentry, no allowance will be made for lack of skill on the part of workmen.
  
- B. Codes and Standards
  - 1. Lumber grading rules and wood species to be in conformance with Voluntary Product Standard PS 20: Grading rules of the following associations apply to materials furnished under this Section:
    - a. West Coast Lumber Inspection Bureau (WCLIB).
    - b. Western Wood Products Association (WWPA).
  - 2. Requirements of Regulatory Agencies
    - a. Pressure treated material: American Wood Preservers Bureau Standards.
    - b. American Wood Preservers Bureau (AWPB):
      - (1) LB-2, Standard for Softwood Lumber, Timber, and Plywood Pressure Treated with Water-borne Preservatives for Above Ground Use.
    - c. Federal Specifications (FS):
      - (1) FF-B-561, Bolts (Screw), Lag.
      - (2) FF-B-575, Bolts, Hexagon and Square.

- (3) FF-B-584, Bolts, Finned Neck; Key Head; Machine; Ribbed Neck; Square Neck; Tee Head.
- (4) FF-N-105, Nails, Wire, Brads and Staples.
- (5) FF-N-836, Nuts, Square, Hexagon, Cap, Slotted, Castellated, Clinch Knurled and Welding.
- (6) FF-S-111, Screw, Wood.
- d. Product Standards (PS)
  - (1) 20, American Softwood Lumber Standard.
- 3. Conflicting requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards or these Specifications, the provisions of the more stringent shall govern.

### **1.3 Submittals**

- A. Certification (only on request of Architect)
  - 1. Pressure-treated wood: Submit certification by treating plant stating chemicals and process used, net amount of salts retained, and conformance with applicable standards.

### **1.4 Product Delivery, Storage and Handling**

- A. Protection
  - 1. Use all means necessary to protect the materials before and after delivery to the job site, and to protect the installed work and materials of all other trades.
  - 2. Deliver the materials to the job site and store, all in a safe area, out of the way of traffic.
  - 3. Store materials a minimum of 6 inches above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.
  - 4. Do not store seasoned materials in wet or damp portions of building.
  - 5. Protect sheet materials from corners breaking and damaging surface, while unloading.
  - 6. Identify all framing lumber as to grades and store all grades separately from other trades. Keep grade marks legible.
  - 7. Protect all metal products with adequate weatherproof outer wrappings.
  - 8. Keep all damaged material clearly identified as damaged, and separately store to prevent its inadvertent use.
  - 9. Do not allow installation of damaged or otherwise noncomplying material.
  - 10. Use all means necessary to protect the installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

## **PART 2 PRODUCTS**

- 2.1 Grade Stamps:** Identify all other materials of this Section by the appropriate stamp of the agency listed in the reference standards, or by such other means as are approved in advance by the Architect.



## **2.2 Materials**

### **A. Lumber**

1. Dimensions
  - a. Specified lumber dimensions are nominal.
  - b. Actual dimensions to conform to PS 20.
2. Moisture Content: Unseasoned or 19% maximum at time of permanent closing in of building or structure, for lumber 2 inches or less nominal thickness.
3. Surfacing: Surface four sides (S4S), unless specified otherwise.
4. End Jointed Lumber
  - a. Structural purposed interchangeable with solid sawn lumber.
5. Framing lumber, any commercial softwood species
  - a. Light framing
    - (1) General framing: Standard and Better or Stud grade. Chloride treated at roof blocking and where in contact with concrete.
    - (2) Plates, blocking, bracing and nailers: Utility grade.
    - (3) Bracing, blocking, bulk headings and general utility purposes: Economy grade.

### **B. Panel Sheathing**

1. Fire Treated Plywood – All interior plywood sheathing shall be Fire-Retardant-Treated Wood meeting the criteria outlined in Section 2303.2 of the International Building Code - 2015. As specified in the code, wood shall be tested in accordance with ASTM E84 or UL723, a listed flame spread index of 25 or less and show no evidence of significant progressive combustion when test is continued for an additional 20-minute period.

### **C. Rough Hardware**

1. Bolts
  - a. FS FF-B-575.
  - b. FS FF-B-584.
2. Nuts: FS FF-N-836.
3. Expansion shields: FS FF-B-561.
4. Lag screws and bolts: FS FF-B-561.
5. Toggle bolts: FS FF-B-588.
6. Wood Screws: FS FF-S-111.
7. Nails and staples: FS FF-N-105.
8. Metal nailing discs:
  - a. Flat caps, minimum 1 inch diameter.
  - b. Minimum 30 gauge sheet metal.
  - c. Formed to prevent dishing.
  - d. Bell or cup shapes not acceptable.

### **D. Materials: Fiberglass Reinforced plastic (FRP) Panels.**

- a. Kemply Panels:
  - a. Manufacturer: CRANE Composites or Approved Equal.
  - b. FRP Face: Linen or Sandstone Texture
  - c. Thickness: 0.09”
  - d. Fire Rating: Class A + C per ASTM E-84
  - e. Color: Color Selection by Architect from Full Color Range
  - f. Size: Standard sizes are 4' x 8' or 4' x 10'. Maximize all panel sizes for minimal joints.

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- g. Moldings and Rivets: Silhouette Trims Moldings
- h. Rivets: Color to Match Panel Selection
- i. Surfaseal Surface Protection: Provide manufacturer's proprietary surfaseal surface protection for fiberglass reinforced plastic (FRP) panels.
- j. Division Bars, Corner Trim: Panel manufacturer's standard length extruded vinyl pieces; longest length possible to eliminate end joints.
- k. Fasteners: Noncorrosive drive rivets.
- l. Substitutions: Product meeting or exceeding these specifications may be substituted with approval from Architect.

**Accessories:** Adhesive: Provide panel adhesive as recommended by panel manufacturer.  
Color Sil Color-Matched Caulking.

- a. Source Quality: obtain fiberglass reinforced plastic (FRP) panels from a single manufacturer. Provide panels and molding only from manufacturer specified to ensure warranty and color harmonization of accessories.
- b. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.
- c. Site Verification of Conditions: Verify that substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.
  - 1. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean, free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
  - 2. Do not begin installation until backup surfaces are in a satisfactory condition.

**Installation:** Fiberglass Reinforced Panel (FRP) Installation:

- a. Cut and drill panels with carbide tipped saw blades or drill bits, or cut with snips.
- b. Install panels with manufacturer's recommended gap for panel field and corner joints.
- c. Predrill fastener holes in panels with 1/8" (3.2 mm) oversize.
- d. For trowel type and application of adhesive, follow adhesive manufacturer's recommendations.
- e. Using products acceptable to panel manufacturer, install FRP system in accordance with panel manufacturer's printed instructions.
- f. Sealing: Caulk all joints and moldings using sealant recommended by manufacturer for high moisture environments. Wipe excess material clean.

## PART 3 EXECUTION

### 3.1 Surface Conditions

- A. Inspection
  - 1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that all rough carpentry may be performed in strict accord with the original design and all pertinent codes and regulations.
- B. Discrepancies
1. In the event of discrepancy, immediately notify the Architect.
  2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### **3.2 Workmanship**

- A. General: All rough carpentry shall produce joints true, tight and well secured with all members assembled in accord with the Drawings and with all pertinent codes and regulations.
- B. Selection of lumber pieces.
1. Carefully select all members; select individual pieces so that knots and obvious defects will not interfere with placing bolts or proper nailing or making proper connections.
  2. Cut out and discard all defects which will render a piece unable to serve its intended function; lumber may be rejected by the Architect, whether or not it has been installed, for excessive warp, twist, bow crook, mildew, fungus, or mold, as well as for improper cutting and fitting.

### **3.3 Installation**

- A. General Framing
1. General: In addition to all framing operations normal to fabrication and erection indicated on the Drawings, install all backing required for the Work of other trades.

### **3.4 Fastening**

- A. Nailing
1. Use only common wire nails or spikes, except where otherwise specifically noted in the Drawings.
  2. Provide penetration into the piece receiving the point of not less than 1/2 the length of the nail or spike provided, however, that 16d nails may be used to connect two pieces of two inch (nominal) thickness.
  3. Do all nailing without splitting wood, preboring as required; replace all split members.
- B. Bolting
1. Drill holes 1/16 inch larger in diameter than the bolts being used; drill straight and true from one side only.
  2. Bolt threads must not bear on wood; use washers under head and nut where both bear on wood; use washers under all nuts.
- C. Screws
1. For lag-screws and wood screws, prebore holes same diameter as root of thread; enlarge holes to shank diameter for length of shank.
  2. Screw, do not drive, all lag screws and wood screws.

### **3.5 Nailing Schedule:** Unless otherwise indicated on the Drawings or required by pertinent codes and regulations, provide at least the nailing shown in Table 2304.10.1 Fastening

Schedule of the International Building Code – 2015 Edition.

**3.6 Cleaning Up**

- A. General: Keep the premises in a neat, safe and orderly condition at all times during execution of this portion of Work, free from accumulation of sawdust, cut-ends, and debris.
  
- B. Sweeping
  - 1. At the end of each working day, or more often, if necessary, thoroughly sweep all surfaces where refuse from this portion of the Work has settled.
  - 2. Remove the refuse to the area of the job site set aside for its storage.
  - 3. Upon completion of this portion of the Work, thoroughly broom clean all surfaces.

\* \* \* \* \*

## SECTION 06 40 00 ARCHITECTURAL WOODWORK

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	2.1 Materials
	1.2 Quality Assurance	2.2 Fabrication
	1.3 Submittals	3.1 Surface Conditions
	1.4 Product Delivery, Storage and Handling	3.2 Preparation
		3.3 Installation
		3.4 Adjusting and Cleaning

### PART 1 GENERAL

#### 1.1 Description

- A. Work Included: Furnish all architectural woodwork shown on Drawings and specified herein. Architectural woodwork includes all exterior and interior woodwork exposed to view in finished building. except as exempted in paragraph B below; and includes plywood, doors and high-pressure laminates.
1. Standing and running trim
  2. Sink Tops
  3. Plastic laminate cabinetry, shelves & countertops
- B. Related Work Specified Elsewhere
1. Rough Carpentry Section 06 10 00
  2. Solid Polymer Fabrications Section 06 61 00
  3. Plumbing Utilities and Fixtures

#### 1.2 Quality Assurance

- A. Qualifications of Fabricators and Installers: Use only personnel who are thoroughly trained and experienced in the fabrication and installation of architectural woodwork. The approved woodwork Manufacturer must have a reputation for doing satisfactory work on time and shall have successfully completed comparable work. The Architect reserves the right to approve and woodwork Manufacturer selected to furnish all of the woodwork. In the acceptance or rejection of architectural woodwork, no allowance will be made for lack of skill on the part of workmen.
- B. Reference Standards
1. The "Quality Standards: of the Architectural Woodwork Institute shall apply and by reference are hereby made a part of this Specification. Any reference to Premium, Custom, or Economy in this Specification shall be a defined in the latest edition of the AWI "Quality Standards".
  2. Any item not given a specific quality grade shall be Custom grade as defined in the latest edition of the AWI "Quality Standards".
  3. Federal Specifications (FS):
    - a. MM-L-736, Lumber, Hardwood
    - b. MMM-A-130, Adhesive, Contact
  4. National Electrical Manufacturers Association (NEMA)

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- a. LD3, High Pressure Decorative Laminates
- 5. National Bureau of Standards (PS)
  - a. 1, Construction and Industrial Plywood
  - b. 20, American Softwood Lumber Standard
  - c. 51, Hardwood and Decorative Plywood

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with the provisions of these Specifications; the following:

- A. Shop Drawings
  - 1. Submit Shop Drawings in accord with Contract Conditions for all cabinets, identified with location, quality grade, type of finish and species of wood. Include component profiles, fastening methods, assembly methods, joint details, accessory listings and schedule of finishes.
  - 2. Show cabinets in related and dimensional position with sections either full-size or 3 inches equal 1 foot scale.
  - 3. The mill shall be responsible for details and dimensions not controlled by job conditions.
  - 4. Show all required field measurements beyond control of the mill.
  - 5. Drawings required for:
    - a. Shelving
    - b. Standing/Running Trim
    - c. Hardware
    - d. Cabinetwork
- B. Brochures: Submit Manufacturer's descriptive literature of specialty items not manufactured by the architectural woodworker, and laminate color samples, as requested by the Architect.

**1.4 Product Delivery, Storage and Handling:** Deliver, store and handle wood cabinets in manner to prevent damage and deterioration.

- A. Protection
  - 1. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
  - 2. Protect all surfaces of cabinets subject to damage while in transit.
- B. Delivery of Materials: The woodwork Manufacturer and the Contractor shall be jointly responsible to make certain that woodwork is not delivered until the building and storage areas are sufficiently dry so that the woodwork will not be damaged by excessive changes in moisture content.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

## PART 2 PRODUCTS

### **2.1 Materials**

- A. Quality Grade: Materials and fabrication; custom grade for transparent finish, in accord with "Quality Standards Illustrated" of the Architectural Woodwork Institute, Latest Edition.

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### B. Wood Materials

1. Softwood Lumber: PS20; graded in accord with AWI; maximum moisture content of 6 percent.
2. Hardwood Lumber: FS MM-L-736; graded in accord with AWI; maximum moisture content of 6 percent.

### C. Sheet Materials

1. Softwood Plywood: PS 1; graded in accord with AWI; core material of lumber or particleboard.
2. Hardwood Plywood: PS 51; graded in accord with AWI; core material of lumber or particleboard type of glue recommended for application.
3. Wood Particleboard: Per AWI standard composed of wood chips, made with high waterproof resin binders.

### D. Laminate Materials

1. Plastic Laminate: NEMA LD3, GP 50 general purpose type; colors as selected.
  - a. Architect to select from full range of colors.
  - b. Manufacturers – Formica, Wilsonart or equal.
2. Laminate Backing Sheet: NEMA LD3: BK20 backing grade, undecorated plastic laminate.

### E. Accessories

1. Adhesive: Type recommended by laminate manufacturer to suit application.
2. Edge Banding:
  - a. Casework and shelf edges – 1mm PVC
  - b. Drawers and doors – 3mm PVC

### F. Hardware: All hardware shall be furnished and installed by the architectural woodwork Manufacturer.

1. Hardware to be as follows:
  - a. Shelf standards, poles and brackets as shown on drawings
  - b. Pulls and handles – Brushed Wire type
  - c. Hinges
  - d. Catches
  - e. Locks
  - f. Support Brackets – Factory Finished Steel for support of counters without base cabinets.

### G. Standing and Running Trim (AWI Section 300)

1. Interior for Transparent Finish
  - a. AWI quality grade: Custom
  - b. Solid wood: Maple
  - c. Plywood: Maple

### H. Casework AWI Section 400)

1. Casework with high pressure laminate finish
  - a. AWI quality grade: Custom
  - b. Construction: Details shall conform to design: Standard overlay.
  - c. Exposed surfaces: Laminate
  - d. Semi-exposed surfaces: As governed by selected AWI quality grade; melamine laminated.

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3. Casework Doors: Doors 3/4" thick shall be laminate. Door edges to match 3mm PVC edging, no tape allowed.
  4. High pressure laminate counter tops
    - a. AWI quality grade: Custom
    - b. Laminate selection: Formica Sarum Grey 2770-58.
  5. Fabrication: Comply with Section 400 AWI Quality Standards.
- I. Closet and Storage Shelving (AWI Section 600) 1. AWI quality grade: Custom
- J. Miscellaneous Ornamental Items (AWI Section 700)
1. AWI quality grade: Custom
  2. Solid Wood: Maple
  3. Plywood: Maple
- K. Other Materials: All other materials, not specifically described but required for a complete and proper installation of architectural woodwork, shall be as selected by the Contractor subject to the approval of the Architect.

### **2.2 Fabrication**

- A. Fabricate all woodwork in accord with the approved Shop Drawings and referenced standards.
- B. Machine sand at mill, make joints to conceal shrinkage. Set nails for putty stopping. Same mill to fabricate all cabinetwork. All cabinetwork to have one coat of preservative.
- C. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- D. Fit shelves, doors and exposed edges with matching hardwood and matching veneer or plastic edging. Use full length pieces only.
- E. Door and drawer fronts: 3/4 inch thick.
- F. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cuttings.
- G. Apply plastic laminate finish in full uninterrupted sheets consistent with manufacturer sizes. Make corners and joints hairline. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- H. Mechanically fasten splash backs to countertops with steel brackets at 16 inches on center.
- I. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- J. Provide cutouts for plumbing fixture, inserts, appliances, outlet boxes and other fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.
- K. Factory Finishing (AWI Section 1 50 00)



1. Field Touch-up: Field touch-up shall be the responsibility of the installing Contractor and shall include the filling and touch-up of exposed job made nail or screw holes. refinishing of raw surfaces resulting from job fittings, repair of job inflicted scratches and mars, and final cleaning up the finished surfaces.

## **PART 3 EXECUTION**

### **3.1 Surface Conditions**

- A. Inspection: Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that the architectural woodwork may be fabricated and installed in accord with the original design, approved Shop Drawings and reference standards. Verify adequacy of backing and support framing.
- B. Discrepancies: In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### **3.2 Preparation**

- A. Field Dimensions: The woodwork Manufacturer is responsible for details and dimensions not controlled by job conditions and shall show on his Shop Drawings all required field measurements beyond his control. The Project Manager and the woodwork Manufacturer shall cooperate to establish and maintain these field dimensions.
- B. Before installing any materials, woodwork shall be conditioned to average prevailing humidity conditions in areas of installation.
- C. Examine pre-fabricated woodwork, before installation, and verify that back priming has been completed and all packing has been removed.

### **3.3 Installation**

- A. Install all woodwork true, square, plumb, level, true and straight without distortions, firmly anchored.
- B. Tops and woodwork shall be scribed and trimmed to fit adjoining work.
  1. Accurately fit all face plates, filler strips and trim strips to irregularities of adjacent surfaces. Leave gaps of 1/32 inch maximum. Do not use additional overlay trim for this purpose.
  2. Where cuts occur, refinish surfaces and repair damaged finishes.
- D. Secure woodwork to anchors or built-in blocking or blocking directly attached to substrates.
  1. Secure woodwork to grounds, furring, stripping and blocking as required with countersunk, concealed fasteners and blind nailing performing a complete installation.
  2. Use thin gauge finishing nails for exposed nailing, countersunk and filled flush with woodwork finished surface.
  3. Use purpose designed fixture attachments at concealed locations for wall mounted

- components.
- 4. Use threaded steel concealed joint fasteners to align and secure adjoining cabinet units and counter tops.
- 5. Conceal with solid plugs of species to match surrounding wood. Finish flush with surrounding surfaces.
- D. Standing and Running Trim:
  - 1. Install trim with a minimum number of joints using maximum lumber lengths furnished to the jobsite.
  - 2. Stagger joints in adjacent and related members.
  - 3. Comply with AWI Quality Standards for joinery.
  - 4. Cope at returns and miter at corners.
- E. Casework:
  - 1. Install casework with distortion so that doors and drawers fit openings properly and are accurately and evenly aligned.
  - 2. Adjust casework hardware centering the doors and drawers in the openings, and provide unencumbered operation.
  - 3. Complete the installation of hardware and accessory items as indicated.
  - 4. Maintain veneer sequence matching of casework with transparent finish, where so manufactured.
  - 5. Secure cabinet and counter bases to floor using appropriate angles and anchorages.
- F. Tops: Anchor tops securely to base units and to other support systems as required.
- G. Finishing: Leave all woodwork ready for finishing by painter. Refer to the finishing sections in Division 9 for site finishing of installed woodwork.

**3.4 Adjustments and Cleaning**

- A. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.
- B. Clean exposed and semi-exposed surfaces of casework, counters, shelves, hardware, fittings and fixtures. Touch-up shop-applied finishes to restore damaged or soiled areas, matching adjoining finish.
- C. Repair damaged and defective woodwork where possible eliminating defects and blemishes. Where not possible to repair damaged or defective work, replace with matching new work at direction of the Architect and at no additional cost to the Owner.
- D. Adjust joinery for uniform appearance. Adjust and lubricate hardware.

\* \* \* \* \*

## **SECTION 06 61 00 - SOLID POLYMER FABRICATIONS**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this section.

<b>INDEX</b>	1.1 Description	1.6 Warranty
	1.2 References	2.1 Solid Polymer Fabrications
	1.3 Submittals	2.2 Fabrication
	1.4 Quality Assurance	3.1 Installation
	1.5 Delivery, Storage & Handling	

### **PART 1 GENERAL**

#### **1.1 Description**

- A. Work included in this section:
  - 1. Counter tops.
  - 2. Miscellaneous Millwork as shown on the drawings.
  
- B. Related work specified elsewhere:
  - 1. Architectural woodwork Section 06 40 00
  - 2. Plumbing Utilities and Fixtures

#### **1.2 References**

- A. Applicable Standards: Standards of the following, as referenced herein:
  - 1. American National Standards Institute (ANSI)
  - 2. American Society for Testing and Materials (ASTM)
  - 3. National Electrical Manufacturers Association (NEMA)
  - 4. Federal Specifications (FS)

#### **1.3 Submittals**

- A. Shop drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Samples: Submit minimum 2" x 2" (50 mm x 50 mm) samples. Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.
- C. Product data: Indicate product description, fabrication information and compliance with specified performance requirements.
- D. Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

#### **1.4 Quality Assurance**

- A. Allowable tolerances:
  - 1. Variation in component size:  $\pm 1/8"$  (3 mm).
  - 2. Location of openings:  $\pm 1/8"$  (3 mm) from indicated location.

### **1.5 Delivery, Storage, and Handling**

- A. Deliver no components to project site until areas are ready for installation. Store components indoors prior to installation.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

### **1.6 Warranty**

- A. Provide manufacturer's 10 year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

## **PART 2 - PRODUCTS**

### **2.1 Solid Polymer Fabrications**

- A. Acceptable Manufacturers:
  - 1. FORMICA® Solid Surface Products
  - 2. CORIAN® Products, Made by DUPONT
  - 3. WILSONART® Solid Surface Material
- B. Material: Homogeneous filled acrylic; not coated, laminated or of composite construction; meeting ANSI Z124.3 & .6, Type Six, and Fed. Spec. WW-P-541E/GEN.
  - 1. Material shall have minimum physical and performance properties specified in the following Section U.
  - 2. Superficial damage to a depth of 0.010" (25 mm) shall be repairable by sanding and polishing.
- C. Lavatory tops with cut-outs for bowls by Plumber; ½" (13 mm) thick countertop of solid polymer material, having edge details as indicated on the Drawings. Provide cut-outs from template provided by Plumber. Provide countertops complete with backsplashes of size shown on the Drawings. Countertop and backsplash shall be of color as selected from the following color groups:
  - FORMICA – Classics Series
  - CORIAN - Groups A-C
  - WILSONART – Groups 1-3
- D. Performance characteristics:
  - 1. Reference Standards:
    - a. ISSFA-2, "Classification and Standards Publications of Solid Surfacing Material".
    - b. Sinks and Vanities: ANSI Z124-3 (vanities) / ANSI Z124-6 (sinks)
    - c. Splash and Food Service Areas: NSF Standard 51.
    - d. Fungal Resistance: ASTM G21 Method [A] [B] no growth.
    - e. Bacterial Resistance: ASTM G22 - no growth.
    - f. Stain Resistance: ANSI Z124-6-5.2 1997.

2. Mechanical Properties:

- a. Tensile Strength: ASTM D 638 (4,000 psi).
- b. Tensile Modulus: ASTM D 638 (1,100,00 psi).
- c. Tensile Elongation: ASTM D 638 (2.10%).
- d. Flexural Strength: ASTM D 790 (8,000 psi).
- e. Barcol Hardness: ASTM D 2583 (60).
- f. Rockwell Hardness: ASTM D 785 (86).
- g. Ball Impact: NEMA LD3-3.8 (>150 degrees).

3. Thermal Properties:

- a. Coefficient of Thermal Expansion: ASTM D 696
- b. Boiling Water Resistance: ISSFA SST 9.1-100 (No Effect)
- c. High Temperature Resistance: ISSFA SST 9.1-100 (No Effect).
- d. Flame Spread Index: ASTM E 84 (<25)
- e. Smoke Development: ASTM E 84 (<25)

E. Accessory Products:

- i. Joint adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.
- ii. Powder Coated concealed metal "L" brackets for support in areas without base cabinets, spaced per manufacturer's recommendations.

## **2.2 Fabrication**

- A. For warranty coverage, solid polymer manufacturer shall approve fabricator/installer.
- B. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and solid polymer manufacturer requirements.
- C. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 2" (50 mm) wide reinforcing strip of solid polymer material under each joint
- D. Provide holes and cutouts for plumbing and bath accessories as indicated on the drawings.
- E. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.
- F. Finish: All surfaces shall have uniform finish.
  - 1. Matte ,with a gloss rating of 5 - 20.

## **PART 3 EXECUTION**

### **3.1 Installation**

- A. Install components plumb and level, in accordance with approved shop drawings and product installation details.
- B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
- C. Provide backsplashes and end splashes as indicated on the drawings. Adhere to countertops using manufacturer's standard color-matched silicone sealant.
- D. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.

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- E. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work that cannot be repaired to architect's satisfaction and invoice for the cost of repairs. Architect to pre-approve cost estimate before repairs are made.
- F. Fabricator/Installer is to provide a commercial care and maintenance video, review maintenance procedures and warranty details with the director of maintenance upon completion of project.

\* \* \* \* \*

## SECTION 07 21 00 INSULATION

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	1.8 Sequencing
	1.2 Quality Assurance	1.9 Project Materials
	1.3 Submittals	2.1 Materials
	1.4 Product Delivery, Storage and Handling	3.1 Surface Conditions
	1.5 Job Conditions	3.2 Preparation
	1.6 Quality Assurance	3.3 Installation
	1.7 Pre-Application Meeting	3.4 Cleaning

### PART 1 GENERAL

#### 1.1 Description

- A. Work Included: Building insulation required for this Work includes, but is not limited to:
  - 1. Batt Insulation
  - 2. Sound Insulation
  
- B. Related Work Specified Elsewhere
  - 1. Carpentry Section 06 10 00
  - 2. Gypsum Wallboard Section 09 29 00
  
- C. Work Furnished by Installer
  - 1. Sound insulation at interior metal stud walls and rigid wall insulation at exterior furred walls by Gypsum Wallboard Contractor.

#### 1.2 Quality Assurance

- A. Design Criteria: The Heating and Air Conditioning system for the Project was designed for the insulation values listed for each type of insulation in Part 2 of this Section. The Contractor will insure that all insulation used meets or exceeds those values. The Architect will order the removal of all material not meeting this Specification. All insulation will meet State Fire Code. Thickness of roof insulation supplied shall not exceed the space available that would require additional blocking, or raising of parapet, door sills, flashing or curbs.
- B. Testing: Flame spread: ASTM E 84, 25 or less.
  
- C. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. E 84, Standard Method of Test for Surface Burning
    - b. C 1289, closed cell polyisocyanurate foam core board.
    - c. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
    - d. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
    - e. ASTM C 1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

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- f. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
  - g. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - h. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics
  - i. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics
  - j. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
  - k. ASTM D 2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
  - l. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
2. Federal Specifications (FS):
- a. HH-I-521, Insulation Blankets, Thermal (Mineral Fiber for Ambient Temperatures)
  - b. HH-I-524, Insulation Board, Thermal (Polystyrene)
  - c. HH-I-1972, Insulation Board, Thermal (Urethane)
  - d. L-P-375, Plastic Film, Flexible, Vinyl Chloride

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accord with the provisions of these Specifications; the following:

- A. Manufacturer's Literature: Manufacturer's recommended installation instructions.
- B. Material List: Submit to the Architect for review a complete list of all insulation material proposed to be furnished. Any material which differs from that specified, shall have engineering data submitted to show that its performance is equal to insulation specified. See Section 01 30 00.
- C. Technical Data: Submit technical data indicating thermal conductance factors of furnished insulation.
- D. Certificates: Manufacturer's certification that materials meet Specification requirements.

### **1.4 Product Delivery, Storage and Handling**

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Deliver materials to Project site in Manufacturer's original unopened packaging.
- C. Identify contents, Manufacturer, brand name, thermal values and applicable standards.
- D. Store materials in area protected from weather, moisture, and open flame or sparks.
- E. Replacements: In the event of damage, immediately replace materials at no additional cost to the Owner. Tears in foil face insulation will not be acceptable.



### **1.5 Job Conditions**

- A. Environmental Requirements: Do not install insulation when temperature is 40 degrees F. or below, during rain or wet weather, or when surfaces are wet.
- B. Scheduling: Coordinate installation with other trades whose work may be affected or have effect.

### **1.6 Quality Assurance**

- A. Manufacturer Qualifications: Manufacturer with a minimum of ten years' experience manufacturing products in this section shall provide all products listed.
- B. Installer Qualifications: Products listed in this section shall be installed by a single organization with at least five years experience successfully installing insulation on projects of similar type and scope as specified in this section.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish areas designated by Architect.
  - 2. Do not proceed with remaining work until workmanship is approved by Architect.
  - 3. Refinish mock-up area as required to produce acceptable work.

### **1.7 PRE-APPLICATION MEETINGS**

- A. Convene minimum two weeks prior to starting work of this section.

### **1.8 SEQUENCING**

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

### **1.9 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 insulation when substrate temperatures are under 40 degrees F (4.4 degrees C) prior to installation.
- C. Surfaces must be dry prior to application of spray foam. Excess humidity may cause poor adhesion, and result in product failure.
- D. To avoid overspray, product should not be applied when conditions are windy.

## **PART 2 PRODUCTS**

### **2.1 Materials** (See Drawing Details for applicable products)

1. Stud sound insulation shall be 3½” unfaced fiberglass sound attenuation batts. Sound batts shall comply with the property requirements of ASTM C665, Type I and ASTM E136 as well as all applicable codes for interior wall use.

## **PART 3 EXECUTION**

### **3.1 Surface Conditions**

- A. Inspection: Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may be installed in accord with original design and the Manufacturer's recommendation.
  1. Examine space allocated for insulation for proper depth to receive material.
  2. Check surfaces to receive rigid insulation to assure they are in uniform plane; and free of mortar chips, debris, grease, oil or other items detrimental to installation.
- B. Discrepancies: In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### **3.2 Preparation:** Remove or protect against projections in construction framing that may damage or prevent proper installation.

### **3.3 Installation**

- A. Gypsum Wallboard: per manufacturer's recommendations.

### **3.4 Cleaning**

- A. Any installer using mastic will clean all excess material from all surfaces to be exposed or to receive the work of other trades. Follow criticisms of Architect completely.

## SECTION 07 92 13 SEALANTS AND CAULKING

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	2.1 Caulking Materials
	1.2 Quality Assurance	2.2 Caulking Equipment
	1.3 Submittals	2.3 Acceptable Manufacturers
	1.4 Product Delivery, Storage and Handling	3.1 Surface Conditions
	1.5 Warranty	3.2 Preparation
		3.3 Installation
		3.4 Caulking Schedule

### PART 1 GENERAL

#### 1.1 Description

- A. Work Included
  - 1. Such caulking will normally be performed under the work of various Sections of these Specifications but shall be performed in strict accord with the provisions of this Section.
  - 2. Interior of Building:
    - a. Millwork to a jointing surfaces.
- B. Related Work Specified Elsewhere: Individual requirements for caulking are described in various other Sections of these Specifications.
  - 1. Architectural Woodwork Section 06 40 00
  - 2. Solid Polymer Fabrications Section 06 61 00
  - 3. Acoustical Treatment Section 09 51 00

#### 1.2 Quality Assurance

- A. Qualifications of Applicators: Installation of caulking shall be performed only by workers thoroughly skilled and specially trained in the techniques of caulking, and who are completely familiar with the published recommendations of the manufacturer of the caulking materials being used. Minimum two years experience and approved by manufacturer.
- B. Rejection of Installed Caulking: Indication of lack of skill on the part of caulking installers shall be sufficient ground for the Architect to reject installed caulking and to require its immediate removal and complete re-caulking at no additional cost to the Owner. This item will be strictly enforced and no excuses accepted.
- C. Manufacturer's Representative: Arrange for manufacturer's technical representative to be on project site to advise installer of proper procedures and precautions for the use of materials and to check installation.
- D. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. C 790, Recommended Practices for Use of Latex Sealing Compounds.
    - b. C 804, Recommended Practice for Use of Solvent-Release Type Sealants.
    - c. C 920, Elastomeric joint sealants.

- d. D 1056, Flexible Cellular Materials - Sponge or Expanded Rubber.
- e. D 1565, Flexible Cellular Materials - Vinyl Chloride Polymers and Co-polymers (Open Cell Foam).

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accord with the provisions of these Specifications; the following:

- A. Product Data: Copies of product manufacturer's specification, recommendations and installation instructions for sealant, backing and associated materials.

#### **1.4 Product Delivery, Storage and Handling**

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery of Materials: Deliver materials in original, tightly sealed containers or unopened packages with Manufacturer's name, labels, product identification and lot numbers where appropriate.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

#### **1.5 Warranty**

- A. Provide Manufacturer's standard year 10 material warranty. Replace sealants which fail because of loss of cohesion or adhesion, or do not cure.
- B. Guarantee workmanship against leakage for two years.

### **PART 2 PRODUCTS**

**2.1 Caulking Materials:** All caulking materials shall be a single or double component, non-sagging type.

- A. Sealants
  1. Silicone base, solvent curing conforming to requirements of C 920, Type S; Grade NS; Class 25; Use NT; Shore 'A' hardness of minimum 15 and maximum 50; non-staining; non-bleeding; color as selected.
  2. Polyurethane base, multi-component, chemical curing; self leveling type for application in horizontal joints and non-sagging type for application in vertical joints; capable of being continuously immersed in water, withstand movement of up to 25 percent of joint width and satisfactorily applied throughout a temperature range of 40 to 80 degrees F.; uniform, homogeneous, and free from lumps, skins and coarse particles when mixed; Shore 'A' hardness of minimum 15 and maximum 50; non-staining; non-bleeding; color as selected.
- B. Accessories
  1. Primer: Non-staining type, as recommended by sealant Manufacturer to suit application.
  2. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant Manufacturer; compatible with joint forming materials.

3. Joint Filler: as recommended by sealant manufacturer to suit application.
4. Bond Breaker: Pressure sensitive tape recommended by sealant Manufacturer to suit application.
5. Masking Tape: Pressure sensitive adhesive paper tape.

**2.2 Caulking Equipment:** All caulking equipment shall be only such equipment as is specifically recommended by the manufacturer of the caulking material being installed.

**2.3 Acceptable Manufacturers**

- A. Dow Chemical
- B. General Electric
- C. Tremco

**PART 3 EXECUTION**

**3.1 Surface Conditions**

- A. Inspection
  1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
  2. Verify that caulking may be installed in accord with the manufacturer's recommendations.
  3. Examine joints to be sealed for construction defects which would adversely affect execution of work.
  4. Ensure that masonry and concrete have cured 28 days minimum.
- B. Discrepancies
  1. In the event of discrepancy, immediately notify the Architect.
  2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

**3.2 Preparation**

- A. Cleaning: Clean joint surfaces, using joint cleaner as necessary to be free of dust, dirt, oil, grease, rust, lacquers, laitance, release agents, moisture, or other matter which might adversely affect adhesion of sealant.
- B. Do not apply caulking to painted surfaces. Remove old paint and caulking material before applying new caulking.
- C. Masking: Mask area adjacent to joints.
- D. Very porous surfaces require priming.
- E. Before caulking, clean and prime surfaces to receive caulking per manufacturer's recommendations.
- F. Verify that joint shaping materials and release tapes are compatible with sealant.

- G. Examine joint dimensions and size materials to achieve required width/depth ratios.
- H. Use joint filler to achieve required joint depths, to allow sealants to perform properly.
- I. Use bond breaker where required.

### **3.3 Installation**

#### **A. Application of Backing**

1. Verify the compatibility of filler material with caulking before installation.
2. Polyurethane for open joints shall be at least 1-1/2 times width of open joint and of thickness to give solid backing.
3. Backing shall fill up joint do depth of joint is approximately 1/2 of its width for joints from 1/2" to 1".
4. Install backing material in joints using blunt instrument to avoid puncturing. Do not twist rod while installing. Install backing so that joint depth is 50% of joint width, but a minimum of 1/4" deep.

#### **B. Mixing: (Two Part)**

1. Mix in exact proportions recommended by Manufacturer.
2. Do not thin.
3. Secure a perfect blend by thorough slow mixing.
4. Mix five minutes mechanically (one-gallon units) or ten minutes by hand.
5. Do not mix in direct sunlight.

#### **C. Application of Caulking**

1. General:
  - a. Do not caulk under weather conditions or sun conditions potentially harmful to the set and curing of the caulking material.
  - b. Perform work in accord with ASTM C 804 for solvent release.
2. Installation
  - a. Install caulking in strict accord with the manufacturer's recommendations, taking care to produce beads of proper width and depth, to tool as recommended by the manufacturer, and to immediately remove all surface caulking.
  - b. Apply with hand caulking gun. Use gun nozzles of proper size to fit joints.
  - c. A minimum adhering surface should be as lease 1/2". For joints from 1/2" to 1" wide, depth of sealant shall be 1/2 the width. For joints over 1", maintain depth of sealant to 1/2". (For unusual requirements, consult supplier.)
  - d. Seal joint when it is normal, not in a contracted or expanded condition.
  - e. Use masking tape to protect surrounding surfaces. Remove tape immediately after drawing bead with inner edge drawn away first to eliminate feather edging.
  - f. Tool with putty knife of suitable size within 10 minutes after gunning. Tool joints as indicated.
  - g. Do not apply caulking at temperatures under 50 degrees F.
  - h. Caulk entire perimeter of all openings unless otherwise indicated.
  - i. Joints: Free of air pockets, foreign embedded matter, ridges and sags.

#### **D. Cleaning: Remove excess materials adjacent to joints by mechanical means or with xylol (xylene) or mineral spirits as work progresses to eliminate evidence of spillage or damage to adjacent surfaces. Note: When using flammable solvents, avoid heat, sparks and open flames. Always provide adequate ventilation and follow all precautions listed on solvent**

container label. Leave finished work in neat, clean condition with no evidence of spillovers onto adjacent surfaces.

**3.4 Caulking Schedule**

A. Carefully study the Drawings and furnish and install the proper caulking of each point where called for on the Drawings plus all other points where caulking is essential in maintaining the continued integrity of the watertight barrier. In general, caulk all joints of masonry meeting non-masonry surfaces including interior and exterior door and window frames, caulk all masonry expansion joints.

1. Silicone base, "Silicone": Glazing systems, toilet rooms.

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## SECTION 08 11 00 METAL DOORS AND FRAMES

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	2.2 Materials
	1.2 Quality Assurance	2.3 Fabrications
	1.3 Submittals	3.1 Inspection
	1.4 Product Delivery, Storage and Handling	3.2 Installation
	2.1 Acceptable Manufacturers	3.3 Adjustment and Cleaning

### PART 1 GENERAL

#### 1.1 Description

A. Work Included

1. The metal doors and frames required for this work are indicated on the Drawings and include non-labeled and labeled hollow metal doors and frames and hollow metal frames for borrowed lites.

B. Related Work Specified Elsewhere

- |                           |                  |
|---------------------------|------------------|
| 1. Architectural Woodwork | Section 06 40 00 |
| 2. Sealants and Caulking  | Section 07 92 13 |
| 3. Finish Hardware        | Section 08 71 00 |
| 4. Glazing                | Section 08 80 00 |
| 5. Finish Painting        | Section 09 91 00 |
| 6. Electrical             | Division 26      |

#### 1.2 Quality Assurance

- A. Qualifications of Installers: For actual installation of metal doors and frames and installation of finish hardware on metal doors and frames, use only personnel who are thoroughly trained and experienced in the skills required and who are completely familiar with the Manufacturer's current recommended methods of installation as well as the requirements of this Work. Minimum two years of experience.

B. Requirements of Regulatory Agencies

1. Testing agency: Underwriters Laboratories, Inc.
2. Door assembly fire test
  - a. Procedure: ASTM E 152.
  - b. Exposure: As labeled on Door Schedule.

C. Reference Standards

1. American National Standards Institute (ANSI):
  - a. A 115, Series on Door and Frame Preparation.
  - b. A 151.1, Performance Test for Standard Steel Doors, Frames, Anchors, Hinge Reinforcing and Exit Device Reinforcings.
2. Hollow Metal Manufacturers Association (HMMA)
  - a. Standard 800, Hollow Metal Manual

3. Steel Door Institute (SDI)
  - a. 100, Recommended Specification, Standard Steel Doors and Frames.
  - b. 105, Recommended Erection Instructions for Steel Frames.
  - c. 107, Hardware on Steel Doors, (reinforcement application).
  - d. 110, Standard Steel Doors and Frames for Modular Masonry Construction.
  - e. 113, Standard Thermal Performance Tests ply Steel Door and Frame Assemblies.
4. In addition to complying with all pertinent codes and regulations:
  - a. Manufacturer all labeled doors in strict accord with the specifications and procedures of Underwriters' Laboratories, Inc.
  - b. In Warranty and Shop Drawings, comply with nomenclature established in American National Standards Institute Publication A 123.1 "Nomenclature for Steel Doors and Steel Door Frames".

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

- A. Samples
  1. A sample of door, showing edge, top and/or bottom construction, insulation, hinge reinforcement and face stiffening.
  2. A sample of a typical frame, showing welded corner joint, welded hinge reinforcements, dust cover boxes and floor anchor.
  3. All samples submitted shall be of the production type and shall represent in all respects the minimum quality of work to be furnished by the Manufacturer. No work represented by the samples shall be fabricated until the samples are approved and any downgrading of quality demonstrated by the samples may be cause for rejection of the work.
- B. Shop Drawings: Illustrations and schedule of door and frame sizes, types, materials, construction, finishing, anchoring, accessories and preparation for installing hardware.
- C. Product Data: Manufacturer's descriptive literature and installation instructions.
- D. Certificates: Manufacturer's certificates that materials meet specification requirements.

#### **1.4 Product Delivery, Storage and Handling**

- A. Protection:
  1. Deliver, store and handle all metal doors and frames in a manner to prevent damage and deterioration.
  2. Provide packaging such as cardboard or other containers, separators, banding, spreaders and paper wrappings as required to completely protect all metal doors and frames during transportation and storage.
  3. Store doors upright, in a protected dry area, at least one inch off the ground and with as least 1/4" air space between individual pieces; protect all prefinished and hardware surfaces as required.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

## **PART 2 PRODUCTS**

**2.1 Acceptable Manufacturers:** All metal doors and frames shall be the product of one Manufacturer.

- A. Hollow metal doors and frames - Pioneer, Amweld, Ceco, Republic, Precision, Steelcraft, Curries, Corrim Co. and Mesker.

**2.2 Materials** (Hollow Metal)

- A. Steel Fabrications: Carbon Steel: Cold rolled, ASTM A 366.
- B. Coating Materials: Primer: Manufacturer's standard rust inhibitive primer.
- C. Core Filler Material: Manufacturer's standard.
- D. Anchors, Fasteners, Hardware and Accessories: Manufacturer's standard.

**2.3 Fabrication** (Hollow Metal)

A. General

- 1. Fabricate hollow metal work to be rigid, neat in appearance and free from defects, warp or buckle.
- 2. Completed fabrications to meet ANSI A 151.1.
- 3. Accurately form metal to required sizes and profiles, including astragals if utilized.
- 4. Clearly identify work, that cannot be permanently factory assembled before shipment, to assure proper assembly at project site.
- 5. Grind and dress exposed welds to form smooth, flush surfaces.
- 6. Do not use metallic filler to conceal manufacturing defects.

B. Doors

- 1. Form interior face sheets of 18 gauge and exterior face sheets of 16-gauge metal.
- 2. Stiffener and Core
  - a. Stiffen face sheet with continuous vertical formed steel sections over full thickness of interior space between door faces.
  - b. Stiffeners of 22 gauge minimum spaced not more than 6 inches apart, spot welded to both face sheets not more than 4 inches on center.
  - c. Fill spaces between stiffeners with core material on interior doors.
  - d. Fill spaces on exterior doors with urethane foam.
- 3. Join door faces at vertical edges by continuous weld extending full height of door, grind welds flush.
- 4. Form astragal on meeting edge of door.
- 5. Close top and bottom edges of doors with steel channel minimum 16 gauge, extending full width of door and spot welded to both faces.
- 6. Form door seal mortise on door bottom.
- 7. Edge profiles shall be provided on both vertical edges of doors as follows:
  - a. Single-acting swing doors - beveled 1/8 inch in 2 inches.
  - b. Double-acting swing doors - rounded on 2-1/8 inch radius.
- 8. Hardware reinforcements
  - a. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accord with the approved hardware schedule and

templates provided by the hardware contractor. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only; all drilling and tapping shall be done by others.

- b. Minimum gages for hardware reinforcing plates shall be as follows:
  - (1) Hinge and pivot reinforcements: 7 gauge
  - (2) Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge
  - (3) Reinforcements for all other surface-mounted hardware: 16 gauge
9. Vision Panels
  - a. Openings to meet ADA requirements.( ADA code - 43" to bottom of the glass)
  - b. Framed for glazing
  - c. Glazing beads:
    - (1) Manufacturer's standard mitered corners.
    - (2) Form beads from minimum 20 gauge metal, prefitted for field glazing.
    - (3) Locate beads on nonsecurity side of opening.
    - (4) Locate screws within one inch of ends of beads and spaced not more than 8 inches apart.
- C. Frames
  1. Anchors: T-strap or stirrup strap type.
  2. Dust cover boxes: Minimum 26 gauge at hardware mortises.
  3. Welded frames
    - a. 14 gauge exterior and 16 gauge interior minimum.
    - b. Weld frames to form rigid, neat, square and true units free of defects, warp or buckle.
    - c. Close corner joints tight with trim faces mitered and continuously welded and ground smooth.
    - d. Weld temporary steel brace to both feet of jambs to serve as brace during shipping handling.
    - e. Head assemblies integrally reinforced and mitered joints with 18 gauge minimum channel section.
- D. Edge Clearances
  1. Between doors and frame at head and jamb: 1/8 inch.
  2. At sills without thresholds: 3/4 inch maximum.
  3. At sills with thresholds: 1/4 inch maximum between threshold and door.
  4. Between meeting edges of pairs of doors: 1/8 inch.
- E. Preparation for Hardware: ANSI A 115.
- F. Finish
  1. Dress tool marks and surface imperfections to smooth surfaces and remove irregularities.
  2. Chemically treat and clean doors and frames.
  3. Apply Manufacturer's standard prime and finish coating. Frames to be painted by the dipping process.

## **PART 3 EXECUTION**

### **3.1 Inspection**

- A. Assure that frame openings correspond to dimensions of frame furnished.
- B. Check that surfaces to contact frame are free of debris.
- C. Verify that metal doors and frames may be installed in strict accord with all pertinent codes and regulations, the original design, approved Shop Drawings and Manufacturer's recommendations.
- D. Discrepancies
  - 1. In the event of discrepancy, immediately notify the Architect.
  - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### **3.2 Installation**

- A. Anchorage
  - 1. Attach anchor to opening.
  - 2. Minimum number of anchors.
    - a. Masonry walls.
      - (1) Frames up to 7 feet 6 inches: 3 anchors per jamb.
      - (2) Frames 7 feet 6 inches to 8 feet 0 inches: 4 anchors per jamb.
      - (3) Frames more than 8 feet 0 inches: 1 anchor for each 2 feet of jamb or fraction thereof.
    - b. Stud partitions
      - (1) Frames up to 7 feet 6 inches: 3 anchors per jamb.
      - (2) Frames 7 feet 6 inches to 8 feet 0 inches: 4 anchors per jamb.
      - (3) Frames more than 8 feet 0 inches: 4 anchors plus one additional anchor for each 2 feet of jamb or fraction thereof.
- B. Frames
  - 1. Remove shipping spreaders if used.
  - 2. Attach frames square, plumb and true to line with adjacent construction.
  - 3. All frames in masonry or precast openings to be mortar filled by mason..
- C. Finish Hardware: Install all finish hardware supplied under Section 08 71 00 in strict accord with the Manufacturer's recommendations, eliminating all hinge-bound conditions and making all items smoothly operating and firmly anchored into position.
- D. Doors: SDI 100.
- E. Installation: Install hollow metal work in accordance with Manufacturer's instructions.

### **3.3 Adjustments and Cleaning**

- A. Remove dirt and excess sealants or glazing compound from exposed surfaces.
- B. Touch up marred or abraded surfaces to match original finish.

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C. Adjust moving parts for smooth operation.

D. Remove debris from project site.

\* \* \* \* \*

**SECTION 08 41 13 ALUMINUM ENTRANCES AND STOREFRONTS**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	2.1 Materials
	1.2 Quality Assurance	2.2 Acceptable Manufacturers
	1.3 Submittals	2.3 Fabrication
	1.4 Product Delivery, Storage and Handling	3.1 Surface Conditions
	1.5 Warranty	3.2 Preparation
		3.3 Installation
		3.4 Adjustments and Cleaning

**PART 1 GENERAL**

**1.1 Description**

- A. Work Included: Aluminum door, window and sash, complete with finish hardware.
  
- B. Related Work Specified Elsewhere
  - 1. Precast Concrete Section 03 41 00
  - 2. Masonry Section 04 20 00
  - 3. Metal Fabrications Section 05 50 00
  - 4. Rough Carpentry Section 06 10 00
  - 5. Caulking Section 07 92 13
  - 6. Anchors and Inserts Section 08 10 00
  - 7. Cylinders for locks Section 08 71 00
  - 8. Glazing Section 08 80 00
  - 9. Electrical Division 26
  
- C. Work Installed but Furnished by Others:
  - 1. Door hardware others than specified in this Section 08 71 00.

**1.2 Quality Assurance**

- A. Qualifications of Installers
  - 1. For actual installation of the work of this Section use only personnel who are thoroughly trained and experienced in the skills required and who are completely familiar with the Manufacturer's current recommended methods of installation as well as the requirements of this Work.
  - 2. In acceptance or rejection of installed doors and frames, no allowance will be made for lack of skill on the part of installers.
  
- B. Design Criteria
  - 1. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F. without causing detrimental effects to system or components.
  - 2. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accord with the applicable building codes.
  
  - 3. Limit mullion deflection to 1/200 or flexure limit of glass with full recovery of glazing

materials, whichever is less.

4. Drain water entering joints, condensation occurring in glazing channels or migrating moisture occurring within system, to exterior.
5. Limit air infiltration through assembly to 0.06 cubic feet per minute per square foot of assembly surface area, measured at a reference differential pressure across assembly of 0.3 inches water gage as measured in accord with ASTM E 2831.
6. System to accommodate, without damage to system or components, or deterioration of perimeter seal; Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.

C. Allowable Tolerances

1. Variation from Plane: 0.03 inches per foot maximum or 0.25 inches per 30 feet, whichever is less.
2. Misalignment of Two Adjoining Members Abutting in Plane: 0.015 inches.

D. Reference Standards

1. American Society for Testing and Materials (ASTM):
  - a. A 164, Electrodeposited Coatings of Zinc on Steel
  - b. A 386, Zinc Coating (Hot-Dip) on Assembled Steel Products
  - c. B 221, Aluminum - Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
  - d. E 283, Air Performance
  - e. E 330, Structural
  - f. E 331, Water
2. Aluminum Association (AA): Designation for Aluminum Finishes.
3. American Architectural Manufacturers Association (AAMA):
  - a. 501, Water
  - b. 1503, Thermal

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

- A. Samples: Submit a sample of the prefinished aluminum material illustrating the actual finish obtained in the specified anodizing.
- B. Shop Drawings: Submit complete Shop Drawings showing all details of the fabrication and installation, including system and component dimensions; components within assembly; framed opening requirements and tolerances; anchorage and fasteners; glass and infills; door hardware requirements; and adequate provision for installation of the specified glass.
- C. Certificates: Manufacturer's certificates that materials meet Specification requirements.

**1.4 Product Delivery, Storage and Handling**

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Deliver materials in Manufacturer's packaging complete with installation instructions.



- C. Provide wrapping or strippable coating to protect prefinished aluminum surfaces.
- D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

**1.5 Warranty:** Provide three year Manufacturer's warranty to cover complete system for failure to meet specified requirements.

## **PART 2 PRODUCTS**

### **2.1 Materials**

- A. Extruded Aluminum: ASTM B 221, 6063 alloy, T5 temper.
- B. Touch-up primer for galvanized surfaces: FS TT-P-641.
- C. Fasteners, where exposed, shall be aluminum, stainless steel or zinc plated steel in accord with ASTM A 164.
- D. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from the aluminum.
- E. Glazing gaskets shall be EPDM elastomeric extrusions.
- F. Single acting entrance frame weatherstripping shall be a non-porous, polymeric material.
- G. Fabricated Components
  - 1. General
    - a. All assemblies for this Work, unless otherwise specifically approved by the Architect, shall be the product of one Manufacturer.
    - b. All exterior frames and doors shall be of thermal break construction. Mullion and perimeter gutters shall be separated from mullion and perimeter faces by PVC members eliminating all metal to metal contact between exterior and interior of the frame so that it will perform in such a manner that condensation will first appear on the glass before the metal.
  - 2. Interior Frames: 4-1/2 inch deep by 1-3/4 inch wide profile Kawneer Tri-Fab II 451; of extruded aluminum alloy; ASTM B 221 complete with extruded aluminum security type snap-in glass stops for sidelights and transom lights, of profile to suit frame section.
  - 3. Doors: Of extruded aluminum alloy; ASTM B 221; wide stile, Kawneer 500, 1-3/4 inches thick with 5-inch-wide vertical stiles, 5-inch-wide top rail and 6 ½ inch wide bottom rail; for 1-inch exterior glass and ¼ inch thick interior glass secured with snap-in glazing splines.
  - 4. Door, Sidelight and Transom Light Glass: Exterior and Interior located; thickness and type same as doors as called for in these Specifications.
- H. Finish
  - 1. All exposed framing surfaces shall be free of scratches and other serious blemishes. Aluminum moldings shall be given a caustic etch followed by an anodic oxide treatment to obtain.

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- a. Anodized Finish Permanodic coating conforming to Aluminum Association Standard AA-M12 C22 A44, Dark Bronze.
  2. Concealed Steel Items: Galvanized in accord with ASTM A 386 to 2 ounces per square foot.
  3. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.
- I. Hardware
1. Weatherstripping, sweep strips, thresholds, hinges: Manufacturer's recommended standard type.
  2. Hinges: Full length piano, heavy duty.
  3. Push/Pulls: Designer style 1" offset tube each face, 12: long.
  4. Panic Device: Panic device per Section 08 71 00 to be provided by Aluminum Entrance Contractor per hardware schedule for aluminum entrance doors. Match existing styles.
  5. Closer: Heavy-Duty type.
  6. Cylinder Lock: 5 pin mortised
  7. Security strike as shown as security on hardware schedule; wiring by Electronic Systems Contractor.
  8. Prepare doors to meet requirements of electronic systems swipe card entry security systems.
  9. Push bottom door opener by Aluminum Door Contractor per Section 08 71 00 2.1 P
- J. Other Materials: All other materials, not specifically described but required for a complete and proper installation shall be new, first quality of their respective kinds and subject to approval of the Architect.

### **2.2 Acceptable Manufacturers:**

- A. Kawneer
- B. U. S. Aluminum
- C. EFCO
- D. CMI Architectural Products
- E. Tubelite

### **2.3 Fabrication**

- A. Fabricate aluminum doors and frames to allow for clearances and shim spacing around perimeter of assemblies to enable installation.
- B. Fabricate aluminum sills, head jamb, jamb closures at exposed precast, insulation as all doors and sash terminations, caps at extended sills, etc, as shown on Drawings.
- C. Provide anchorage devices to securely and rigidly fit door and frame assemblies in place.
- D. Accurately and rigidly fit together joints and corners. Match components ensuring continuity of line and design. Ensure joints and connections are flush, hairline and weatherproof.

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- E. Provide for moisture entering joints and condensation occurring within frame construction to drain to exterior.
- F. Make provision for hardware and provide required internal reinforcing.
- G. Shop prefabricate all doors and frames into complete units.
- H. Fabricate in strict accord with the approved Shop Drawings and the Manufacturer's published recommendations.
- I. Weld or mechanically fasten along entire line of contact on the unexposed side.
- J. No discoloration of the face after anodizing will be acceptable.

### **PART 3 EXECUTION**

#### **3.1 Surface Conditions**

- A. Inspection
  1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
  2. Verify that doors and frames may be installed in complete accord with the original design and the approved Shop Drawings.
  3. Assure that frame openings correspond to dimensions of frame furnished.
  4. Beginning of installation means acceptance of existing conditions.
- B. Discrepancies
  1. In the event of discrepancy, immediately notify the Architect.
  2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

#### **3.2 Preparation**

- A. Verify all measurements at the job site prior to fabrication.

#### **3.3 Installation**

- A. Install aluminum doors and frames in accord with Manufacturer's recommendations. Ensure assemblies are plumb, level and free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- B. Use sufficient anchorage devices to securely and rigidly fasten door and frame assemblies to the building.
- C. Install all members with adequate provision for settling, expanding and contracting to occur without breaking glass.
- D. Install hardware in accord with Manufacturer's recommendations, using proper templates. Adjust operating hardware.
- E. Install batt insulation in shim spaces around perimeter of door and frame assemblies,

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to maintain continuity of thermal barrier.

- F. Install interior and exterior perimeter sealant and related backing materials in accord with workmanship and installation requirements indicated in Section 07 92 13.

**3.4 Adjustment and Cleaning**

- A. Remove protective material from prefinished aluminum surfaces.
- B. Remove dirt from exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealants or glazing compounds from exposed surfaces by moderate use of mineral spirits or other solvent acceptable to sealant Manufacturer.
- D. Touch up marred or abraded surfaces to match original finish.
- E. Adjust moving parts for smooth operation.
- F. Remove debris from project site.

\* \* \* \* \*

## SECTION 08 71 00 HARDWARE

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	2.2 Acceptable Manufacturers
	1.2 Quality Assurance	3.1 Deliveries
	1.3 Submittals	3.2 Installation
	1.4 Product Delivery, Storage and Handling	3.3 Inspection of Installation
	2.1 Materials	3.4 Setup & Training

### PART 1 GENERAL

#### **1.1 Description**

- A. Work Included: The required hardware for doors is indicated on the Drawings in the form of a hardware schedule.
- B. Related Work Specified Elsewhere
  - 1. Rough Carpentry Section 06 10 00
  - 2. Architectural woodwork Section 06 40 00
  - 3. Installation on wood doors and frames Section 08 14 00

#### **1.2 Quality Assurance**

- A. Qualification of Supplier: The finish hardware supplier will employ a hardware consultant who will prepare all submittals and be available to the Owner for consultation should any problems arise during the course of the work; this consultation will be at no additional cost to the Owner. The hardware consultant shall check all installations and report to the Architect.
- B. Quality of Hardware: All hardware will meet applicable materials and finishes standards of the Builders' Hardware Manufacturer's Assn., ANSI A156, and Underwriters' Laboratory for all hardware in fire rated assemblies.
- C. Reference Standards
  - 1. American National Standards Institute (ANSI):
    - a. A115.4 - Door and Frame Preparation for Lever Lockset
    - b. A115.14 - Preparation for Standard Steel Doors for Open Back Strikes.
    - c. A156.8 - Door Controls (Overhead Holders).

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

- A. Samples
  - 1. Submit samples of each type of hardware required for job.
  - 2. Indicate required style and finish.
- B. Shop Drawings and Product Data

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1. Submit Shop Drawings and product data for each style of hardware.
  2. Indicate locations and mounting heights of each type of hardware.
  3. Supply templates to door and frame manufacturers to enable proper and accurate sizing and locations of cutouts for hardware.
- C. Material List: Before any finish hardware is ordered for this work, submit to the Architect, for approval, a complete list of all finish hardware proposed to be furnished, giving Manufacturer's name, catalog number with a picture of each item.
- D. Operation and Maintenance Data: Provide Architect with Manufacturer's parts list and maintenance instructions for each type of hardware supplied and necessary wrenches and tools required for proper maintenance of hardware.

### **1.4 Product Delivery, Storage and Handling**

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Packaging
1. Furnish all finish hardware with each unit clearly marked or numbered in accord with the Hardware Schedule.
  2. Pack each item complete with all necessary pieces and fasteners.
  3. Properly wrap and cushion each item to prevent scratches during delivery and storage.
- C. Delivery: Deliver all finish hardware to the installers in a timely manner to ensure orderly progress of the total work.
- D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

## **PART 2 PRODUCTS**

**2.1 Materials:** All Hardware Finish is to match existing hardware in each project area. Existing hardware is either US4 – Satin Brass or US10 Satin Bronze. Prior to submitting a bid, hardware contractor shall visit the site to verify color. Up to three colors may be required, one for each work area.

- A. General
1. Provide items as listed in this Section, complete to function as intended.
  2. Furnish all finish hardware with all necessary screws, bolts and other fasteners of suitable size and type to anchor the hardware in position securely.
  3. Furnish fastenings where necessary with expansion shields, toggle bolts, hex bolts and other anchors approved by the Architect, according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer.
  4. Design: All fastenings shall harmonize with the hardware as to material and finish.
  5. Fire label approved hardware to be used on all fire rated doors.

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- B. Hinges: 5 knuckle, button tip, full mortise, template type, butts with non-rising loose pins. See schedule for ball bearings. Finish 4-1/2 X 4-1/2.
- C. Closures: Closures shall be LCN 4040XP Series or equal from Norton. Size all closers in accord with the Manufacturer's recommendations and good standard practice. All surface mounted closures shall be the product of a single manufacturer. Hold opens and door stops where scheduled. Stanley Precision 2000 series is also acceptable.
- D. Door Holders: Surface mounted or integral with door closure where applicable.
- E. Push-pull: Designer style 1" offset tube - Rockwood #107X70B with Rockwood #70B push plate.
- F. Door stops:
  - 1. Wall mounted, rubber tipped, mount level with knob. 1" projection.
  - 2. Floor mounted: cast dome type, rubber cushion.
  - 3. Door mounted: Rubber tipped, 3-3/4" projection, mount where shown.
  - 4. Integral with closer where scheduled.
- H. Sound stop: Tear drop shape, Zero #188N or equal.
- I. Kick-plates: Stainless Steel
- J. Name Plates: ABS plastic with raised lettering. White letters; background color - selected from standard palette and symbols. ADA approved signs at toilet rooms. See drawings for details.
- K. Keying
  - 1. All cylinders shall be construction master keyed. No substitutions will be allowed.
  - 2. Master key all locks in accord with Owner's Master Key system.
  - 3. Perform all keying at the factory. Have construction Master Keys only delivered to the job site. Send all other keys, tagged and identified directly to the Owner by registered mail. Stamp all permanent keys and key blanks: "Do Not Duplicate".
  - 4. Deliver two keys for each type of lock plus two master keys.

### **2.2 Acceptable Manufacturers**

- |              |                              |
|--------------|------------------------------|
| A. Wall Stop | Ives, Corbin Russwin         |
| B. Hinges    | Hager, Ives                  |
| C. Locksets  | Best Access Systems, Schlage |

## **PART 3 EXECUTION**

- 3.1 Deliveries:** Stockpile all items sufficiently in advance to ensure their availability and make all necessary deliveries in a timely manner to ensure orderly progress of the total work.

**3.2 Installation**

- A. Install all hardware securely in place, test, oil, grease, adjust for perfect operation.
- B. Maintain following mounting heights for doors, from finished floor to center line of hardware item: Conform to applicable codes for accessibility requirements.
  - 1. Hinges
    - a. Top - 5 inches from head of frame to top of hinge.
    - b. Bottom - 10 inches from finished floor to bottom of hinge.
    - c. Intermediate - centered between top and bottom hinges.
    - d. On Dutch doors - 5 inches from head of frame to top of hinge; 10 inches from finished floor to bottom of bottom hinge. 5 inches from split line to top and bottom respectively of lower and upper intermediate hinges.
  - 2. Unit and integral type locks and latches - 38 inches to centerline of knob.
  - 3. Nameplates - 60 inches to centerline, on wall adjacent to latch side of door.

**3.3 Inspection of Installation:** Upon completion of the installation, and as a condition of its acceptance, deliver to the Architect a report signed by the hardware consultant stating that the consultant's inspection was made, that all adjustments recommended have been complete, and that all finish hardware furnished under this Section has been installed and is in optimum working condition.

**3.4 Setup and Training:** Upon completion of the installation of the electronic access hardware, install software and card encoder on site. Provide on site training and one-year of telephone support.

\* \* \* \* \*



## SECTION 08 80 00 GLAZING

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	2.2 Acceptable Manufacturers
	1.2 Quality Assurance	2.3 Fabrication
	1.3 Submittals	3.1 Surface Conditions
	1.4 Product Delivery, Storage and Handling	3.2 Preparation
	1.5 Job Conditions	3.3 Installation
	1.6 Warranty	3.4 Protection of Completed Work
2.1 Materials	3.5 Cleaning	

### PART 1 GENERAL

#### **1.1 Description**

- A. Work Included: Glass and glazing required for this Work includes tempered and regular plate glass; insulating glass; wire glass and safety glass; and bronze tint insulating glass; glass mirrors; glass doors; and glass sound seal.
- B. Related Work Specified Elsewhere
  - 1. Joint sealers Section 07 92 13
  - 2. Aluminum entrances and storefronts Section 08 41 13

#### **1.2 Quality Assurance**

- A. Qualifications of Manufacturers
- B. Qualifications of Installers: Provide at least one person who shall be thoroughly trained and experienced in the skills required, who shall be completely familiar with the referenced standards and the requirements of this Work, and who shall personally direct all installation performed under this Section of these specifications.
- C. Requirements of Regulatory Agencies: Install glass and glazing to meet requirements of State and Federal Building Codes.
- D. Source Quality Control
- E. Reference Standards
  - 1. American National Standards Institute (ANSI):
    - a. Z 97.1, Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings
  - 2. American Society for Testing and Materials (ASTM):
    - a. E 84, Surface Burning Characteristics of Building Materials.
  - 3. Federal Specifications (FS):
    - a. DD-G-451, Glass, Float or Plate, Sheet, Figured (Flat, for Glazing, Mirrors and Other Uses).
    - b. DD-G- 1403, Glass, Plate (Float), Sheet, Figured, and Spandrel (Heat Strengthened and Fully Tempered).

- c. TT-S-230, Sealing Compound: Synthetic Rubber Base, Single Component, Chemically Curing for Caulking, Sealing and Glazing in Building Construction.
- d. TT-S-1543, Sealing Compound: Silicone Rubber Base (for Caulking, Sealing and Glazing in Buildings and Other Structures).
- 4. Conform to Flat Glass Marketing Association (FGMA) Glazing Manual and Glazing Sealing Systems Manual for glazing installation methods.
- 5. Sealed Insulating Glass Manufacturers Association (SIGMA):
  - a. 64-7-2, Specification for Sealed Insulating Glass Units.

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:

- A. Shop Drawings: Sections and details of glass installation at framing members such as head, mullions, transoms, jambs and sills. Provide schedule of sizes, quantities, locations and mounting methods.
- B. Manufacturer's Literature
  - 1. Manufacturer's descriptive data of glass materials. Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
  - 2. Provide data on glazing sealant identifying available colors.

**1.4 Product Delivery, Storage and Handling**

- A. Protection
  - 1. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
  - 2. Keep glass free from contamination by materials capable of staining glass.
- B. Delivery of Materials
  - 1. Deliver glass with Manufacturer's labels intact. Do not remove labels until glass has been installed.
  - 2. Deliver glazing compounds and sealants in Manufacturer's unopened, labeled containers.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

**1.5 Job Conditions**

- A. Environmental Requirements
  - 1. Perform glazing when ambient temperature is above 40 degrees F.
  - 2. Perform glazing on dry surfaces only.

**1.6 Warranty**

- 1. The subcontract for the glass will not be approved by the Owner until the subcontractor has submitted to the Owner, for approval, the proposed warranty on the glass material to be supplied. This warranty should be supplied to the Owner on execution of the General Contract. This warranty should cover a period of 5 years.
- 2. Include coverage of sealed glass units from seal failure, interpane dusting or misting and replacement of same.

3. Mirror warranty to cover glass and coating against discoloration or manufacturing defects and against failure from mastic.

## **PART 2 PRODUCTS**

### **2.1 Materials**

#### **A. Glass**

1. Insulated Glass Units: Double pane units with edge seal; outer pane 1/4 inch **Bronze** tint, inner pane 1/4" clear, 1/2 inch interpane space purged with inert argon gas. Total unit thickness 1 inch. Low emensitivity #3 surface. Tempered pane each face where required by 1.2.C or if shown on Drawings or specified in addition to above code reference.  
Insulating glass to meet the following requirements:
  - a. Transmittance: average daylight – 44%; solar -35%; UV – 23%
  - b. External reflectance: average daylight – 8%; solar – 7%.
  - c. Winter U-Value – 0.30
  - d. Shading coefficient – 0.53
  - e. Relative heat gain - 111
2. Exterior and interior glass edge finished for silicone butt glazing.
  - a. Silicone Sealant: FS-S-1543, Type II, Class A, single component **neutral** cure medium modulus silicone for butt glazing, color as selected by Owner.
  - b. Urethane Sealant: FS S-230-6, Type II, Class A, single component polymer for general glazing, color as selected by Owner.

#### **B. Glazing Accessories**

1. Setting Blocks: Neoprene; 70-90 Shore A durometer hardness; 4 inches long by 3/8 inch wide by 1/4 inch high, chemically compatible with sealant used.
2. Spacer Shims: Neoprene; 50 Shore A durometer hardness; 3 inches long by 1/4 inch wide by 1/4 inch thick; self adhesive one face, chemically compatible with sealant used.
3. Glazing Tape: Preformed butyl compound; 10-15 Shore A durometer hardness; coiled on release paper; Size and spacers where recommended by manufacturer; black color.
4. Glazing Splines: Resilient polyvinylchloride extruded shape to suit glazing channel retaining slot; color as selected.
5. Glazing Clips: Manufacturer's standard type.
6. Filler Rod: Compressible synthetic rubber of foam, chemically compatible with sealant use.
7. Primer-Sealers and Cleaners: As recommended by glass Manufacturer.

### **2.2 Acceptable Manufacturers**

#### **A. Glass: SIGMA Member**

#### **B. Glazing Compound: Tremco**

1. Butt glazing: Silicone sealant: Spectrum 2
2. Standard glazing: Dymonic

#### **C. Substitutions: Under provisions of Section 01 60 00.**

### **2.3 Fabrication**

- A. Glass: All glass shall bear labels showing strength, thickness, type and quality and shall be relatively distortion free with all distortion waves in the horizontal direction and shall be in the following qualities.
- B. Interior Glazing: Door lites all tempered; 1/4 inch clear, tint, or frosted per door schedule: fixed lites 1/4 inch clear or tint plate tempered below eye level; 3/8 inch and 1/4 inch clear or tint plate, edges for butt glazing.
  - 1. Tinting Schedule
    - a. Provide Clear Glass Interior
- D. Tempered Glass: Where tempered insulating glass is required by code, both lites will be tempered.

## **PART 3 EXECUTION**

### **3.1 Surface Conditions**

- A. Inspection
  - 1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
  - 2. Verify that all glazing may be performed in accord with all pertinent codes and regulations, the original design and the reference standards.
  - 3. Check that glazing channels are free of burrs, irregularities and debris.
  - 4. Check that glass is free of edge damage or face imperfections.
  - 5. Do not proceed with installation until conditions are satisfactory.
  - 6. Beginning of installation means acceptance of substrate.
- B. Discrepancies
  - 1. In the event of discrepancy, immediately notify the Owner.
  - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### **3.2 Preparation**

- A. Field Measurements
  - 1. Measure size of frames to receive glass.
  - 2. Compute actual glass size, allowing for edge clearances.
- B. Preparation of Surfaces
  - 1. Remove protective coatings from surfaces to be glazed.
  - 2. Clean glass and glazing surfaces, to remove dust, oil and contaminants and wipe dry.
  - 3. Seal porous glazing channels or recesses.
  - 4. Prime surfaces scheduled to receive sealant.

**3.3 Installation - Application - Erection**

A. General

1. Positioning Glass
  - a. Orient pattern and draw of glass pieces in same direction.
  - b. Place glass waves parallel to floor.
  - c. Set smooth side to exterior.
2. Do not cut, seam, nip or abrade tempered, heat strengthened, coated or insulating glass.
3. Slope exterior surfaces of gaskets, tapes and sealant beads to provide for water runoff.
4. All glazing materials must be compatible.
5. Provide weep holes to remove all water from the glazing assembly.

C. Interior Dry Method (Tape and Tape)

1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sightline.
2. Place setting blocks at 1/4 1/3 points.
3. Rest glass on setting blocks and push against tape for full contact at perimeter of pane.
4. Place glazing tape on free perimeter of pane in same manner described above.
5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
6. Knife trim protruding tape.

**3.4 Protection of Completed Work**

- A. Attach crossed streamers away from glass face.
- B. Do not apply markers to glass surface.
- C. Replace damaged glass.

**3.5 Cleaning**

- A. Remove excess glazing compound from installed glass and frames.
- B. Remove labels from glass surface as soon as installed.
- C. Wash and polish both faces of glass.
- D. Remove debris from worksite.

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## SECTION 09 29 00 GYPSUM WALLBOARD

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	1.5 Job Conditions
	1.2 Quality Assurance	2.1 Materials
	1.3 Submittals	3.1 Surface Conditions
	1.4 Product Delivery, Storage and Handling	3.2 Installation
		3.3 Application
		3.4 Adjust and Clean

### PART 1 GENERAL

#### **1.1 Description**

- A. Work Included: Gypsum wallboard is required on interior wall and ceiling surfaces where so indicated on the Drawings.
  - 1. Metal Framing required for gypsum board.
  - 2. Gypsum board.
  - 3. Taped and sanded joint treatment.
  
- B. Related Work Specified Elsewhere
  - 1. Painting Section 09 91 00

#### **1.2 Quality Assurance**

- A. Qualifications of Installers
  - 1. Use only skilled and experienced gypsum wallboard installers for laying up the wall board, fastening, taping and finishing.
  - 2. In the acceptance or rejection of installed gypsum wallboard, no allowance will be made for lack of skill on the part of installers.
  
- B. Requirements of Regulatory Agencies
  - 1. Underwriters' Laboratories, Inc.
    - a. Fire Hazard Classification (40 U8.22).
    - b. Fire Resistance Classification (40 U18).
  
- C. Testing: Fire resistance: ASTM E 119.
  
- D. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. C 36, Gypsum Wallboard
    - b. C 475, Joint Treatment for Gypsum Wallboard Construction.
    - c. C 754, Specification for Installation of Steel Framing Members to Receive Screw-attached Gypsum Wallboard, Backing Board or Water-resistant Backing Board.
    - d. E 119, Standard Methods of Fire Tests of Building Construction and Materials.
  - 2. Underwriters' Laboratories, Inc. (UL)
    - a. UL U8-22, Wallboard, Gypsum
    - b. UL 40 U18, Fire Resistance Classification.
  
  - 3. Gypsum Association (GA)

- a. GA-214-M-97 - recommended levels of Gypsum Board Finish.

**1.3 Submittals:** Within 15 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

- A. Manufacturer's Recommendations
  - 1. Submit two copies of the Manufacturer's current recommended method of installation for each item.
  - 2. The Manufacturer's recommended methods of installation, when approved by the Architect, shall be the basis for acceptance or rejection of actual installation methods used in this Work.

#### **1.4 Product Delivery, Storage and Handling**

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery and Handling
  - 1. Deliver materials to the project site with Manufacturer's labels intact and legible.
  - 2. Handle materials with care to prevent damage.
  - 3. Deliver fire-rated materials bearing testing agency label and required fire classification numbers.
- C. Storage
  - 1. Store materials inside under cover, stack flat, off floor.
  - 2. Stack wallboard so that long lengths are not over short lengths.
  - 3. Avoid overloading floor system.
  - 4. Store adhesives in dry area, provide protection against freezing at all times.
- D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

#### **1.5 Job Conditions**

- A. Environmental Conditions: Ventilation: Provide ventilation during and following adhesives and joint treatment applications.
- B. Protection: Protect adjacent surfaces against damage and stains.

### **PART 2 PRODUCTS**

#### **2.1 Materials**

- A. Gypsum Wallboard: Provide gypsum wallboard materials in accord with recommendations of GA 216. Fire Partitions constructed per approved UL Design Number.
  - 1. Fire-rated board
    - a. ASTM C 36, Type X
    - b. Thickness: 5/8 inch.



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2. Sag resistant board at ceilings
    - a. ASTM C 1395/ C 1396
    - b. Thickness: ½ inch
  3. Moisture resistant board at toilet rooms.
  4. Cement board backer at ceramic wall tile.
  5. Vapor barrier – 6 mil at all exterior walls
- B. Fasteners
1. Screws
    - a. Self-drilling, self-tapping, bugle head, for use with power driven tools.
      - (1) Type S for wallboard to sheet metal application.
      - (2) Type G for wallboard to wallboard application.
    - b. Length
      - (1) Single layer or base layer application.
        - (a) Type W: 1-1/4"
      - (2) Face layer of two layer application
        - (a) Type W: 1-5/8"
      - (3) Wallboard to wallboard in multiple application: Type G, 1-1/2".
- C. Joint Treatment Materials
1. General: All joint system including tape and compounds, shall be a system recommended by the manufacturer of the gypsum panels used as compatible with the gypsum panels.
  2. Joint Tape: ASTM C 475: Perforated tape.
  3. Joint compound: Ready-mixed joint compounds.
- D. Metal Cornerbead and Trim: All metal cornerbead and trim and all accessory items, shall be a system recommended by the Manufacturer of the gypsum panels used as being compatible with the gypsum panels.
- E. Water: All water used in joint system shall be clean, fresh and free from deleterious amounts of foreign material.
- F. Non-Loadbearing Prefabricated Steel Screw Studs
1. Cold formed galvanized steel.
  2. Thickness: 25 gauge.
  3. Shape: Roll formed channel with punched openings along solid web and knurled flanges.
  4. Furnish floor and ceiling tracks of acceptable stud manufacturer's regular type for stud specified.
  5. Size: 3-5/8 inches.
- G. Sound Seal: Manufacturer's standard, caulk type sound seal at floor and roof deck.
- H. Metal Accessories
1. General:
    - a. Shapes used as grounds: Sized and dimensioned to provide for required plaster thicknesses.
    - b. Flanges:
      - (1) Designed to permit complete embedment of accessory in plaster.
      - (2) Provide for alignment and attachment to underlying surface.

2. Corner Beads:
  - a. Fabrication: Minimum 26 gauge galvanized steel.
  - b. Flexible type, perforated flanges.
3. Casing beads:
  - a. Fabrication: Minimum 24 gauge galvanized steel.
  - b. Style: Square end
4. Expansion Joints:
  - a. Fabrication: minimum 26 gauge galvanized steel
  - b. Provide with double stops.
  - c. Flanges: expanded
  - d. Provide adjustable opening with solid type flanges.
  - e. No plastic accessories allowed.

Other Materials: All other materials, not specifically described but required for a complete and proper installation of gypsum drywall, shall be as selected by the Contractor subject to approval of the Architect.

## **PART 3 EXECUTION**

### **3.1 Surface Conditions**

- A. Inspection
  1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
  2. Verify that gypsum wallboard may be installed in accord with the original design, all pertinent codes and regulations, and the Manufacturer's recommendations as approved by the Architect.
  3. Check framing for accurate spacing and alignment.
  4. Verify that spacing of installed framing does not exceed maximum allowable for thickness of wallboard to be used.
  5. Verify that frames are set for thickness of wallboard to be used.
  6. Do not proceed with installation of wallboard until deficiencies are corrected and surfaces to receive wallboard are acceptable.
  7. Protrusions of framing, twisted framing members or unaligned members must be repaired before installation of wallboard is started.

### **3.2 Installation**

- A. Furring and Lathing
  1. Erection of Non-loadbearing Screw Studs - Hollow Partitions:
    - a. Floor and ceiling Tracks
      - (1) Align floor and ceiling tracks.
      - (2) Attach to concrete with power-driven fasteners.
      - (3) Wire-tie to structural framing.
      - (4) Attach tracks to structure at maximum of 24 inches on center.
    - b. Screw Studs:
      - (1) Plumb and align studs.
      - (2) Space studs 16 inches on center.
      - (3) Attach studs to floor and ceiling track by screwing

- (4) If necessary, splice studs by nesting with minimum lap of 8 inches.
- c. Horizontal Stiffeners:
  - (1) Brace studs with steel channel stiffeners place horizontally on inside of partition.
  - (2) Spacing: Maximum 4'-6" o.c. quarter points vertically.
  - (3) Secure as recommended by stud Manufacturer.
- d. Framing Around Door Openings:
  - (1) Hollow metal door frames:
    - (a) Install stud at each jamb of hollow metal door frames continuous for full height of partition.
    - (b) Screw stud to jamb anchors of frame.
    - (c) Tack weld a second stud to stud at door jamb, nested to form box.
  - (2) Attach section of floor track horizontally to head of frame.
    - (a) Install jack studs at 16 inches on center over head of door frame.
    - (b) Attach jack studs to floor track and anchor top in same manner as provided for full studs.
- e. Form corners and intersections of partitions with three studs.
- f. Place studs forming internal corners 2 inches from point of partition intersection.
- g. Provide headers above and below framed wall openings having area of 2 square feet or more.

B. Follow U.L. Specifications for Fire Rated Assemblies.

### **3.3 Application**

#### **A. General**

- 1. Use wallboard of maximum lengths to minimize end joints.
- 2. Stagger end joints when they occur.
- 3. Framing and wallboard will fit tight to stems and flanges of existing precast concrete roof deck for two hour rated construction.
- 4. Support ends and edges of wallboard panels on framing members.
- 5. Perform gypsum wallboard work in accord with recommendations of ASTM C 754 and GA 216 unless otherwise specified in this Section.

#### **B. Joint System**

- 1. Taping and finished joints
  - a. Taping or embedding joints
    - (1) Apply compound in thin uniform layer to all joints and angles to be reinforced.
    - (2) Apply reinforcing tape immediately.
    - (3) Center tape over joint and seat tape into compound.
    - (4) Leave approximately 1/64 to 1/32 inch compound under tape to provide bond.
    - (5) Apply skim coat immediately following tape embedment but not to function as fill or second coat.
    - (6) Dry embedding coat prior to application of fill coat.
  - b. Filling
    - (1) Apply joint compound over embedding coat.
    - (2) Fill taper flush with surface.
    - (3) Apply fill coat to cover tape.
    - (4) Feather out fill coat beyond tape and previous joint compound line.
    - (5) Joints with no taper: Feather out at least 4 inches on eight side of tape.
    - (6) Allow fill coat to dry prior to application of finish coat.
  - c. Finishing

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- (1) Spread joint compound evenly over and beyond fill coat on all joints.
- (2) Feather to smooth uniform finish.
- (3) Apply finish coat to taped angles to cover tape and taping compound to provide surface ready for decoration.
2. Filling and finishing depressions
  - a. Apply joint compound as first coat to fastener depressions.
  - b. Apply at least two additional coats of compound after first coat is dry.
  - c. Leave filled and finished depressions level with plane of surface.
3. Finishing beads and trim
  - a. First fill coat
    - (1) Apply joint compound to bead and trim.
    - (2) Feather out from ground to plane of the surface.
    - (3) Dry compound prior to application of second fill coat.
  - b. Second fill coat
    - (1) Apply joint compound in same manner as first fill coat.
    - (2) Extend beyond first coat onto face of wallboard.
    - (3) Dry compound prior to application of finish coat.
  - c. Finish coat
    - (1) Apply joint compound to bead and trim.
    - (2) Extend beyond second fill coat.
    - (3) Feather finish coat from ground to plane of surface.
    - (4) Sand finish coat to provide flat surface ready for decoration.
4. Finish to be minimum levels according to the "recommended levels of gypsum board finish #GA-214-M-97.

**3.4 Adjust and Clean**

- A. Nail Pop
  1. When face paper is punctured drive new nail or screw approximately 1-1/2 inches from defective fastening and remove defective fastening.
  2. Fill damaged surface with compound.
- B. Fill cracks with compound and finish smooth and flush.
- C. Cleaning Up: Do not allow the accumulation of scraps and debris arising from the work of this Section but maintain the premises in a neat and orderly condition at all times; in the event of spilling or splashing compound onto other surfaces, immediately remove the spilled or splashed material and all trace of the residue to the approval of the Architect.

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**SECTION 09 31 00 CERAMIC TILE**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	2.1 Materials
	1.2 Quality Assurance	2.2 Acceptable Manufacturers
	1.3 Submittals	3.1 Surface Conditions
	1.4 Product Delivery, Storage and Handling	3.2 Installation
	1.5 Job Conditions	3.3 Cleaning

**PART 1 GENERAL**

**1.1 Description**

- A. Work Included: Ceramic tile required for this Work is indicated on the Drawings and includes walls, floors and base.
  
- B. Related Work Specified Elsewhere
  - 1. Gypsum Wallboard Section 09 29 00
  - 2. Toilet and Bath Accessories Section 10 28 13
  - 3. Plumbing Systems Division 22
  
- C. Work Installed but Furnished by Others
  - 1. Toilet and Bath Accessories Section 10 28 13
  - 2. Painting Section 09 91 00

**1.2 Quality Assurance**

- A. Qualifications of Installers
  - 1. For cutting, installing and grouting of ceramic tile, use only thoroughly trained and experienced journeyman tile setters who are completely familiar with the requirements of this Work and the recommendations contained in the referenced Standards.
  - 2. In acceptance or rejection of installed ceramic tile, no allowance will be made for lack of skill on the part of tile setters.
  
- B. Reference Standards
  - 1. American National Standards Institute (ANSI):
    - a. A 108.1 Installation of Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile and Paver Tile with Portland Cement Mortar.
    - b. A 108.5 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar on Latex-Portland Cement Mortar.
    - c. A 118.1, Dry-Set Portland Cement Mortar.
    - d. A 136.1, Organic Adhesives for Installation of Ceramic Tile.
  - 2. American Society for Testing and Materials (ASTM):
    - a. A 185, Welded Steel Wire Fabric for Concrete.
    - b. C 144, Aggregate for Masonry Mortar.
    - c. C 150, Portland Cement.
  - 3. Tile Council of America, Inc. (TCA)
    - a. 137, Recommended Specification for Ceramic Tile.
  - 4. Set all tile in accord with the "Handbook for Ceramic Tile Installation" of the Tile

Council of American, Inc.

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

- A. Samples
  - 1. Glazed wall tile: Panel for each color and type.
  - 2. Paver Tile: Two tiles per sample for each color and type.
  - 3. Accessories: Each color, type and style.
  - 4. Edging Strips:
    - a. Length: 12 inches.
    - b. Show type and finish.
  - 5. Grout color chips.
- B. Manufacturer's Instructions: Furnish manufacturer's instructions for use of mortars, adhesives and grouts.
- C. Extra Stock: Provide 1/4 cartons of each tile.

#### **1.4 Product Delivery, Storage and Handling**

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery and Storage of Materials
  - 1. Deliver materials in manufacturer's original sealed containers.
    - a. Labels legible and intact identifying brand name and contents.
    - b. Tile cartons grade-sealed by manufacturer in accord with TCA 137.
    - c. Grade-seals unbroken.
    - d. Manufactured mortars and grouts to contain hallmarks certifying compliance with referenced standards and be types recommended by tile Manufacturer for application.
    - e. Adhesives in containers labeled with hallmarks certifying compliance with reference standards.
  - 2. Deliver dry-set mortar in sealed, moisture-proof containers.
  - 3. Store materials under cover in manner to prevent damage or contamination.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

#### **1.5 Job Conditions**

- A. Environmental Requirements: Set and grout tile when ambient temperature is at least 50 degrees F. and rising.

### **PART 2 PRODUCTS**

#### **2.1 Materials**

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### A. Tile

1. Conforming to TCA 137.1.
  - a. Grade: Standard
2. Paver Tile: (CFT-1) Ceramic Floor Tile
  - a. Manufacturer: Daltile or Approved Equal
  - b. Product: Volume 1.0 Glazed Porcelain with Stepwise Technology
  - c. Size: 12" x 12" Floor Tile
  - d. Color: Architect selection from full color range.
  - e. Thickness: 5/16"
3. Wall Tile: (CWT-1) Ceramic Wall Tile
  - a. Manufacturer: Daltile or Approved Equal
  - b. Product: Volume 1.0 Glazed Porcelain
  - c. Size: 12" x 24" Wall Tile
  - d. Color: Architect selection from full color range.
  - e. Thickness: 5/16"
  - f. Finish: Matte Smooth

### B. Setting Materials

1. Portland Cement Mortar:
  - a. Portland cement: ASTM C 150, Type I.
  - b. Sand ASTM C 144.
  - c. Water: Clean and potable.
  - d. Mortar bed reinforcement.
    - (1) Welded wire fabric:
      - (a) Conforming to ASTM A 185.
      - (b) Size: 2" x 2" mesh - 16/16 wire
2. Dry-set Mortar: Conforming to ANSI A 118.1.

### C. Grouting Materials

1. Commercial portland cement grout:
  - a. As manufactured by
  - b. Color: As selected
2. Sand-portland cement grout:
  - a. Portland cement: ASTM C 150, Type 1.
  - b. Sand: ASTM C 144.
  - c. Hydrated lime: ASTM C 206, or ASTM C 207, Type S.
  - d. Water: Clean and potable.
  - e. Mixes:
    - (1) For pavers: mix 1 part portland cement to 2 parts fine graded sand, and up to 1/5 part hydrated lime by volume. Color as selected.
3. Dry-Set Grout:
  - a. Dry-set grout as manufactured for ceramic wall tile.
  - b. Color: White
  - c. Porcelain tile: Follow tile manufacturer's recommendations for grout and mixing.
4. Latex-portland cement grout: Special latex emulsions with dry-set grout, replacing all or part of water according to directions.

### D. Accessories

1. Metal termination bars and control joints - Required at all terminations
  - a. Blanke or Schluter

## **2.2 Acceptable Manufacturers**

- A. Tile Work:
  - 1. American-Olean
  - 2. U. S. Ceramic
  - 3. Dal-Tile
  - 4. Crossville

## **PART 3 EXECUTION**

### **3.1 Surface Conditions**

- A. Inspection
  - 1. Examine surfaces to receive ceramic tile, setting, beds, or accessories before tile installation begins for:
    - a. Defects or conditions adversely affecting quality and execution of tile installation.
  - 2. Do not proceed with installation work until unsatisfactory conditions are corrected.
- B. Condition of Surfaces to Receive Tile
  - 1. Surfaces to be firm, dry, clean and free of oily or waxy films.
  - 2. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile to be installed prior to proceeding the tile work.
- C. Discrepancies
  - 1. In the event of discrepancy, immediately notify the Architect.
  - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### **3.2 Installation**

- A. Ceramic Tile
  - 1. Conventional portland cement mortar: ANSI A 108.1.
  - 2. Dry-set portland cement mortar: ANSI A 108.5.
  - 3. Methods:
    - a. Floor Tile and Pavers: Install tile in accord with TCA Method. F-113-03
    - b. Wall and Base Tile: Install tile in accord with TCA Method W-244-03 over plaster base or cement board per details.
- B. Install Edge Strips
  - 1. At openings without thresholds and similar discontinuous edges of thin-set tile floors.
  - 2. Where ceramic tile floors are adjacent to other flooring material at the same level.
  - 3. Where ceramic tile cove base is combined with other types of flooring.
- C. Color Patterns
  - 1. See drawings for wall and floor accent stripes and patterns.

- 3.3 Cleaning Up:** Upon completion of all ceramic tile installation and grouting, thoroughly clean and polish the exposed surfaces of all ceramic tile.



## SECTION 09 51 00 ACOUSTICAL CEILINGS

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	2.1 Materials
	1.2 Quality Assurance	2.2 Acceptable Manufacturers
	1.3 Submittals	3.1 Surface Conditions
	1.4 Product Delivery, Storage and Handling	3.2 Preparation
	1.5 Job Conditions	3.3 Installation
		3.4 Adjustments and Cleaning

### PART 1 GENERAL

#### **1.1 Description**

- A. Work Included: The suspended acoustical ceiling systems required for this work are indicated on the Drawings and consist of suspended exposed metal grid (existing) with new acoustical board panels.
- B. Related Work Specified Elsewhere
  - 1. Gypsum Wallboard Section 09 29 00
  - 2. Existing Fire Alarm System
  - 3. Electrical Fixtures
  - 4. Light fixtures and HVAC Utilities
- C. Work Furnished but Not Installed: Furnish hanger inserts in time to be installed in precast decking.

#### **1.2 Quality Assurance**

- A. Qualification of Installers
  - 1. The suspended ceiling subcontractor shall have a record of successful installations of similar ceilings acceptable to the Architect and shall be currently approved by the Manufacturer of the ceiling suspension system.
  - 2. For the actual fabrication and installation of all components of the system, use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work.

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

- A. Samples
  - 1. Submit one full size samples of each type of acoustical material to illustrate color and range of appearance.
  - 2. Submit one full size sample of each suspension system member, moldings and hangers.
- B. Manufacturer's Recommendations: Submit for review of Architect the Manufacturer's recommendation for installation of suspension system.

C. Maintenance Materials

1. Furnish extra materials equal to 2 percent of each type of acoustical material supplied.
2. Furnish suspension system components in amount sufficient to install extra ceiling units.
3. Securely wrap and identify all extra materials.

**1.4 Product Delivery, Storage and Handling**

- A. Delivery of Materials: Deliver materials in original, unopened, protective packaging, with Manufacturer's labels indicating brand name, pattern, size, thickness and fire rating as applicable, legible and intact.
- B. Store materials in original protective packaging to prevent soiling, warpage, physical damage or wetting.
- C. Do not begin installation until sufficient materials to complete a room are received.
- D. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

**1.5 Job Conditions**

A. Environmental Requirements

1. Installation of acoustical treatment shall not begin until all wet work, such as plastering, concrete and terrazzo work, is completely dry.
2. Maintain relative humidity of not more than 70 percent in area where acoustical materials are to be installed, 25 hours before, during and 25 hours after installation.
3. Maintain a uniform temperature in the space of 60 to 85 degrees F. prior to and during installation of materials.

**PART 2 PRODUCTS**

**2.1 Materials**

A. Suspension Materials

1. Suspension Systems:
  - a. Suspension Systems:
    - (1) ASTM C 635.
    - (2) Structural classification: 1-1/2" Intermediate duty systems for 3/4" panels.
    - (3) All components of system from one Manufacturer.
  - b. Main, cross and concealed members:
    - (1) Web design: Double
    - (2) Cold-rolled steel, minimum thickness of 0.020 inch, electrozinc coated and factory painted low sheen satin white finish.
  - c. Edge molding, minimum 0.020 inch steel channel or angle shaped, with minimum flange width of 15/16 inch.
  - d. Rough Suspension:
    - (1) Hanger wire: Minimum 12 gage, galvanized, soft-annealed, mild steel wire.
    - (2) Wire ties: 18 gage, galvanized annealed steel wire.

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2. Adhesive: ASTM D 1779.
  3. Caulking: Non-staining type, .
- B. Acoustical Unit Materials
1. FS SS-S-118.
  2. Acoustic Tiles (Acoustical Tile ACT-1 on Room Finish Schedule in Drawings): USG Acoustone, fire resistant glacier shadowline edge; 24" x 24" x 3/4". Conforming to the following:
    - a. Size: 24 inches by 24 inches. Foil backed.
    - b. Thickness: 3/4 inches.
    - c. Composition: Mineral fiber
    - d. Density: .67 pounds per cubic foot.
    - e. Light Reflectance: ASTM C 523, LR-1 (0.75 or more).
    - f. NRC Range: ASTM C 423 0.75 to 0.85.
    - g. STC Range: AMA 1-11, 25-29.
    - h. Edge: Shadowline (Reveal)
    - i. Surface Color: White, factory applied.
  3. Acoustical Unit Materials (Acoustical Tile ACT-2 on Room Finish Schedule in Drawings)  
Acoustic Tiles: ClimaPlus - Vinyl: Conforming to the following:
    - a. Size: 24 inches by 24 inches. Paper backed.
    - b. Thickness: 1/2 inches.
    - c. Composition: Sheet Rock
    - d. Light Reflectance: ASTM C 523, LR-1 (0.77 or more).
    - e. Edge: Square
    - f. Surface Color: White, factory applied

### **2.2 Acceptable Manufacturers**

- A. Suspension Systems
1. Armstrong
  2. Chicago Metallic Corporation
  3. Donn Corporation
- B. Acoustical Units
1. Armstrong
  2. Celotex
  3. United States Gypsum

## **PART 3 EXECUTION**

### **3.1 Surface Conditions**

- A. Inspection
1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that suspended ceiling systems may be installed in strict accord with all pertinent codes and regulations, the approved Shop Drawings and the Manufacturer's recommendations. Verify that layout of hangers will not interfere with other work.

2. Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities and dampness that would affect quality and execution of Work.
3. Mark access provisions as to size and location before beginning installation
4. Areas to which acoustical units will be cemented. Must be free of oils from residue or materials that will affect bond capabilities of adhesive.
5. Discrepancies: In the event of discrepancy, immediately notify the Architect. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.
6. Beginning of installation means acceptance of existing conditions.

**3.2 Installation**

A. General

1. Installation of products in this Section shall occur after all components in the ceiling plenum are installed. The building shall be in proper condition to receive the acoustical materials and suspension system before any of the material shall be installed. The acoustical materials shall be installed under conditions of normal occupancy. All wet work shall be completely dry, and the building fully enclosed.

B. Suspension Systems: ASTM C 636.

D. Acoustical Units

1. Install in level plane in straight line courses, free from twist, warp and dents.
2. Cut out tile face at walls attached to grid for flat tile insertion.
3. Place materials to bear all around on suspension members.
4. Minimum width of border tiles: One-half unit dimension.
5. Sound barrier: Install fiberflax pads with foil face up.

**3.4 Adjustments and Cleaning**

A. Clean soiled or discolored unit surfaces after installation.

B. Touch up scratches, abrasions, voids and other defects in painted surfaces. At the Owner's discretion, remove and replace any repaired units that still do not have a like new appearance.

C. Remove and replace damaged or improperly installed units.

\* \* \* \* \*

## SECTION 09 91 00 PAINTING

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

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	1.5 Job Conditions	3.4 Reinstallation of Removed Items
	2.1 Materials	3.5 Cleaning Items
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### PART 1 GENERAL

#### 1.1 Description

##### A. Work Included

1. The Painting Contractor shall furnish all material, labor and equipment required to complete all painting and finishing as shown on the Drawings, Plans and Specifications.
2. The Painting Contractor shall examine the Specifications for the various other trades and shall thoroughly become familiar with all provisions regarding painting. All surfaces that are left unfinished by the requirements of other Specifications shall be painted or finished as a part of this Work.
3. In general, paint all wood, metal surfaces, doors, frames, masonry; omit acoustic tile and aluminum.
4. Following Specifications cover complete painting, finishing of wood and other surfaces throughout interior and exterior of building, unless otherwise noted.
5. The types of paint to be used and the number of coats to be applied are listed in the Painting Schedule in Part 3.7 of this Section of these Specifications.
6. Furnish tools, ladders, scaffolding, other equipment necessary for work completion.

##### B. Related Work Specified Elsewhere

1. Prefinishing: Shop priming and factory prefinishing are required on some, but not all of the items described in other Sections of these Specifications.
2. Structural Steel, Miscellaneous Metals and Metal Doors and Frames; one shop coat and touching up in field.
3. Cabinetwork Section 06 40 00
4. Sealants and Caulking Section 07 92 13
5. Metal Doors and Frames Section 08 11 00
6. Gypsum Board System Section 09 29 00

##### C. Definitions

1. The term "Paint", as used herein, includes enamels, paints, sealers, fillers, emulsions, and other coatings, whether used as prime, intermediate or finish coats.
2. "Coats" described later are based on roller, brush or spray application. Above does not refer to processes that require spraying only for their application or where

- specifically specified to be sprayed.
3. Conform to ASTM D16 for interpretation of terms used in this Section.

## **1.2 Quality Assurance**

- A. Qualifications of Painters
  1. Maintain a crew of painters throughout the duration of the work who shall be qualified to fully satisfy the requirements of this Specification.
  2. Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Apprentices may be employed to work under the direction of qualified journeymen, in accord with trade regulations. In the acceptance or rejection of installed painting, no allowance will be made for lack of skill on the part of painters.
- B. Requirements of Regulatory Agencies
  1. Occupational Safety and Health and pollution Regulations: Conform to the Federal and State requirements for painting work applicable to this Project.
  2. Permits: Obtain and pay for any special permits required by local governmental agencies.
- C. Reference Standards
  1. American Society for Testing and Materials (ASTM):
    - a. D 16, Definitions of Terms Relating to Painting, Varnish, Lacquer and Related Products.
  2. In addition to complying with all pertinent codes and regulations, comply with "Standard (Type 1)" as defined by the Painting and Decorating Contractors of America in their "Modern Guide to Paint Specifications", current Edition.

## **1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:

- A. Samples: Accompanying the materials list, submit to the Owner two copies of the full range of colors, textures and finishes available in each of the proposed products.
- B. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these Specifications, submit for the Owner's review the current Manufacturer of the proposed material.
- C. Material List
  1. A complete list of all materials proposed to be furnished and installed under this portion of the Work.
  2. This shall in no way be construed as permitting substitution of materials for those specified or approved for this Work by the Owner.
- D. Color Charts: Include color charts for selection by Owner.
- E. Extra Stock: Upon completion of this portion of the Work, deliver to the Owner an extra stock of paint equaling approximately 10% of each color used in each coating material used, with all such extra stock tightly sealed in clearly labeled containers. Extra stock to be from batch mix furnished for Work.

#### **1.4 Product Delivery, Storage and Handling**

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery of Materials: Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at time of use.
- C. Storage of Materials
  1. Store only the approved materials at the job site, and store only in suitable and designated area restricted to the storage of paint materials and related equipment.
  2. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.
  3. Store paint materials at minimum ambient temperature of 45 degrees F. and a maximum of 90 degrees F., in well ventilated area, unless required otherwise by Manufacturer's instructions.
- D. Handling Materials and Equipment
  1. Take precautionary measures to prevent fire hazards and spontaneous combustion.
  2. All soiled or used rags, waste and trash must be removed from the building each night and every precaution taken to avoid the danger of fire.
  3. Toxic Materials:
    - a. Where toxic materials, including both toxic and explosive solvents are used, take appropriate precautions as a regular procedure, conforming to the Manufacturer's recommendations and to the requirements of the applicable safety regulatory agencies.
    - b. In applying acid etch coating or solutions and toxic materials, provide ventilation and take protective measures to conform to the requirements of regulatory agencies.
- E. Replacements: The painting trade is responsible for making repairs of their own Work when due to defective workmanship or materials. Repair of damaged paint finish caused by other trades will be done by this Contractor but paid for by the contractor causing such damage. See Section 01 70 00.

#### **1.5 Job Conditions**

- A. Environmental Requirements
  1. Comply with Manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
  2. Do not apply finish in areas where dust is being generated.
  3. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F. for 24 hours before, during and for 48 hours after application of finishes, unless required otherwise by Manufacturer's instructions.
  4. Do not apply exterior coatings during rain or snow or when relative humidity is

- above 50 percent, unless required otherwise by Manufacturer's instructions.
5. Minimum Application Temperatures for Latex Paints: 45 degrees F. for interiors; 50 degrees F. for exteriors; unless required otherwise by Manufacturer's instructions.
  6. Minimum Application Temperature for Varnish Finishes: 65 degrees F. for interior, unless required otherwise by Manufacturer's instructions.
  7. Provide lighting level of 80-foot candles measured mid-height at substrate surface.
  8. Do not do exterior work on unprotected surfaces if it is raining or moisture from any other source is present or expected before applied materials can dry or attain proper cure.
  9. Allow surfaces wetted by rain or other moisture source to dry and to attain temperatures and conditions specified before proceeding or continuing with coating application.

**B. Protection**

1. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.
2. The Painting Contractor shall protect surfaces and objects inside and outside the building, as well as the grounds, lawns, shrubbery and adjacent properties against damage. The Painting Contractor shall be held responsible for damage to adjacent furnishings.
3. Drop Cloths: Provide sufficient drop cloths, shields and protective equipment to prevent spray or drippings from fouling surfaces not being painted including surfaces within the paint storage and preparation areas.
4. Exposed Concrete Floors: Floor slabs that will not be covered by other finishes will be protected against staining or damage by the work of the Painting Contractor. Repair of such damage may include replacement of the slab if so determined by the Architect or Owner.

**PART 2 PRODUCTS**

**2.1 Materials**

- A. Select primary products of the coating system from products of a single manufacturer.
- B. Secondary products not specified by name and required for the job such as oils, thinners, patching, compounds, putty, shall be "best grade" or "first line" products of a reputable manufacturer.
- C. Compatibility
1. All paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; all tools and equipment shall be compatible with the coating to be applied.
  2. Thinners, when used, shall be only those thinners recommended for that purpose by the Manufacturer of the material to be thinned.
  3. All shop primers are required to be approved by finish coat paint manufacturer.
- D. Colors and glosses: All colors shall be as selected by the Owner and will be limited to not more than six paint colors in the total Work.
1. Colors of paints and stains match color chips submitted to the Owner.



## **2.2 Acceptable Manufacturers**

- A. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

## **2.3 Mixing and Tinting**

- A. Deliver paints and enamels ready-mixed to job site.
- B. Accomplish job mixing and job tinting only when acceptable to the Owner.
- C. Fungicidal agent shall be incorporated into the paint by the Manufacturer.

# **PART 3 EXECUTION**

## **3.1 Surface Conditions**

- A. Inspection
  - 1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
  - 2. Verify that paint finishes may be applied in strict accord with all pertinent codes and regulations and the requirements of these Specifications.
  - 3. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work as included in Article 3.2 Preparation.
  - 4. If woodwork, metal or any other surface to be finished cannot be put in proper condition for finishing by customary cleaning, filling, sanding, dusting, puttying operation, notify Owner immediately for clarification.
  - 5. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.
  - 6. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums or as required by paint materials manufacturer: (submit written documentation by paint manufacturer).
    - a. Plaster and Gypsum Wallboard: 12 percent.
    - b. Masonry, Concrete and Concrete Unit Masonry: 12 percent.
    - c. Interior Located Wood: 15 percent, measured in accord with ASTM D 2016.
  - 7. Beginning of installation means acceptance of existing surfaces or substrate.

## **3.2 Preparation**

- A. General
  - 1. Protection: Prior to all surface preparation and painting operation, completely mask, remove or otherwise adequately protect all hardware, accessories, machined surfaces, plates, lighting fixtures and similar items in contact with painted surfaces, but not scheduled to receive paint.
  - 2. Priming:
    - a. Spot prime all exposed nails and other metals which are to be painted with emulsion paints using a primer recommended by the Manufacturer of the coating

- system.
- b. Back prime interior trim before installation, with interior trim primer.
- 3. Cleaning:
  - a. Before applying paint or other surface treatment, thoroughly clean all surfaces involved.
  - b. Previously Painted Surfaces:
    - (1) Remove all blistered, peeling and scaling paint to bare substrate. Remove heavy chalk by scrubbing with seal and water. Sand or etch any glossy areas and dust clean. Clean and spot prime any failed areas. Rinse clean and let. dry. Any existing mildew on the surface must be completely killed and remove before applying paint.
    - (2) Efflorescence should be removed from masonry surfaces. Rusted or abraded areas on painted metal should be thoroughly hand or power toll cleaned and spot primed. For optimum performance in more corrosive areas, entire metal surface should be abrasive blast cleaned. In all cases if the old paint shows poor adhesion, it shall all be removed and the entire surface primed.
    - (3) Where new work joints existing work, prepare existing surfaces extending to the nearest break in the plane.
    - (4) Wash surfaces with detergent and water or other solution as required to remove any accumulated dirt, oil, grease or other foreign matter which would impair bond or bleed through new finishes. After washing, rinse with water and allow to dry thoroughly.
  - c. Schedule all cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
  - d. Work will be received broom clean only from General Contractor. Note protection and cleaning required by Painting Contractor.
- B. Wood Surfaces
  - 1. Cleaning: Clean all wood surfaces until they are free from dirt, oil and other foreign substances. Remove all pencil marks and grade stamps, sanding when a semi-transparent finish is to be applied. All loose wood fibers or dust should be removed by brushing.
  - 2. Smoothing:
    - a. Unless specifically noted to be left rough, smooth all finished wood surfaces exposed to view, using the proper sandpaper, the dust off.
    - b. Where so required, use varying degrees of coarseness in sandpaper to produce uniformly smooth and unmarred wood surfaces.
  - 3. Dryness: Unless specifically approved by the Owner, do not proceed with the painting of wood surfaces
- C. Gypsum Wallboard
  - 1. Allow plaster to dry thoroughly for as least 30 days before painting. Sand smooth any irregularities.
  - 2. Fill narrow, shallow cracks and small holes with spackling compound.
  - 3. Allow to dry.
  - 4. Sand smooth. Do not raise nap of paper on wallboard.
- A. General
  - 1. Workmanship: Very best, spread materials evenly, glow on smoothly without runs, sags, employ skilled mechanics.
  - 2. Use materials only as specified by Manufacturer's direction label on container.

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3. Where interior or exterior wood and metal are primed in the mill or ship, use material in every case same as the specified for such surfaces; use as per Manufacturer's directions for first or priming coat.
  4. Finish door tops, bottoms, edges, same as balance of doors after they are fitted.
  5. Cover surfaced to be stained with uniform stain coat; wipe off as required.
  6. Sand smoothly woodwork to be finished with stain. Clean surface before proceeding with first coat application. Use fine sand paper between coats. Finish wood or metal to produce even, smooth finish.
  7. Do not apply finishes to surfaces that are not dry.
  8. Each coat shall cover preceding coat, so that preceding coat shall not show through. Each coat of paint shall be slightly darker than preceding coat unless otherwise directed. Undercoats shall be tinted similar to finish coats. Color of priming shall be lighter than body coat. Body coat shall be same color but lighter than finish coat.
  9. Paint all surfaces, except glass, flat concrete and similar items, not pre-finished and not called out as unfinished.
  10. Apply paint enamel stain and varnish with suitable brushes, or rollers, or spraying equipment.
    - a. Rate of application shall not exceed that as recommended by paint Manufacturer for the surface involved.
    - b. Keep brushes, and rollers, and spraying equipment clean, dry, free from contaminates and suitable for the finish required.
    - c. Apply stain by brush.
  11. Finish coats shall be smooth, free of brush marks, streaks, laps or pile up of paints, and skipped or missed areas.
    - a. Finished metal surfaces shall be free of skips, voids or pinholes in any coat when tested with a low voltage detector. Test required on first application.
  12. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.
  13. Apply primer on all work before glazing.
  14. Refinish whole wall where portion of finish has been damaged or is not acceptable.
  15. Finish metal doors and frames to be Manufacturer's standard primed (not finish coated); finish coats by Painting Contractor.
  16. No overhead doors or rolling steel doors should be painted. Rolling steel door track and all tube steel door jambs are scheduled to be painted.
  17. All ceilings to be painted except acoustical tile ceilings. See schedules.
- B. Drying
1. Allow sufficient drying time between coats.
  2. Modify the period as recommended by the material Manufacturer to suit adverse weather conditions.
- C. Environmental Conditions
1. Comply with the Manufacturer's recommendations as to environmental conditions under which the coating system may be applied. No painting allowed when temperatures are below 50 degrees F., above 120 degrees F. or with 90% or above relative humidity.
  2. Do not apply paint in areas where dust is being generated.
- D. Defects: Sand and dust between coats to remove all defects visible to the unaided eye from a distance of five feet.
- E. Dry Mil Thickness

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1. General: Apply all coatings to the dry mil thickness indicated in the "Painting Schedule". In general, all painted surfaces to have a DFT as listed unless noted otherwise.

### F. Recoating

1. Whenever possible, notify Architect between coats.

**3.4 Reinstallation of Removed Items:** Following completion of painting, in each space, promptly reinstall all items removed for painting or wall covering using only workmen skilled in the particular trade.

### **3.5 Cleaning Up**

#### A. General

1. During progress of the Work, do not allow the accumulation of empty containers or other excess items except in areas specifically set aside for the purpose.
2. Prevent accidental spilling of paint materials and in event of such spill, immediately remove all spilled material and the waste or other equipment used to clean up the spill, and wash the surfaces to their original undamaged condition, all at no additional cost to the Owner.
3. Collect cotton waste, cloths and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.
4. Touch up and restore finish where damaged.
5. Do not mar surface finish of item being cleaned.
6. Leave storage space clean and in condition required for equivalent spaces in project.

- B. Prior to Final Inspection: Upon completion of this portion of the Work visually inspect all surfaces and remove all paint and traces of paint from surfaces not scheduled to be painted.

### **3.6 Painting Schedule**

#### A. Surfaces Not to be Painted.

1. Pre-finished wall, ceiling and floor coverings.
2. Items with factory applied final finish.
3. Concealed ducts, pipes and conduit.
4. Glass, flat concrete and similar items, not pre-finished.
5. Ceramic tile, acoustical tile and plastic laminate.

#### B. Interior Work

1. Interior Wood - transparent finish:
  - a. First Coat: VOC compliant wiping stain; spreading rate: as needed to match Owner's sample.
  - b. 2nd Coat: Polyurethane satin varnish
  - c. 3rd Coat: Polyurethane satin varnish:  
Min DFT: 1.7 mils per coat;  
Min. Volume Solids: 41%;  
Sheen: 20-35 units at 60 degrees.
2. Interior Wood - painted
  - a. First Coat: 100% acrylic primer;

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- Min. DFT: 1.6 mils; Min. Volume Solids: 39%
- b. 2nd Coat: Non-blocking, acrylic semi-gloss
- c. 3rd Coat: Non-blocking, acrylic semi-gloss Pencil Hardness (ASTM D3363): H or harder;  
Min. DFT: 1.3 mils per coat;  
Min. Volume Solids: 33%;  
Sheen: 35-45 units at 60 degrees.
- 3. Gypsum Drywall - walls (scheduled for Latex - E)
  - a. First Coat: 100% acrylic primer  
Min. DFT: 1.6 mils per coat  
Min. Volume Solids: 39%
  - b. Second Coat: Vinyl acrylic eggshell finish
  - c. Third Coat: Vinyl acrylic eggshell finish  
Min. DFT: 1.6 mils per coat  
Min. Volume Solids: 37%  
Sheen: 10 - 20 units at 85 degrees
- 4. Gypsum Drywall - walls (scheduled for Latex - S)
  - a. First Coat: 100% acrylic primer  
Min. DFT: 1.6 mils per coat  
Min. Volume Solids: 39%
  - b. Second Coat: Vinyl acrylic Semi-gloss finish
  - c. Third Coat: Vinyl acrylic Semi-gloss finish  
Min. DFT: 1.6 mils per coat  
Min. Volume Solids: 37%  
Sheen: 25 - 35 units at 60 degrees
- 5. Interior Ferrous Metal:
  - a. Touch-up: Rust-inhibitive waterborne acrylic primer, free of heavy metals;  
Min. DFT: 2.5 - 5.0 mils  
Min. Volume Solids: 44%
  - b. 2nd Coat: Non-blocking, acrylic semi-gloss
  - c. 3rd Coat: Non-blocking, acrylic semi-gloss coating; Pencil Hardness (ASTM D3363): H or harder  
Min. DFT: 1.3 mils per coat;  
Min. Volume Solids: 33%;  
Sheen: 35-45 units at 60 degrees.

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**SECTION 10 21 13 SOLID PHENOLIC CORE PLASTIC LAMINATE-CLAD TOILET COMPARTMENTS**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	2.1 Materials
	1.2 Quality Assurance	2.2 Acceptable Manufacturers
	1.3 Submittals	2.3 Fabrication
	1.4 Product Delivery, Storage and Handling	3.1 Surface Conditions
	1.5 Warranty	3.2 Installation
		3.3 Adjust and Clean

**PART 1 GENERAL**

**1.1 Description**

- A. Work Included: Solid Phenolic toilet and urinal screens, and accessories indicated on the Drawings.
- B. Related Work Specified Elsewhere
  - 1. Blocking within stud walls Section 06 10 00
  - 2. Toilet and Bath Accessories Section 10 28 13
- C. Work Furnished but Not Installed
  - 1. Wall reinforcement for concealed in-wall construction Section 06 10 00

**1.2 Quality Assurance**

- A. Qualifications of Manufacturers: Regularly engaged in manufacture of solid plastic toilet partitions.
- B. Qualifications of Installers: For actual installation of toilet partitions, use only personnel who are skilled in the Work required, completely familiar with the Manufacturer's recommended methods of installation, and thoroughly familiar with the requirements of this Work.
- C. Requirements of Regulatory Agencies: Conform to ANSI A 117.1 and applicable State and Federal codes for provisions for the physically handicapped.
- D. Erection Tolerances
  - 1. Maximum Variation from Plumb or Level: 1/8 inch.
  - 2. Maximum Misplacement from Intended Position: 1/8 inch.
- E. Reference Standards
  - 1. American National Standards Institute (ANSI):
    - a. A 117.1, Specifications for Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped.
  - 2. American Society for Testing and Materials (ASTM):
    - a. A 167, Corrosion-Resisting Chromium-Nickel Steel Plate

3. Federal Specifications (FS):
  - a. FF-B-588, Bolt, Toggle; and Expansion Sleeve, Screw
  - b. FF-S-325, Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
  - c. MMM-A-188, Adhesives; Urea-Resin-Type (Liquid and Powder)

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

- A. Shop Drawings
  1. Indicate partition layout and dimensions, panel and door sizes, door swings and elevations.
  2. Show fabrication and erection of partition assemblies, to extent not fully described by Manufacturer's data sheets.
  3. Show anchorage, accessory items and finishes.
  4. Provide location template drawings for bolt hole locations in supporting members for attachment of partitions.
- B. Color Chips: Accompanying the Shop Drawings, submit color chips representing the full range of standard colors available from the selected Manufacturer in the quality of partition specified.
- C. Installation Methods: Accompanying the Shop Drawings, submit two copies of the Manufacturer's currently recommended installation methods, showing all required blocking and bracing.

#### **1.4 Product Delivery, Storage and Handling**

- A. Protection: Use all means necessary to protect toilet partitions, urinal screens, and shower partitions, during and after installation and to protect the installed work and materials of all other trades.
- B. Deliver items in Manufacturer's original unopened protective packaging.
- C. Store materials in original protective packaging to prevent soiling, physical damage, or wetting.
- D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

**1.5 Warranty:** Warranty all defects in workmanship and materials for fifteen years from date of acceptance of Owner.

## **PART 2 PRODUCTS**

### **2.1 Materials**

- A. Type and Style
  1. Solid Phenolic plastic toilet compartments shall be floor mounted. Doors and pilasters



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- shall have a finish thickness of  $\frac{3}{4}$ " Panels shall be  $\frac{1}{2}$ ".
2. Pilasters to be anchored to overhead member (which member is to be supplied by others) with standard  $\frac{3}{8}$ " threaded rod, hex nuts, and washers to provide vertical adjustment and necessary strength.
- B. Partitions. Pilaster, Screens and Doors: Solid Phenolic Core:
- C. Adhesive: Manufacturer's Standard.
- D. Hardware and Fittings:
1. All exposed door hardware shall be of die cast aluminum and shall be as noted:
    - a. Heavy-duty "Bank Vault" hinge shall have gravity-acting cams and are fabricated from a die cast aluminum alloy with a brushed polish chrome-plated finish and wraparound flanges. The cam is constructed from a  $\frac{3}{4}$ " diameter nylon rod and a  $\frac{3}{8}$ " stainless steel pin. Hinges are through bolted onto doors and pilasters using stainless steel, tamper-resistant through bolts. Hinges are easily adjusted at the job site to a full close or partially open position, as required.
    - b. Hardware includes coat hook, bumper, stop and keeper, and all necessary fasteners for installation.
    - c. Fasteners shall be of stainless steel; door hinges and latches will be mounted with theft-proof barrel nuts and machine screws; hooks and handles will be mounted with theft-proof full-thread screws.
    - d. All slide latches shall be mounted at mid-point of the door, 29" up from the bottom of the door. Keepers shall be designed and installed permitting emergency access to the compartment by lifting the door until the latch bolt is clear of the keeper. Install keeper on pilaster.
  2. Headrail shall be installed between end pilaster and wall secured by stirrup brackets above end panel to inner surface of headrail and on the opposing wall surface.
  3. Wall brackets shall be secured to walls with anchoring and/or expansion shields. Brackets to be type 304 stainless steel 1 ear or 2 ear connections.
  4. Pilaster shoes shall be of type 304 stainless steel having a #4 finish.
  5. All mounting brackets shall be cast stainless steel. All material shall be through bolted with stainless steel tamper resistant fasteners.
- E. Fasteners:
1. Toggle bolts: FS FF-B-588.
  2. Masonry anchors: FS FF-S-325.
  3. Exposed bolts and screws: Theft resistant, one-way heads, finished to match hardware.
- F. Accessories: Provide stainless coat hook at each door. Toilet paper holders and grab bars as shown on Drawings are specified in Section 10 28 13.
- G. Color: All toilet partitions shall be factory pre-finished in the colors selected by the Architect from the Manufacturer's standard range of colors.

### **2.2 Acceptable Manufacturers**

- A. Embassy Phenolic Partitions manufactured by Global Steel Products, Deer Park, New York.
- B. Equivalent partitions from following manufacturers are acceptable:
  1. Bobrick – Duraline series – solid phenolic.

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2. Metpar – Forum – solid phenolic.
3. Scranton Products

### **3.3 Fabrication**

- A. Partitions, Pilasters, Screens and Doors
  1. No splices or joints in faces.
  2. All edges sealed against moisture and edged with plastic laminate.
  3. Reinforce with steel plate reinforcement sandwiched within particle core at attachment points, hardware and fittings. Router cut openings as required.
  4. Notch recesses and drill holes for hardware and fittings.
- B. Pilasters, Supports and Hangers: Equipped with leveling devices, anchor studs and locking nuts.
- C. Pilaster Shoes: Plinths, one piece hemmed top and bottom, formed to fit pilaster, equipped with concealed clips.
- D. Wall Brackets: Panel brackets, two ear, "T" style, 1 inch stock.
- E. Panel to Pilaster Brackets: Stirrup style brackets.
- F. Door Hardware
  1. Hinge: Self-lubricating, inward and outward, surface mounted, cut out insert, gravity, spring action cam, torsion rod type, return movement, adjustable to hold door open at any angle up to 90 degrees. Nylon bearings.
  2. Latch: Combination rubber faced door strike and keeper, equipped for emergency access.
  3. Coat Hook: Combination unit with hook and rubber tipped pin.
  4. Door Pull: Outswing door type.

## **PART 3 EXECUTION**

### **3.1 Surface Conditions**

- A. Inspection
  1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
  2. Verify that toilet partitions and urinal screens may be installed in complete accord with the original design, the approved Shop Drawings and the Manufacturer's recommendations.
  3. Check areas scheduled to receive partitions for correct dimensions, plumbness of walls and soundness of wall surfaces that would affect the installation of holding brackets.
  4. Verify spacing of plumbing fixtures to assure compatibility with installation of partitions.
  5. Verify correct location of built-in framing, anchorage and bracing.
  6. Beginning of installation means installer accepts existing conditions.
- B. Discrepancies
  1. In the event of discrepancy, immediately notify the Architect.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### **3.2 Installation**

#### A. General

1. Install all toilet partitions and urinal screens where indicated on the Drawings and as indicated on the approved Shop Drawings in accord with Manufacturer's instructions.
2. Install partition rigidly, straight, plumb and level.
3. Provide clearances of not more than 1/2 inch between pilasters and panels.
4. Provide clearances of not more than one inch between panels and walls.
5. Secure panels to walls with not less than two stirrup brackets, attached near top and bottom of panel.
6. Locate wall brackets so that holes for wall anchorages occur in masonry or tile joints where applicable.
7. Conceal evidence of drilling, cutting and fitting to room finish.

#### B. Wall mounted Partitions

1. Attach to wall with anchoring devices and wall brackets.
2. Position, level and tighten units.

### **3.3 Adjust and Clean**

- A. Adjust and lubricate hardware for proper operation after installation.
- B. Adjust and align door hardware to uniform clearance at vertical edges of doors. Clearance space not to exceed 3/16 inch.
- C. Set hinges on inward swing doors to hold doors open approximately 30 degrees from closed position when unlatched.
- D. Set hinges on outward swing doors to hold doors open approximately 10 degrees from closed position when unlatched.
- E. Perform final adjustments to leveling devices and hardware.
- F. Touch-up all scratches and abrasions to be completely invisible.
- G. Remove protective coverings.

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## SECTION 10 28 13 TOILET ACCESSORIES

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

<b>INDEX</b>	1.1 Description	2.2 Washroom Accessories
	1.2 Quality Assurance	2.3 Acceptable Manufacturers
	1.3 Submittals	2.4 Fabrication
	1.4 Product Delivery, Storage and Handling	3.1 Surface Conditions
	2.1 Materials	3.2 Preparation
		3.3 Installation
		3.4 Adjust and Clean

### PART 1 GENERAL

#### **1.1 Description**

- A. Work Included: Washroom accessories required are described in these Specifications and shown on the Drawings.
  
- B. Related Work Specified Elsewhere
  - 1. Gypsum Wallboard Section 09 29 00
  - 2. Ceramic Tile Section 09 31 00
  - 3. Plumbing Fixtures Division 22
  - 4. Electrical Division 26
  
- C. Work Furnished but Installed by Others:
  - 1. Wood blocking for accessories Section 06 10 00

#### **1.2 Quality Assurance**

- A. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. A 123, Zinc (Hot Galvanized) Coating on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.
    - b. A 167, Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
    - c. A 366, Specifications for Cold Rolled Carbon Steel Sheets, Commercial Quality.
    - d. A 386, Zinc Coating (Hot-Drip on Assembled Steel Products).
  - 2. Federal Specifications (FS):
    - a. WW-P-541, Plumbing Fixtures (Land Use).

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

- A. Material Lists: Manufacturer's catalog cuts and data sheets, complete parts list, and installation requirements for each accessory item specified.
- B. Maintenance data, operating instructions and keys required for each type of equipment and lock.

#### **1.4 Product Delivery, Storage and Handling**

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery of Materials: Deliver items in Manufacturer's original unopened protective packaging.
- C. Storage of Materials, Equipment and Fixtures: Store materials in original protective packaging to prevent soiling, physical damage, or wetting.
- D. Handling Materials and Equipment
  - 1. Handle so as to prevent damage to finished surfaces.
  - 2. Protection:
    - a. Maintain protective covers on all units until installation is complete.
    - b. Remove protective covers at final clean-up of installation.
- E. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

### **PART 2 PRODUCTS**

#### **2.1 Materials**

- A. Stainless Steel:
  - 1. Type: 302/304, ASTM A 167.
  - 2. Finish: No.4, satin
- B. Mounting Devices: Galvanized steel, ASTM A 386.

#### **2.2 Washroom Accessories:**

- A. As scheduled on drawings. Includes but is not necessarily limited to the following:
  - 1. Owner provided Soap Dispensers
  - 2. Owner provided Paper Towel Dispensers
    - a. Contractor to install all owner provided items
- B. Grab Bars
  - 1. Material: Stainless steel, 1-1/4" diameter, satin finish.
  - 2. Strength Requirements: Material and anchorage capabilities to withstand downward force of 800 pounds.
  - 3. Flanges: Match bars and material and finish.
  - 4. Mounting plate: Concealed type, minimum 13 gauge, stainless steel.
  - 5. Grab Bar Anchor for Toilet Partitions: 3/4"-1" Thickness anchor
    - a. Bobrick 258 Series
    - b. One anchor per flange – count per plans
- C. Mirrors:
  - 2. (4) 18" x 36" frameless mirror

### **2.3 Acceptable Manufacturers**

- A. Washroom Accessories
  - 1. Bobrick
  - 2. Bradley

### **2.4 Fabrication**

- A. Fabricate recessed units with seamless one piece flange on exposed face.
- B. Locked dispensing units: Key alike for all accessories.
- C. Coin operated dispensing units: Key coin boxes separately from dispensing unit.
- D. Weld corners, leaving no open miters.

## **PART 3 EXECUTION**

### **3.1 Surface Conditions**

- A. Inspection
  - 1. Check opening scheduled to receive recessed units for correct dimensions, plumbness of blocking or frames, preparation that would affect installation of accessories.
  - 2. Check areas to receive surface mounted units for conditions that would affect quality and execution of work.
  - 3. Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.
  - 4. Do not begin installation of washroom accessories until openings and surfaces are acceptable.

### **3.2 Preparation**

- A. Coordinate work and cooperate with other trades to avoid delays in Work.
- B. Furnish items to be built into other Work to trades concerned and locate items for installation.

### **3.3 Installation**

- A. Drill holes to correct size and application that is concealed by item, with 1/4 inch tolerance.
- B. Mount recessed accessories into wall openings with wood screws through cabinet side into wood blocking, or sheet metal screws into metal frames.
- C. Mount surface mounted accessories to back up with toggle bolts, plumb and align.
- D. Lock grab bars to concealed mounting plate installed in wall.

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- E. Accessories shall be located as indicated on Drawings. The exact type of fastening devices for each type of accessory shall be approved by Architect.
- F. Where accessories are set with screws, provide the necessary grounds, insert, screws and bolts as required to provide suitable anchorage.

**3.4 Adjust and Clean**

- A. Adjust accessories for proper operation.
- B. After completion of installation, clean and polish all exposed surfaces.
- C. Deliver keys and instruction sheets to Owner.

\* \* \* \* \*



## 21 11 00: FIRE SUPPRESSION SPRINKLERS

### 1.1 GENERAL

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Particular attention to design-build scope of work on the drawings.
- B. Summary: This section includes fire-suppression sprinklers, piping, and equipment for the following building systems:
1. Wet-pipe, fire-suppression sprinklers, including piping, valves, specialties, and automatic sprinklers.
- C. Definitions:
1. CPVC: Chlorinated polyvinyl chloride plastic.
  2. Working Plans: Documents, including drawings, calculations, and material specifications prepared according to NFPA 13 for obtaining approval from authorities having jurisdiction.
- D. System Performance Requirements:
1. Design sprinklers and obtain approval from authorities having jurisdiction.
    - a. Minimum Density for Automatic-Sprinkler Piping Design: As follows:
      - 1) Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (6.3 mL/s over 139-sq. m) area.
      - 2) Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (9.5 mL/s over 139-sq. m) area.
      - 3) Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. (12.6 mL/s over 139-sq. m) area.
      - 4) Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. (18.9 mL/s over 232-sq. m) area.
      - 5) Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. (25.2 mL/s over 232-sq. m) area.
      - 6) Special Occupancy Hazard: As determined by authorities having jurisdiction.
    - b. Maximum Protection Area per Sprinkler: As follows:
      - 1) Office Space: 225 sq. ft. (20.9 sq. m).
      - 2) Storage Areas: 130 sq. ft. (12.1 sq. m).
      - 3) Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
      - 4) Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
      - 5) Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
  2. Components and Installation: Capable of producing piping systems with 175-psig (1200-kPa) minimum working-pressure rating, unless otherwise indicated.
- E. Submittals:
1. Product Data: For the following:
    - a. Pipe and fitting materials and methods of joining for sprinkler piping.
    - b. Pipe hangers and supports.
    - c. Valves, including specialty valves, accessories, and devices.

- d. Alarm devices. Include electrical data.
  - e. Fire department connections. Include type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
  - f. Excess-pressure pumps. Include electrical data.
  - g. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
2. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction. Include hydraulic calculations, if applicable.
  3. Hydraulic calculations. All as required by local authorities.
  4. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
  5. Maintenance Data: For each type of sprinkler specialty to include in maintenance manuals specified in Division 1.
- F. Quality Assurance:
1. Installer Qualifications: An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction.
  2. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified engineer. Base calculations on results of fire-hydrant flow test.
  3. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.
  4. Sprinkler Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction.
  5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
  6. NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following:
    - a. NFPA 13, "Installation of Sprinkler Systems."
    - b. NFPA 231, "General Storage."
    - c. NFPA 231C, "Rack Storage of Materials."

## 1.2. PRODUCTS

- A. Manufacturers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Specialty Valves and Devices:
      - 1) Badger Fire Protection, Inc.
      - 2) Central Sprinkler Corp.
      - 3) Firematic Sprinkler Devices, Inc.
      - 4) Globe Fire Sprinkler Corp.

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- 5) Grinnell Corp.
  - 6) Reliable Automatic Sprinkler Co., Inc.
  - 7) Star Sprinkler Corp.
  - 8) Viking Corp.
- b. Water-Flow Indicators and Supervisory Switches:
- 1) Gamewell Co.
  - 2) Grinnell Corp.
  - 3) Pittway Corp.; System Sensor Div.
  - 4) Potter Electric Signal Co.
  - 5) Reliable Automatic Sprinkler Co., Inc.
  - 6) Viking Corp.
  - 7) Watts Industries, Inc.; Water Products Div.
- c. Sprinkler, Drain and Alarm Test Fittings:
- 1) Central Sprinkler Corp.
  - 2) Fire-End and Croker Corp.
  - 3) Grinnell Corp.
  - 4) Victaulic Co. of America.
- d. Sprinkler, Branch-Line Test Fittings:
- 1) Elkhart Brass Mfg. Co., Inc.
  - 2) Fire-End and Croker Corp.
  - 3) Smith Industries, Inc.; Potter-Roemer Div.
- e. Sprinkler, Inspector's Test Fittings:
- 1) Fire-End and Croker Corp.
  - 2) G/J Innovations, Inc.
  - 3) Triple R Specialty of Ajax, Inc.
- f. Fire Department Connections:
- 1) Badger Fire Protection, Inc.
  - 2) Elkhart Brass Mfg. Co., Inc.
  - 3) Fire-End and Croker Corp.
  - 4) Firematic Sprinkler Devices, Inc.
  - 5) Grinnell Corp.
  - 6) Guardian Fire Equipment, Inc.
  - 7) Reliable Automatic Sprinkler Co., Inc.
  - 8) Smith Industries, Inc.; Potter-Roemer Div.
- g. Sprinklers:
- 1) Badger Fire Protection, Inc.
  - 2) Central Sprinkler Corp.
  - 3) Firematic Sprinkler Devices, Inc.
  - 4) Globe Fire Sprinkler Corp.
  - 5) Grinnell Corp.
  - 6) Reliable Automatic Sprinkler Co., Inc.
  - 7) Star Sprinkler Corp.
  - 8) Viking Corp.
- h. Indicator Posts and Indicator-Post, Gate Valves:
- 1) American Cast Iron Pipe Co.; Waterous Co.

- 2) Grinnell Corp.
  - 3) McWane, Inc.; Clow Valve Co. Div.
  - 4) McWane, Inc.; Kennedy Valve Div.
  - 5) Nibco, Inc.
  - 6) Stockham Valves & Fittings, Inc.
- i. Indicator Valves:
- 1) Central Sprink, Inc.
  - 2) Grinnell Corp.
  - 3) McWane, Inc.; Kennedy Valve Div.
  - 4) Milwaukee Valve Co., Inc.
  - 5) Nibco, Inc.
  - 6) Victaulic Co. of America.
- j. Fire-Protection-Service Valves:
- 1) Central Sprink, Inc.
  - 2) Central Sprinkler Corp.
  - 3) Grinnell Corp.
  - 4) McWane, Inc.; Kennedy Valve Div.
  - 5) Nibco, Inc.
  - 6) Stockham Valves & Fittings, Inc.
  - 7) Victaulic Co. of America.
- k. Keyed Couplings for Steel Piping:
- 1) Central Sprink, Inc.
  - 2) Ductilic, Inc.
  - 3) Grinnell Corp.
  - 4) National Fittings, Inc.
  - 5) Star Pipe Products, Inc.; Star Fittings Div.
  - 6) Victaulic Co. of America.
- l. Press-Seal Fittings for Steel Piping:
- 1) Victaulic Co. of America.
- B. Piping Materials: Refer to 1.3 EXECUTION, "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- C. Pipes and Tubes:
1. Standard-Weight Steel Pipe: ASTM A 53, ASTM A 135, or ASTM A 795; Schedule 40 in NPS 6 (DN150) and smaller, and Schedule 30 in NPS 8 (DN200) and larger.
  2. Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN125) and smaller and NFPA 13 specified wall thickness in NPS 6 to NPS 10 (DN150 to DN250).
- D. Pipe and Tube Fittings:
1. Cast-Iron Threaded Fittings: ASME B16.4.
  2. Malleable-Iron Threaded Fittings: ASME B16.3.
  3. Steel, Threaded Couplings: ASTM A 865.
  4. Steel Welding Fittings: ASTM A 234/A 234M, ASME B16.9, or ASME B16.11.
  5. Steel Flanges and Flanged Fittings: ASME B16.5.

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6. Steel, Grooved-End Fittings: UL-listed and FM-approved, ASTM A 47 (ASTM A 47M), malleable iron or ASTM A 536, ductile iron; with dimensions matching steel pipe and ends factory grooved according to AWWA C606.
- E. Joining Materials: Refer to Division 23 Section "Common Work Results for HVAC" for pipe-flange gasket materials and welding filler metals.
- F. Fire-Protection-Service Valves:
1. General: UL listed and FM approved, with minimum 175-psig (1200-kPa) nonshock working-pressure rating. Valves for grooved-end piping may be furnished with grooved ends instead of type of ends specified.
  2. Gate Valves, NPS 2 (DN50) and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y; and rising stem.
  3. Gate Valves, NPS 2-1/2 (DN65) and Larger: UL 262, iron body, bronze mounted, taper wedge, OS&Y, and rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.
  4. Indicator-Post, Gate Valves: UL 262, iron body, bronze mounted, solid-wedge disc, and nonrising stem with operating nut and flanged ends.
  5. Swing Check Valves, NPS 2 (DN50) and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
  6. Swing Check Valves, NPS 2-1/2 (DN65) and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.
  7. Split-Clapper Check Valves, NPS 4 (DN100) and Larger: UL 312, cast-iron body with rubber seal, bronze-alloy discs, and stainless-steel spring and hinge pin.
- G. Specialty Valves:
1. Alarm Check Valves: UL 193, 175-psig (1200-kPa) working pressure, designed for horizontal or vertical installation, with cast-iron flanged inlet and outlet, bronze grooved seat with O-ring seals, and single-hinge pin and latch design. Include trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
    - a. Option: Grooved-end connections for use with keyed couplings.
    - b. Drip Cup Assembly: Pipe drain without valves, and separate from main drain piping.
    - c. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
  2. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4 (DN20), ball check device with threaded ends.
- H. Sprinklers:
1. Automatic Sprinklers: With heat-responsive element complying with the following:
    - a. UL 199, for applications except residential.
    - b. UL 1626, for residential applications.
    - c. UL 1767, for early suppression, fast-response applications.
  2. Sprinkler Types and Categories: Nominal 1/2" (12.7-mm) orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
  3. Sprinkler types, features, and options include the following:
    - a. Concealed ceiling sprinklers, including cover plate.

- b. Flow-control sprinklers, with automatic open and shut off feature.
  - c. Flush ceiling sprinklers, including escutcheon.
  - d. Pendent sprinklers.
  - e. Recessed sprinklers, including escutcheon.
  - f. Sidewall sprinklers.
  - g. Upright sprinklers.
4. Sprinkler Finishes: Chrome-plated
  5. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
    - a. Ceiling Mounting: Chrome-plated steel, one piece, flat.
    - b. Sidewall Mounting: Chrome-plated steel, one piece, flat.
  6. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.
- I. Fire Department Connections:
1. Wall, Fire Department Connections: UL 405; cast-brass body with brass, wall, escutcheon plate; brass, lugged caps with gaskets and brass chains; and brass, lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking "AUTO SPKR."
    - a. Type: Flush mounting.
    - b. Escutcheon Plate: Rectangular.
    - c. Finish: Polished brass.
- J. Alarm Devices:
1. General: Types matching piping and equipment connections.
  2. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250-psig (1725-kPa) pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
  3. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
- K. Pressure Gages:
1. Pressure Gages: UL 393, 3½"- to 4½"- (90- to 115-mm-) diameter dial with dial range of 0 to 250 psig (0 to 1725 kPa).

### 1.3. EXECUTION

- A. Piping Applications:
1. Do not use welded joints with galvanized steel pipe.
  2. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

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3. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
  4. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
  5. Underground Service-Entrance Piping: Use ductile-iron, push-on-joint pipe and fittings and restrained joints.
  6. Underground Service-Entrance Piping: Use ductile-iron, mechanical-joint pipe and fittings and restrained joints.
  7. Underground Service-Entrance Piping: Use ductile-iron, grooved-end pipe and fittings; ductile-iron, keyed couplings; and grooved joints.
  8. Sprinkler Feed Mains and Risers: Use the following:
    - a. NPS 6 (DN100) and Smaller: Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved joints.
  9. Wet-Pipe, Sprinkler Branch Piping: Use the following:
    - a. NPS 2 and Smaller: Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
- B. Valve Applications: Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13.
    - a. Shutoff Duty: Use gate valves.
  2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13.
    - a. Shutoff Duty: Use gate, ball, or butterfly valves.
    - b. Throttling Duty: Use globe, ball, or butterfly valves.
- C. Joint Construction:
1. Refer to Section "Common Work Results for HVAC" for basic piping joint construction.
  2. Ductile-Iron-Piping, Grooved Joints: Use ductile-iron pipe with radius-cut-grooved ends; ductile-iron, grooved-end fittings; and ductile-iron, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
  3. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut or roll-grooved ends and Schedule 30 or thinner steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.
- D. Service-Entrance Piping:
1. Refer to Section "Common Work Results for Plumbing" for basic piping installation.
  2. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

- a. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
  3. Install underground service-entrance piping according to NFPA 24 and with restrained joints.
  4. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
  5. Install unions adjacent to each valve in pipes NPS 2 (DN50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
  6. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN65) and larger connections.
  7. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.
  8. Install sprinkler piping with drains for complete system drainage.
  9. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to sprinkler risers when sprinkler branch piping is connected to sprinkler risers.
  10. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
  11. Install alarm devices in piping systems.
  12. Hangers and Supports: Comply with NFPA 13 for hanger materials and installation.
  13. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
  14. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.
  15. Install pressure gages on riser or feed main and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 (DN8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- E. Specialty Sprinkler Fitting Installation: Install specialty sprinkler fittings according to manufacturer's written instructions.
- F. Valve Installation:
1. Gate Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.
  2. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
  3. Alarm Check Valves: Install valves in vertical position for proper direction of flow, including bypass check valve and retard chamber drain-line connection.
- G. Sprinkler Applications:
1. General: Use sprinklers according to the following applications:
    - a. Rooms without Ceilings: Pendent sprinklers.
    - b. Rooms with Suspended Ceilings: Concealed sprinklers.
    - c. Wall Mounting: Sidewall sprinklers.
    - d. Sprinkler Finishes: Use sprinklers with the following finishes:



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- 1) Upright, Pendent, and Sidewall Sprinklers: Chrome-plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
  - 2) Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  - 3) Flush Sprinklers: Bright chrome, with painted white escutcheon.
  - 4) Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
- H. Sprinkler Installation: Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.
- I. Connections:
1. Connect water supplies to sprinklers. Include backflow preventers.
  2. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
  3. Connect piping to specialty valves, specialties, fire department connections, and accessories.
  4. Electrical Connections: Power wiring is specified in Division 26.
  5. Connect alarm devices to fire alarm.
- J. Labeling and Identification:
1. Install labeling & pipe markers on equipment & piping according to requirements in NFPA 13 and in Division 23 Section "Common Work Results for HVAC."
  2. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 23 Section "Mechanical Identification."
- K. Field Quality Control:
1. Flush, test, and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.
  2. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
  3. Report test results promptly and in writing to Architect and authorities having jurisdiction.
- L. Cleaning:
1. Clean dirt and debris from sprinklers.
  2. Remove and replace sprinklers having paint other than factory finish.
- M. Protection: Protect sprinklers from damage until Substantial Completion.
- N. Commissioning:
1. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
  2. Verify that specified tests of piping are complete.
  3. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
  4. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
  5. Verify that potable-water supplies have correct types of backflow preventers.

6. Verify that fire department connections have threads compatible with local fire department equipment.
  7. Fill wet-pipe sprinkler piping with water.
  8. Energize circuits to electrical equipment and devices.
  9. Coordinate with fire alarm tests. Operate as required.
- O. Demonstration:
1. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
  2. Schedule demonstration with Owner with at least seven days' advance notice.

END 21 11 00.

## 22 05 00 COMMON WORK RESULTS FOR PLUMBING

### 1.1. GENERAL

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section

Plumbing contractor to provide full as-built red line drawings to the GC and Owner

- B. Summary:

1. This Section includes the following basic mechanical materials and methods to complement other Division 22 and 23 Sections.
  - a. Piping materials and installation instructions common to most piping systems.
  - b. Escutcheons
  - c. Dielectric fittings.
  - d. Flexible connectors.
  - e. Equipment nameplate data requirements.
  - f. Labeling and identifying mechanical systems
  - g. Field-fabricated metal and wood equipment supports.
  - h. Installation requirements common to equipment specification sections.
  - i. Mechanical demolition.
  - j. Cutting and patching.
  - k. Touchup painting and finishing.
2. Pipe and pipe fitting materials are specified in Division 22 piping system Sections.

- C. Definitions:

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
5. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
6. The following are industry abbreviations for plastic materials:
  - a. CPVC: Chlorinated polyvinyl chloride plastic.
  - b. NP: Nylon plastic.
  - c. PE: Polyethylene plastic.
  - d. PVC: Polyvinyl chloride plastic.

7. The following are industry abbreviations for rubber materials:
  - a. CR: Chlorosulfonated polyethylene synthetic rubber.
  - b. EPDM: Ethylene propylene diene terpolymer rubber.
  
- D. Quality Assurance:
  1. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
  2. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.
  
- E. Delivery, Storage, and Handling:
  1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
  2. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
  3. Protect flanges, fittings, and piping specialties from moisture and dirt.
  
- F. Sequencing and Scheduling:
  1. Coordinate mechanical equipment installation with other building components.
  2. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
  3. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
  4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
  5. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
  6. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."
  7. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

## 1.2. PRODUCTS

- A. Manufacturers:
  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 following:
  
- B. Pipe and Pipe Fittings:

1. Refer to individual Division 22 piping Sections for pipe and fitting materials and joining methods.
  2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. Joining Materials:
1. Solder Filler Metals: ASTM B 32.
    - a. Alloy Sn95 or Alloy Sn94: Approximately 95% tin and 5% silver, with 0.10% lead content.
    - b. Alloy E: Approximately 95% tin and 5% copper, with 0.10% maximum lead content.
    - c. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10% maximum lead content.
    - d. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10% maximum lead content.
    - e. Alloy Sb5: 95% tin and 5% antimony, with 0.20% maximum lead content.
  2. Solvent Cements: Manufacturer's standard solvent cements for the following:
    - a. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  3. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
    - a. Sleeve: ASTM A 126, Class B, gray iron.
    - b. Followers: Malleable iron or ASTM A 536 ductile iron.
    - c. Gaskets: Rubber.
    - d. Bolts and Nuts: AWWA C111.
    - e. Finish: Enamel paint.
- D. Dielectric Fittings:
1. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
  2. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
  3. Insulating Material: Suitable for system fluid, pressure, and temperature.
  4. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180° F (82° C).
  5. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150-psig (1035-kPa) minimum working pressure as required to suit system pressures.
  6. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
    - a. Provide separate companion flanges and steel bolts and nuts for 150 psig (1035-kPa) minimum working pressure as required to suit system pressures.
  7. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225° F (107° C).
- E. Identifying Devices and Labels:
1. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22 Sections. If more than one

- type is specified for application, selection is Installer's option, but provide one selection for each product category.
2. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.
    - a. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
    - b. Location: Accessible and visible location.
  3. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 1¼"- (30-mm-) high letters for ductwork and not less than ¾"- (19-mm-) high letters for access door signs and similar operational instructions.
    - a. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form and grade.
    - b. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.
  4. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.
    - a. Fabricate in sizes required for message.
    - b. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
    - c. Punch for mechanical fastening.
    - d. Thickness: ⅛", unless otherwise indicated.
    - e. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.
  5. Plastic Equipment Markers: Color-coded, laminated plastic. Comply with the following color code:
    - a. Green: Cooling equipment and components.
    - b. Yellow: Heating equipment and components.
    - c. Yellow/Green: Combination cooling and heating equipment and components.
    - d. Brown: Energy reclamation equipment and components.
    - e. Blue: Equipment and components that do not meet any criteria above.
    - f. For hazardous equipment, use colors and designs recommended by ASME A13.1.
    - g. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
      - 1) Name and plan number.
      - 2) Equipment service.
      - 3) Design capacity.
      - 4) Other design parameters such as pressure drop, entering and leaving conditions, and rpm.
    - h. Size: Approximate 2½" by 4" (65 by 100 mm) for control devices, dampers, and valves; and 4½" by 6" (115 by 150 mm) for equipment.

6. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.
  - a. Multiple Systems: If multiple systems of same generic name are indicated, provide identification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

### 1.3. EXECUTION

#### A. Piping Systems – Common Requirements:

1. General Locations and Arrangements: 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.
2. Install components with pressure rating equal to or greater than system operating pressure.
3. Install piping free of sags and bends.
4. Install piping to allow application of insulation plus 1" (25-mm) clearance around insulation.
5. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
6. Install couplings according to manufacturer's written instructions.
7. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
8. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
  - a. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  - b. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  - c. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
  - d. 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) Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    - 2) Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
    - 3) Align threads at point of assembly.
    - 4) Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    - 5) Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

9. Piping Connections: Make connections according to the following, unless otherwise indicated:
  - a. Install unions, in piping 2" NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2" NPS or smaller threaded pipe connection.
  - b. Install flanges, in piping 2½" NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
  - c. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - d. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
  
- B. Equipment Installation – Common Requirements:
  1. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
  2. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
  3. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
  4. 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.
  5. Install equipment giving right of way to piping installed at required slope.
  6. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.
  
- C. Labeling and Identifying:
  1. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
    - a. Stenciled Markers: According to ASME A13.1.
    - b. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.
    - c. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior non-concealed locations:
      - 1) Near each valve and control device.
      - 2) Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
      - 3) Near locations if pipes pass through walls, floors, ceilings, or enter 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 of 50' (15-m) intervals along each run. Reduce intervals to 25' (7.5 m) in congested areas of piping and equipment.
      - 7) On piping above removable acoustical ceilings, except omit intermediately spaced markers.



2. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of mechanical equipment.
    - a. Lettering Size: Minimum ¼"- (6.4-mm-) high lettering for name of unit if viewing distance is less than 24" (610 mm), ½"h- (12.7-mm-) high lettering for distances up to 72" (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
    - b. Text of Signs: Provide name of identified unit. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
  3. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.
- D. Concrete Bases: Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."
- E. Demolition:
1. Disconnect, demolish, and remove Work specified in Division 22 Sections.
  2. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
  3. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
  4. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2" beyond face of adjacent construction. Cap and patch surface to match existing finish.
  5. Removal: Remove indicated equipment from Project site.
  6. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.
- F. Cutting and Patching:
1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
  2. Repair cut surfaces to match adjacent surfaces.

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END 22 05 00.

## **22 05 29 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

### **PART – GENERAL**

#### 1.01 SUMMARY

- A. Section Includes pipe and equipment supports and hangers

#### 1.02 REFERENCES

- A. ASME B31.1 (American Society of Mechanical Engineers) – Power Piping.
- B. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) – Pipe Hangers and Supports – Materials, Design and Manufacturer.
- C. NFPA 13 2010 (National Fire Protection Association) – Installation of Sprinkler Systems.
- D. UPC 2012 (Uniform Plumbing Code) – Defines support spacing of hangers

#### 1.03 SUBMITTALS

- A. Section 01 33 00 – Submittal Procedures: Submittal sheets with technical data available.
- B. Product Data: Submit manufacturers catalog data including load capacity.
- C. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

#### 1.04 QUALITY ASSURANCE

- A. Hangers and supports shall have the manufacturer's name and applicable size stamped in the part itself for identification.
- B. Hangers and supports shall be designed and manufactured in accordance with MSS SP 58.
- C. Hangers and supports for sprinkler piping shall conform to NFPA 13 specification.

### **PART 2 – PRODUCTS**

#### 2.01 MANUFACTURERS

- A. Manufacturer: Pipe hangers and supports shall be manufactured by Hilti, Inc.

#### 2.02 MANUFACTURED UNITS

- A. Pipe Hangers and Supports for Steel Pipe: The following is a list of acceptable hangers and supports for steel pipe with or without insulation:
  - 1. Speed Lock Clevis (SLC) hanger: Hilti SLC-EG 2" - 8"
  - 2. Insulation Shield: Hilti Speed Lock (SLIS) Insulation Shield MH-SLIS 2" – 8"
  - 3. Standard Clevis hanger: Hilti SDC-EG ½" - 14"

4. Short Hinged Riser Clamps (uninsulated pipe only:) Hilti Speed Lock Riser MH-SLR-S 1" – 4"
  5. Long Hinged Riser Clamps: Hilti Speed Lock Riser MH-SLR-LH 1" – 4"
  6. Slotted Riser Clamps: Hilti Speed Lock Riser MH-SLR-LS 3" – 10"
  7. Malleable Iron Split Ring hanger: Hilti SR-EG ½" - 4"
  8. Adjustable Swivel / Loop hanger: Hilti LH ½" - 8"
  9. Beam Clamps: Hilti BC ¼" - ¾"
  10. Continuous Concrete Insert Strut – Hilti Strut CIS 138-12 & Strut CIS 1316-12
  11. Steel Concrete Spot Insert – Hilti Concrete Insert EG & Plain
- B. Pipe Hangers and Supports for Copper Pipe / Tube: The following is a list of acceptable hangers and supports for copper pipe / tube without insulation:
1. Hilti Copper Speed Lock Riser Clamp MH-CSLR-LH 1" – 4"
  2. Malleable Iron Copper Split ring hanger – Hilti Copper SR ½" - 3"
- C. Trapeze Supports
1. Trapeze Supports shall be constructed using 12 gauge structural steel conforming to ASTM A1011 GR. 33 and have a minimum dimension of 1 5/8" wide by 1 5/8" deep. Hilti strut HS-158-12 or stronger shall be used as the primary supporting member.
  2. Piping shall be restrained on the strut using strut clamps. The following Strut Clamps shall be used:
    - Rigid Pipe: Hilti Rigid Strut Clamps R45 ½" – 8" or Hilti RBA ½" - 6"
    - Copper Pipe – Hilti MH-CB 3/8" – 4"

## 2.03 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, continuous threaded.
- B. Split Nut: Hilti MH-SLT Split Nut and Washer may be installed at any position on the continuous threaded rod.

## 2.04 HANGER SPACING

- A. All piping shall be supported properly to avoid any sagging. Hanger spacing shall be determined using either Chapter 2, Part 5, Section 121 (ASME B31.1 – Standard for Pressure and Power Piping) or UPC 2012 whichever is deemed applicable by the project engineer.

## 2.05 FINISHES

- A. Indoor Applications
1. Hangers and supports for steel pipe shall be electro-galvanized or plain.
  2. Hangers and supports for copper pipe / tube shall have a copper electroplate finish.

3. For Trapeze applications, strut shall have either a pre-galvanized finish conforming to ASTM A653 GR 33 specification or (for copper pipe and tubing) a green electro-deposition coating.

## **PART 3 – EXECUTION**

### **3.01 INSTALLATION**

- A. All Pipe Hanger and Support Installation shall conform to MSS-SP 58. Installation of hangers, supports, clamps and attachments shall be performed to properly support piping from building structure.

### **3.02 PIPE HANGERS AND SUPPORTS**

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum ½ inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1½ inch (38 mm) minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
- F. Support vertical piping independently of connected horizontal piping.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Design hangers for pipe movement with disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

### **3.03 SUPPORT SPACING**

- A. All horizontal steel piping shall be supported in accordance with MSS-SP 58 tables

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END OF SECTION

## 22 05 53 IDENTIFICATIONS FOR PLUMBING PIPING AND EQUIPMENT

### 1.1 GENERAL

- A. Summary: This section includes:
  - 1. Nameplates
  - 2. Tags
  - 3. Pipe markers
  - 4. Labels
  
- B. References:
  - 1. American Society of Mechanical Engineers:
    - a. ASME A13.1 - Scheme for the Identification of Piping Systems.
  
  - 2. National Fire Protection Association:
    - a. NFPA 99 - Standard for Health Care Facilities.
  
- C. Submittals:
  - 1. Section 01 33 00 - Submittal Procedures: Submittal procedures.
  - 2. Product Data: Submit manufacturers catalog literature for each product required.
  - 3. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
  - 4. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.
  - 5. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
  
- D. Closeout Submittals:
  - 1. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
  - 2. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.
  
- E. Quality Assurance:
  - 1. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.
  - 2. Maintain one copy of each document on site.
  
- F. Qualifications:
  - 1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
  - 2. Installer: Company specializing in performing Work of this section with minimum three years experience.
  
- G. Field Measurements: Verify field measurements prior to fabrication.

### 1.2. PRODUCTS

March 16, 2023

- A. Nameplates:
  - 1. Manufacturers:
    - a. Craftmark Identification Systems
    - b. Safety Sign Co.
    - c. Seton Identification Products
    - d. Kolbi
  - 2. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.
- B. Tags:
  - 1. Plastic Tags:
    - a. Manufacturers:
      - 1) Kolbi Model
      - 2) Equals accepted.
    - b. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.
  - 2. Tag Chart: Typewritten letter size list of applied tags and location.
- C. Pipe Markers:
  - 1. Color and Lettering: Conform to ASME A13.1.
  - 2. Plastic Pipe Markers:
    - a. Manufacturers:
      - 1) Kolbi
      - 2) Equals Accepted.
    - b. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
  - 3. Plastic Tape Pipe Markers:
    - a. Manufacturers:
      - 1) Kolbi
      - 2) Equals accepted
    - b. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
  - 4. Plastic Underground Pipe Markers:
    - a. Manufacturers:
      - 1) Kolbi
      - 2) Equals accepted
    - b. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- D. Labels:



1. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification.

### 1.3. EXECUTION

#### A. Preparation:

1. Degrease and clean surfaces to receive adhesive for identification materials.
2. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

#### B. Installation:

1. Apply stencil painting in accordance with Section 09 90 00.
2. Install identifying devices after completion of coverings and painting.
3. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
4. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
5. Install tags using corrosion resistant chain. Number tags consecutively by location.
6. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
7. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
8. Identify control panels and major control components outside panels with plastic nameplates.
9. Identify valves in main and branch piping with tags.
10. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

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## 22 05 53 IDENTIFICATIONS FOR PLUMBING PIPING AND EQUIPMENT

### 1.1 GENERAL

#### A. Summary:

1. Section Includes:
  - a. Plumbing piping insulation, jackets and accessories.
  - b. Plumbing equipment insulation, jackets and accessories.
2. Related Sections:
  - a. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
  - b. Section 09 90 00 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

#### B. References:

1. ASTM International:
  - a. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - b. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - c. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
  - d. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - e. ASTM C450 - Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
  - f. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
  - g. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
  - h. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
  - i. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - j. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  - k. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
  - l. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
  - m. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - n. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - o. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

- p. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
  - q. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
  - r. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - s. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- 2. National Fire Protection Association:
    - a. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
  - 3. Underwriters Laboratories Inc.:
    - a. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
- C. Submittals:
- 1. Section 01 33 00 - Submittal Procedures: Submittal procedures.
  - 2. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
  - 3. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
  - 4. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- D. Quality Assurance:
- 1. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 450 in accordance with ASTM E84.
  - 2. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
  - 3. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- E. Qualifications:
- 1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
  - 2. Applicator: Company specializing in performing Work of this section with minimum three years experience.
- F. Delivery, Storage, and Handling:
- 1. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
  - 2. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
  - 3. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

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- G. Environmental Requirements:
  - 1. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
  - 2. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
  - 3. Maintain temperature before, during, and after installation for minimum period of 24 hours.
- H. Field Measurements: Verify field measurements prior to fabrication.
- I. Warranty:
  - 1. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
  - 2. Furnish five year manufacturer warranty for man made fiber.

## 2. PRODUCTS

- A. Manufacturer:
  - 1. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
    - a. CertainTeed
    - b. Knauf
    - c. Johns Manville
    - d. Owens-Corning
- B. Pipe Insulation:
  - 1. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.
    - a. Thermal Conductivity: 0.23 at 75 degrees F.
    - b. Operating Temperature Range: 0 to 850 degrees F.
    - c. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
    - d. Jacket Temperature Limit: minus 20 to 150 degrees F.
  - 2. TYPE P-2: ASTM C547, molded glass fiber pipe insulation.
    - a. Thermal Conductivity: 0.23 at 75 degrees F.
    - b. Operating Temperature Range: 0 to 850 degrees F.
    - c. Vapor Barrier : ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
    - d. Jacket. White premolded PVC
    - e. Jacket Temperature Limit: minus 20 to 120 degrees F.
  - 3.

## 3. EXECUTION

- A. Examination:
  - 1. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
  - 2. Verify piping has been tested before applying insulation materials.
  - 3. Verify surfaces are clean and dry, with foreign material removed.

- B. Installation – Piping Systems:
1. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
  2. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than one hour.
  3. Piping Systems Conveying Fluids Below Ambient Temperature (including storm drainage):
    - a. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
    - b. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
    - c. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
  4. Hot Piping Systems less than 140 degrees F:
    - a. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
    - b. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
    - c. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
  5. Inserts and Shields:
    - a. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
    - b. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
      - 1) Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
      - 2) Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
    - c. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
  6. Buried Piping (within building): not insulated

C. Schedules:

1. Water Supply Services Piping Insulation Schedule:

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Pipe Type		Pipe Size	Insulation Thickness (in.)
Domestic Hot Water Supply and Recirculation	P-1	1-1/4 inches and smaller 1-1/2 inches and larger	1.0 1.0
Domestic Cold Water	P-1	1-1/4 inches and smaller 1-1/2 inches and larger	1.0 1.0
Storm Drain	P-2	All above grade	1.0

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## 22 11 00 DOMESTIC WATER PIPING

### 1.1 GENERAL

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Summary:
  - 1. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.
  - 2. Related Sections include the following:
    - a. Division 22 Section "Plumbing Specialties" for water distribution piping specialties.
- C. Definitions:
  - 1. CPVC: Chlorinated polyvinyl chloride plastic.
  - 2. PA: Polyamide (nylon) plastic.
  - 3. PE: Polyethylene plastic.
  - 4. PEX: Crosslinked polyethylene plastic.
  - 5. PP: Polypropylene plastic.
  - 6. PVC: Polyvinyl chloride plastic.
- D. Performance Requirements:
  - 1. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
    - a. Domestic Water Distribution Piping: 125psi.
- E. Submittals:
  - 1. Product Data: For pipe, tube, fittings, and couplings.
- F. Quality Assurance:
  - 1. Piping materials shall bear label, stamp, or other markings of specified testing agency.
  - 2. Comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances," and NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for combined fire-protection and domestic water service piping to building.
  - 3. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

### 1.2. PRODUCTS

- A. Piping Materials: Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

- B. Copper Tubing:
1. Soft Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper.
    - a. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
    - b. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
    - c. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
  2. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.
    - a. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
    - b. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
    - c. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
    - d. Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
      - 1) Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.
- C. Valves, General:
1. Refer to Part 3 "Valve Applications" Article for applications of valves.
  2. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.
  3. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.
  4. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
  5. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
  6. Valve Actuators:
    - a. Handwheel: For valves other than quarter-turn types.
    - b. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
  7. Extended Valve Stems: On insulated valves.
  8. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- D. Copper-Alloy Ball Valves:
1. Manufacturers:
    - a. Three-Piece, Copper-Alloy Ball Valves:

- 1) Conbraco Industries, Inc.; Apollo Div.
  - 2) DynaQuip Controls
  - 3) Grinnell Corporation
  - 4) Hammond Valve
  - 5) Jamesbury, Inc.
  - 6) Kitz Corporation of America
  - 7) NIBCO Inc.
  - 8) PBM, Inc.
  - 9) Red-White Valve Corp.
  - 10) Worcester Controls
2. Copper-Alloy Ball Valves, General: MSS SP-110. Zinc content of alloys shall be 15% maximum.
  3. Three-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full - port, chrome-plated bronze ball; PTFE or TFE <Insert other> seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
  4. Refer to Section "Plumbing Specialties" for balancing and drain valves.

### 1.3. EXECUTION

#### A. Piping Applications:

1. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
2. Flanges may be used on aboveground piping, unless otherwise indicated.
3. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:
  - a. NPS 1-1/2 (DN 40) and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - b. NPS 2 (DN 50): Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - c. NPS 2-1/2 and up: Hard copper tube, Type L copper pressure fittings; and soldered joints.
4. Underground Domestic Water Piping: Use any of the following piping materials for each size range:
  - a. NPS 3 and Smaller: Soft Copper tube, Type K; copper pressure fittings; and swaged joints.
  - b. NPS 4 and larger: Ductile Iron; mechanical joints.

#### B. Valve Applications:

1. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - a. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
  - b. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
  - c. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
  - d. Drain Duty: Hose-end drain valves.

2. Domestic Water Piping: Use the following types of valves:
  - a. Ball Valves, NPS 2 (DN 50) and Smaller: Three-piece, CWP rating, copper alloy.
  - b. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Flangeless, 150-psig (1035-kPa) rating, ferrous alloy, with EPDM liner.
  - c. Spring Loaded Check Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 125, bronze.
  - d. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.
  
- C. Piping Installation:
  1. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.
  2. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 23 Section "Common Work Results for HVAC" for wall penetration systems.
  3. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each domestic water service.
  4. Perform the following steps before operation:
    - a. Close drain valves, hydrants, and hose bibbs.
    - b. Open shutoff valves to fully open position.
    - c. Open throttling valves to proper setting.
    - d. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
    - e. Remove and clean strainer screens. Close drain valves and replace drain plugs.
    - f. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.
  5. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
  6. Energize pumps and verify proper operation.
  
- D. Joint Construction:
  1. Refer to Division 23 Section "Common Work Results for HVAC" for basic piping joint construction.
  2. 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.
  3. Alternative joint method: Viega ProPress is acceptable.
  
- E. Valve Installation:
  1. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
    - a. Install hose-end drain valves at low points in water mains, risers, and branches.
    - b. Install stop-and-waste drain valves where indicated.

2. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.
- F. Hanger and Support Installation:
1. Install the following:
    - a. Vertical Piping: MSS Type 8 or Type 42, clamps.
    - b. Individual, Straight, Horizontal Piping Runs: According to the following:
      - 1) 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
      - 2) Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
      - 3) Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
    - c. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
    - d. Base of Vertical Piping: MSS Type 52, spring hangers.
  2. Support vertical piping and tubing at base and at each floor.
  3. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
  4. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
    - a. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
    - b. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
    - c. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
    - d. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
    - e. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
  5. Install supports for vertical copper tubing every 10 feet (3 m).
- G. Connections:
1. Drawings indicate general arrangement of piping, fittings, and specialties.
  2. Install piping adjacent to equipment and machines to allow service and maintenance.
  3. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
  4. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:
    - a. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

- b. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
  - c. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.
- H. Field Quality Control:
- 1. Inspect domestic water piping as follows:
    - a. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
      - 1) Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
    - b. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
    - c. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  - 2. Test domestic water piping as follows:
    - a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
    - b. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    - c. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
    - d. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
    - e. Prepare reports for tests and required corrective action.
- I. Adjusting: Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
- 1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
  - 2. Adjust calibrated balancing valves to flows indicated.
- J. Cleaning:
- 1. Clean and disinfect potable domestic water piping as follows:
    - a. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.

- b. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
  - 1) Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - 2) Fill and isolate system according to either of the following:
    - a) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
    - b) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
  - 3) Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  - 4) Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
2. Prepare and submit reports of purging and disinfecting activities.
3. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

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## 22 13 00 FACILITY SANITARY SEWERAGE

### 1.1 GENERAL

#### A. Summary:

1. Section Includes:
  - a. Sanitary sewer piping buried within 5 feet of building.
  - b. Sanitary sewer piping above grade.
  - c. Unions and flanges.
  - d. Pipe hangers and supports.
  - e. Bedding and cover materials.
  
2. Related Sections:
  - a. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete specified by this section.
  - b. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
  - c. Section 08 31 13 - Access Doors and Frames: Product requirements for access doors for placement by this section.
  - d. Section 31 20 00 - Earthwork: Soils for backfill in trenches. Aggregates for Earthwork: Aggregate for backfill in trenches. Trenching: Execution requirements for trenching required by this section.
  - e. Section 31 23 16 - Excavation: Product and execution requirements for excavation and backfill required by this section.

#### B. References:

1. American Society of Mechanical Engineers:
  - a. ASME A112.14.1 - Backwater Valves.
  - b. ASME A112.14.3 - Grease Interceptors.
  - c. ASME A112.14.4 - Grease Removal Devices.
  - d. ASME A112.21.1 - Floor Drains.
  - e. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
  - f. ASME B16.3 - Malleable Iron Threaded Fittings.
  - g. ASME B16.4 - Gray Iron Threaded Fittings.
  - h. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
  - i. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
  - j. ASME B31.9 - Building Services Piping.
  
2. ASTM International:
  - a. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
  - b. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - c. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
  - d. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

- e. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
- f. ASTM A536 - Standard Specification for Ductile Iron Castings.
- g. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
- h. ASTM B32 - Standard Specification for Solder Metal.
- i. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
- j. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
- k. ASTM B75 - Standard Specification for Seamless Copper Tube.
- l. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
- m. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- n. ASTM B302 - Standard Specification for Threadless Copper Pipe.
- o. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
- p. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- q. ASTM C443M - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric).
- r. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- s. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- t. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- u. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- v. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- w. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- x. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
- y. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- z. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- aa. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- bb. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- cc. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
- dd. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

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3. Cast Iron Soil Pipe Institute:
    - a. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
    - b. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
  4. Manufacturers Standardization Society of the Valve and Fittings Industry:
    - a. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
    - b. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
    - c. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
    - d. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
    - e. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
    - f. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
    - g. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
  5. Plumbing and Drainage Institute:
    - a. PDI G101 - Standard - Testing and Rating Procedure for Grease Interceptors.
- C. Submittals:
1. Section 01 33 00 - Submittal Procedures: Submittal procedures.
  2. Product Data:
    - a. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
    - b. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
    - c. Hangers and Supports: Submit manufacturers catalog information including load capacity.
    - d. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
  3. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.
  4. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- D. Closeout Submittals:
1. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
  2. Project Record Documents: Record actual locations of equipment and clean-outs.

3. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.
- E. Qualifications:
1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
  2. Installer: Company specializing in performing Work of this section with minimum three years experience.
- F. Delivery, Storage, and Handling:
1. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
  2. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- G. Environmental Requirements:
1. Section 01 60 00 - Product Requirements.
  2. Do not install underground piping when bedding is wet or frozen.
- H. Field Measurements: Verify field measurements prior to fabrication.
- I. Warranty:
1. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

## 1.2. PRODUCTS

- A. Sanitary Sewer Piping, Buried Within 5 Feet of Building:
1. Cast Iron Soil Pipe: ASTM A74, service weight, bell and spigot ends.
    - a. Fittings: Cast iron, ASTM A74.
    - b. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
  2. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material. If allowed by local code.
    - a. Fittings: ASTM D2729, PVC.
    - b. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- B. Sanitary Sewer Piping, Above Grade:
1. Cast Iron Pipe: CISPI 301, hub-less, service weight.
    - a. Fittings: Cast iron, CISPI 301.
    - b. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
  2. Copper Pipe: ASTM B42.
    - a. Fittings: ASME B16.23, cast bronze, or ASME B16.29 wrought copper.

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- b. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
    3. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material. If allowed by local code.
      - a. Fittings: ASTM D2729, PVC.
      - b. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
    4. CPVC Pipe. (for RA Plenums). Schedule 40.
      - a. Flame spread rating of 25 or less.
      - b. Smoke developed index of 50 or left.
- C. Unions and Flanges:
  1. Unions for Pipe 2 inches and Smaller:
    - a. Copper Piping: Class 150, bronze unions with soldered.
    - b. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
    - c. PVC Piping: PVC.
  2. Flanges for Pipe 2-1/2 inches and Larger:
    - a. Copper Piping: Class 150, slip-on bronze flanges.
    - b. PVC Piping: PVC flanges.
    - c. Gaskets: 1/16 inch thick preformed neoprene gaskets.
  3. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.
- D. Pipe Hangers and Supports:
  1. Manufacturers:
    - a. Carpenter & Paterson Inc.
    - b. Creative Systems Inc.
    - c. Flex-Weld, Inc.
    - d. Glope Pipe Hanger Products Inc.
    - e. Michigan Hanger Co.
    - f. Superior Valve Co.
  2. Drain, Waste, and Vent: Conform to ASME B31.9.
  3. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
  4. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
  5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  6. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
  7. Wall Support for Pipe Sizes 3 inches and Larger: Welded steel bracket and wrought steel clamp.
  8. Vertical Support: Steel riser clamp.
  9. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

10. Copper Pipe Support: Carbon-steel, copper-plated adjustable ring.

### 1.3. EXECUTION

- A. Examination:
  1. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
  2. Verify excavations are to required grade, dry, and not over-excavated.
- B. Preparation:
  1. Ream pipe and tube ends. Remove burrs.
  2. Remove scale and dirt, on inside and outside, before assembly.
  3. Prepare piping connections to equipment with flanges or unions.
  4. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- C. Installation – Hangers and Supports:
  1. Inserts:
    - a. Provide inserts for placement in concrete forms.
    - b. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
    - c. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
    - d. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
    - e. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
  2. Pipe Hangers and Supports:
    - a. Install in accordance with ASME B31.9 ASTM F708 and MSS SP 89.
    - b. Support horizontal piping as scheduled.
    - c. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
    - d. Place hangers within 12 inches of each horizontal elbow.
    - e. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
    - f. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
    - g. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
    - h. Provide copper plated hangers and supports for copper piping.
    - i. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
    - j. Install hangers adjacent to motor driven equipment with vibration isolation; refer to Section 21 05 48.

- D. Installation – Buried Piping Systems:
1. Verify connection size, location, and invert are as indicated on Drawings.
  2. Establish elevations of buried piping with not less than 4 ft of cover.
  3. Establish minimum separation of from piping in accordance with code.
  4. Remove scale and dirt on inside of piping before assembly.
  5. Excavate pipe trench in accordance with Section 31 23 16.
  6. Install pipe to elevation required for fall.
  7. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches loose depth.
  8. Install pipe on prepared clean sand bedding. 4" depth minimum.
  9. Route pipe in straight line.
  10. Pipe Cover and Backfilling:
    - a. Backfill trench in accordance with Section 31 23 23.
    - b. Maintain optimum moisture content of fill material to attain required compaction density.
    - c. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
    - d. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
    - e. Do not use wheeled or tracked vehicles for tamping.
  11. Install Work in accordance with
- E. Installation – Above Ground Piping:
1. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.
  2. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
  3. Encase exterior cleanouts in concrete flush with grade.
  4. Install floor cleanouts at elevation to accommodate finished floor.
  5. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
  6. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
  7. Install piping to maintain headroom. Do not spread piping, conserve space.
  8. Group piping whenever practical at common elevations.
  9. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 21 05 16.
  10. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.
  11. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
  12. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.
  13. Install bell and spigot pipe with bell end upstream.
  14. Sleeve pipes passing through partitions, walls and floors.

- 15. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section.
- 16. Support drainage piping at every joint.
- 17. PVC is not allowed in above ceiling return air plenum spaces. Contractor shall use cast iron, listed CPVC or other approved method.

F. Field Quality Control:

- 1. Section: Field inspecting, testing, adjusting, and balancing.
- 2. Test sanitary waste and vent piping system in accordance with applicable code local authority having jurisdiction.

G. Schedules:

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING (Feet)	HANGER ROD DIAMETER (Inches)
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
PVC (All Sizes)	4	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

*Note for Cast Iron Pipe: Provide close to joint on barrel. Also provide hanger at each change of direction and each branch connection.*

END OF SECTION



## 22 44 00 PLUMBING FIXTURES

### 1.1 GENERAL

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Summary: This Section includes plumbing fixtures and related components.
- C. Definitions:
  - 1. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
  - 2. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- D. Submittals:
  - 1. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
  - 2. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
  - 3. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.
- E. Quality Assurance:
  - 1. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
    - a. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
  - 2. 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.
  - 3. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
  - 4. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.
  - 5. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

6. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
7. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
8. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - a. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - b. Hand Sinks: NSF 2 construction.
  - c. Plastic Laundry Trays: ANSI Z124.6.
  - d. Plastic Mop-Service Basins: ANSI Z124.6.
  - e. Plastic Sinks: ANSI Z124.6.
  - f. Plastic Whirlpool Bathtubs: ANSI Z124.1 and ASME A112.19.7M.
  - g. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
  - h. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
  - i. Vitreous-China Fixtures: ASME A112.19.2M.
  - j. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
  - k. Water-Closet, Flushometer Tank Trim: ASSE 1037.
9. Comply with the following applicable standards and other requirements specified for lavatory faucets:
  - a. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
  - b. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  - c. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
  - d. Faucet Hose: ASTM D 3901.
  - e. Faucets: ASME A112.18.1M.
  - f. Hose-Connection Vacuum Breakers: ASSE 1011.
  - g. Hose-Coupling Threads: ASME B1.20.7.
  - h. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
  - i. NSF Materials: NSF 61.
  - j. Pipe Threads: ASME B1.20.1.
  - k. Supply and Drain Fittings: ASME A112.18.1M.
10. Comply with the following applicable standards and other requirements specified for shower faucets:
  - a. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
  - b. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
  - c. Faucets: ASME A112.18.1M.
  - d. Hand-Held Showers: ASSE 1014.
  - e. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
  - f. Hose-Coupling Threads: ASME B1.20.7.
  - g. Manual-Control Antiscald Faucets: ASTM F 444.
  - h. Pipe Threads: ASME B1.20.1.
  - i. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

- j. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
11. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
- a. Atmospheric Vacuum Breakers: ASSE 1001.
  - b. Brass and Copper Supplies: ASME A112.18.1M.
  - c. Manual-Operation Flushometers: ASSE 1037.
  - d. Plastic Tubular Fittings and Piping: ASTM F 409.
  - e. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
  - f. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.
12. Comply with the following applicable standards and other requirements specified for miscellaneous components:
- a. Floor Drains: ASME A112.21.1M.
  - b. Grab Bars: ASTM F 446.
  - c. Hose-Coupling Threads: ASME B1.20.7.
  - d. Off-Floor Fixture Supports: ASME A112.6.1M.
  - e. Pipe Threads: ASME B1.20.1.
  - f. Plastic Toilet Seats: ANSI Z124.5.
  - g. Supply and Drain Protective Shielding Guards: ICC A117.1.
- F. Coordination: Coordinate roughing-in and final plumbing fixture locations and verify that fixtures can be installed to comply with original design and referenced standards.

## 1.2. PRODUCTS

### A. Toilet Seats:

- 1. Toilet Seats: Solid plastic.
  - a. Configuration: Open front without cover.
  - b. Size: Elongated
  - c. Class: Heavy-duty commercial.
  - d. Color: White
  - e. Material: Solid Plastic

B. Protective Shielding Guards: Protective Shielding Guard, Manufactured, plastic enclosure for covering for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.

C. Fixture Supports: Lavatory Support, Type I, lavatory carrier with exposed arms and tie rods, Type II, lavatory carrier with concealed arms and tie rod or Type III, lavatory carrier with hanger plate and tie rod. Include steel uprights with feet.

- 1. Accessible Fixture Support: Include rectangular steel uprights.

### D. Water Closets:

- 1. Water Closets: vitreous-china fixture designed for flushometer valve operation. Refer to drawing schedules.
  - a. Products:
    - 1) American Standard, Inc.
    - 2) Crane Plumbing/Fiat Products

- 3) Kohler Co.
  - 4) TOTO USA, Inc.
  - 5) U.S. Industries, Eljer Plumbingware Div
- b. Style: Flush valve siphon jet.
    - 1) Bowl Type: Elongated with siphon-jet design.
      - a) Design Consumption: 1.28 gal./flush (5 L/flush).
    - 2) Color: White.
    - 3) Design Consumption: 1.28 gal./flush (6 L/flush) .
- E. Urinal:
- 1. Vitreous-china fixture designed for flushometer valve operation. Refer to drawing schedules.
    - a. Products:
      - 1) American Standard, Inc.
      - 2) Crane Plumbing/Fiat Products
      - 3) Kohler Co.
      - 4) TOTO USA, Inc.
      - 5) U.S. Industries, Eljer Plumbingware Div
    - b. Style: Flush valve wall mount.
      - 1) washout design.
      - 2) Color: White.
- F. Design Consumption: 0.5 gal./flush (2 L/flush)
- G. Lavatories:
- 1. Lavatories: Accessible, vitreous-china fixture.
    - a. Faucet Hole Punching: Three, 2-inch (51-mm) centers, holes.
    - b. Products:
      - 1) American Standard, Inc.
      - 2) Crane Plumbing/Fiat Products
      - 3) Kohler Co.
      - 4) TOTO USA, Inc.
      - 5) U.S. Industries, Eljer Plumbingware Div
    - c.
    - d. Faucet Hole Location: Top.
    - e. Color: White
    - f. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
    - g. Drain: Grid.
    - h. Drain Piping: NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40) chrome-plated cast-brass trap; thick tubular brass waste to wall; and wall escutcheon.
    - i. Protective Shielding Guards: as scheduled.
  - 2. Bar Sinks, Residential, single-compartment, counter-mounting, stainless-steel fixture.
    - a. Products:
      - 1) Dayton Products, Inc.
      - 2) Elkay Manufacturing Co.

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- 3) Franke Consumer Products, Inc., Federal Home Products Div.
- 4) Just Manufacturing Co.
- 5) Moen, Inc.
- 6) Sterling Plumbing Group, Inc.

- b. Drain: 3-1/2-inch (89-mm) crumb cup.
- c. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated cast-brass trap, 0.045-inch- (1.1-mm-) thick tubular brass waste to wall, and wall escutcheon.

### H. Kitchen Sinks

1. Residential, two-compartment, stainless-steel fixture. Refer to drawing schedules.
  - a. Products:
    - 1) Elkay Manufacturing Co.
    - 2) Franke Consumer Products, Inc., Federal Home Products Div.
    - 3) Just Manufacturing Co.
    - 4) Moen, Inc.
    - 5) Sterling Plumbing Group, Inc.
  - b. Food disposer, 1/2hp, as scheduled.
  - c. Accessories as scheduled

### I. Service Basins:

1. Service Basins: Flush-to-wall, floor-mounting precast terrazzo or heavy plastic basin with rim guard.
  - a. Products:
    - 1) Acorn Engineering Co.
    - 2) Crane Plumbing/Fiat Products
    - 3) Floestone Products Co
    - 4) Precast Terrazzo Enterprises, Inc.
    - 5) Stern-Williams Co.
    - 6) JONESPEC Speciality Plumbing Products
    - 7) Mustee, E. L. & Sons, Inc.
    - 8) American Standard
    - 9) Swan Corp. (The)
  - b. Refer to schedule.
  - c. Accessories. As scheduled.
  - d. Drain: Grid with NPS 3 (DN 80) outlet.

### J. Commercial Personal Showers:

1. Complete accessible shower assemblies including shower base, receptor, strainer, trap, shower wall enclosures, head assembly, shower valve.
2. General Fabrication

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- 1) Exposed Parts finish: Type 304 stainless steel or chrome-plated brass.
- 2) Nominal stainless steel thickness: 0.050 inch (1.3 mm) minimum.
- 3) Valve Bodies: Solid brass castings.
- 4) Flow Control 2gpm unless noted otherwise.
3. Pressure balancing or thermostatic mixing valves ASSE 1016. ADA Compliant
4. Handheld Showerhead. Hand held shower head on a 60" ½" flexible hose with quick disconnect and bracket.
5. Fixed shower head. Fixed head adjustable spray
6. Diverter Valve. Accessible.
7. Barrier Free Seat. As indicated by the drawings.
8. Grab Bars. Accessible
9. Shower Basin. Accessible
  - a. Slip resistant to ASTM F462
  - b. solid surface, textured floor, center drain
  - c. Drain: Grid with NPS 2 (DN 80) outlet.
10. Walls. Fiberglass/Acrylic. Finish selection by
11. Finish. Polished Chrome or as directed by Architect

### 1.3. EXECUTION

#### A. Examination:

1. Examine roughing-in for water soil 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.
2. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

#### B. Fixture Installation:

1. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
2. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
  - a. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  - b. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  - c. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
3. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.
4. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

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5. Install wall-hanging fixtures with tubular waste piping attached to supports.
6. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
7. Install counter-mounting fixtures in and attached to casework.
8. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
9. 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.
  - a. Exception: Use ball, gate, or globe valve if stops are not specified with fixture.
10. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
11. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
12. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
13. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
14. Install toilet seats on water closets.
15. 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.
16. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
17. 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.
18. Install shower, flow-control fittings with specified maximum flow rates in shower arms.
19. Install traps on fixture outlets.
  - a. Exception: Omit trap on fixtures with integral traps.
  - b. Exception: Omit trap on indirect wastes, unless otherwise indicated.
20. Install disposer in outlet of sinks indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
21. Install hot-water dispensers in back top surface of sink or in counter with spout over sink.
22. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 23 Section "Common Work Results for HVAC" for escutcheons.
23. Set shower receptors, and service basins in leveling bed of cement grout.
24. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant

color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

- C. Connections:
1. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
  2. Connect water supplies from water distribution piping to fixtures.
  3. Connect drain piping from fixtures to drainage piping.
  4. 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.
  5. 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.
  6. Ground Equipment: 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.
- D. Field Quality Control:
1. Verify that installed fixtures are categories and types specified for locations where installed.
  2. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
  3. Inspect installed fixtures for damage. Replace damaged fixtures and components.
  4. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
  5. Install fresh batteries in sensor-operated mechanisms.
- E. Adjusting:
1. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
  2. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.
  3. Replace washers and seals of leaking and dripping faucets and stops.
- F. Cleaning:
1. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
    - a. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
    - b. Remove sediment and debris from drains.
- G. Protection:
1. Provide protective covering for installed fixtures and fittings.
  2. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.



## 23 05 00 COMMON WORK RESULTS FOR HVAC

### 1.1 GENERAL

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

Mechanical contractor to provide full as-built red line drawings to the GC and owner

B. Summary:

1. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.
  - a. Piping materials and installation instructions common to most piping systems.
  - b. Escutcheons
  - c. Dielectric fittings.
  - d. Flexible connectors.
  - e. Equipment nameplate data requirements.
  - f. Labeling and identifying mechanical systems.
  - g. Field-fabricated metal and wood equipment supports.
  - h. Installation requirements common to equipment specification sections.
  - i. Mechanical demolition.
  - j. Cutting and patching.
  - k. Touchup painting and finishing.

C. Definitions:

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
5. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
6. The following are industry abbreviations for plastic materials:
  - a. CPVC: Chlorinated polyvinyl chloride plastic.
  - b. NP: Nylon plastic.
  - c. PE: Polyethylene plastic.
  - d. PVC: Polyvinyl chloride plastic.

7. The following are industry abbreviations for rubber materials:
  - a. CR: Chlorosulfonated polyethylene synthetic rubber.
  - b. EPDM: Ethylene propylene diene terpolymer rubber.
  
- D. Quality Assurance:
  1. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
  2. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.
  
- E. Delivery, Storage, and Handling:
  1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
  2. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
  3. Protect flanges, fittings, and piping specialties from moisture and dirt.
  
- F. Sequencing and Scheduling:
  1. Coordinate mechanical equipment installation with other building components.
  2. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
  3. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
  4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
  5. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
  6. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."
  7. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

## 1.2. PRODUCTS

### A. Manufacturers:

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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 following:
- B. Pipe and Pipe Fittings:
  1. Refer to individual Sections for pipe and fitting materials and joining methods.
  2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. Joining Materials:
  1. Solder Filler Metals: ASTM B 32.
    - a. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
    - b. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
    - c. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
    - d. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
    - e. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.
  2. Solvent Cements: Manufacturer's standard solvent cements for the following:
    - a. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  3. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
    - a. Sleeve: ASTM A 126, Class B, gray iron.
    - b. Followers: Malleable iron or ASTM A 536 ductile iron.
    - c. Gaskets: Rubber
    - d. Bolts and Nuts: AWWA C111
    - e. Finish: Enamel paint.
- D. Dielectric Fittings:
  1. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
  2. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
  3. Insulating Material: Suitable for system fluid, pressure, and temperature.
  4. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
  5. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150-psig (1035-kPa) minimum working pressure as required to suit system pressures.
  6. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

- a. Provide separate companion flanges and steel bolts and nuts for 150 psig (1035-kPa) minimum working pressure as required to suit system pressures.
7. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- E. Identifying Devices and Labels:
  1. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.
  2. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.
    - a. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
    - b. Location: Accessible and visible location.
  3. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch- (30-mm-) high letters for ductwork and not less than 3/4-inch- (19-mm-) high letters for access door signs and similar operational instructions.
    - a. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form and grade.
    - b. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.
  4. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.
    - a. Fabricate in sizes required for message.
    - b. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
    - c. Punch for mechanical fastening.
    - d. Thickness: 1/8 inch, unless otherwise indicated.
    - e. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.
  5. Plastic Equipment Markers: Color-coded, laminated plastic. Comply with the following color code:
    - a. Green: Cooling equipment and components.
    - b. Yellow: Heating equipment and components.
    - c. Yellow/Green: Combination cooling and heating equipment and components.
    - d. Brown: Energy reclamation equipment and components.

- e. Blue: Equipment and components that do not meet any criteria above.
  - f. For hazardous equipment, use colors and designs recommended by ASME A13.1.
  - g. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
    - 1) Name and plan number.
    - 2) Equipment service.
    - 3) Design capacity.
    - 4) Other design parameters such as pressure drop, entering and leaving conditions, and rpm.
  - h. Size: Approximate 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; and 4-1/2 by 6 inches (115 by 150 mm) for equipment.
6. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.
- a. Multiple Systems: If multiple systems of same generic name are indicated, provide identification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

### 1.3. EXECUTION

- A. Piping Systems – Common Requirements:
- 1. General Locations and Arrangements: 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.
  - 2. Install components with pressure rating equal to or greater than system operating pressure.
  - 3. Install piping free of sags and bends.
  - 4. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.
  - 5. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
  - 6. Install couplings according to manufacturer's written instructions.
  - 7. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
  - 8. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
    - a. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- b. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  - c. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
  - d. 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) Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    - 2) Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
    - 3) Align threads at point of assembly.
    - 4) Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    - 5) Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
9. Piping Connections: Make connections according to the following, unless otherwise indicated:
- a. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
  - b. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
  - c. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - d. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
- B. Equipment Installation – Common Requirements:
- 1. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
  - 2. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
  - 3. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
  - 4. 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.
  - 5. Install equipment giving right of way to piping installed at required slope.
  - 6. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.
- C. Labeling and Identifying:

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1. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
    - a. Stenciled Markers: According to ASME A13.1.
    - b. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.
    - c. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:
      - 1) Near each valve and control device.
      - 2) Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
      - 3) Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible 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 of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
      - 7) On piping above removable acoustical ceilings, except omit intermediately spaced markers.
  2. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of mechanical equipment.
    - a. Lettering Size: Minimum 1/4-inch- (6.4-mm-) high lettering for name of unit if viewing distance is less than 24 inches (610 mm), 1/2-inch- (12.7-mm-) high lettering for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
    - b. Text of Signs: Provide name of identified unit. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
  3. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.
- D. Concrete Bases: Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."
- E. Cutting and Patching:
1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

2. Repair cut surfaces to match adjacent surfaces.

END OF SECTION



## **23 05 29 – HVAC HANGERS AND SUPPORTS**

### **GENERAL**

#### 1.1 SECTION INCLUDES

- A. Pipe, ductwork, and equipment hangers, supports, anchors, saddles and shields.
- B. Mechanical flashing.
- C. Equipment curbs.
- D. Mechanical sleeves and seals.
- E. Flashing and sealing equipment and pipe stacks.
- F. Sealants, firestop insulation, putty and compounds.
- G. Pipe Stands

#### 1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
- B. References.
- C. Submittals.
- D. Operation and maintenance manuals.
- E. Project record documents.
- F. Delivery, storage, and handling.

## **2. PRODUCTS**

### 2.1 PIPE HANGERS AND SUPPORTS

- A. Hydronic Piping:
  - 1. Conform to International Mechanical Code, ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89 as applicable.
- B. Steam and Steam Condensate Piping:
  - 1. Conform to International Mechanical Code, ASME B31.1, ASTM F708, MSS SP58, MSS SP69, MSS SP89, as applicable.
- C. Refrigerant Piping
  - 1. Conform to International Mechanical Code, ASME B31.1, ASTM F708, MSS SP58, MSS SP69, MSS SP89, as applicable.

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D. Hangers and Supports:

1. Hangers for Hot and Cold Pipe Sizes 1/2 to 1-1/2 Inch, Carbon steel, adjustable swivel, band type.
2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 to 4 Inches; Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
7. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast-iron roll.
8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
10. Vertical Support: Steel riser clamp.
11. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
12. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
14. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
15. Roof Support for Hot and Cold Pipe: See PIPE STANDS section below.
16. Hangers for insulated pipe shall be enlarged to compensate for insulation thickness so that hangers support insulation. See Section 23 07 19.
17. See Section 23 05 48 for vibration isolation hangers and supports if applicable.

2.2 DUCTWORK HANGERS AND SUPPORTS

- A. 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."
- B. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- C. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:

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1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Exposed Stainless-Steel Ducts: Stainless-steel shapes and plates.

### 2.3 ACCESSORIES

- A. Hanger Rods: ASTM A36 steel or galvanized threaded both ends, threaded one end, or continuous threaded.
  1. Ductwork: Use double nuts and lock washers on threaded rod supports.

### 2.4 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

### 2.5 FLASHING

- A. Metal Flashing: 26 gage galvanized steel.
- B. Metal Counterflashing: 22 gage galvanized steel.
- C. Flexible Flashing: 47 mil thick sheet buty; compatible with roofing.
- D. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

### 2.6 EQUIPMENT CURBS

- A. Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, 1-1/2 inch thick insulation, factory installed wood nailer. Minimum 18 inch height, unless specified otherwise.

### 2.7 SLEEVES

- A. Sleeves for Pipes through Fire Rated Floors and Walls: Schedule 40 steel pipe.
- B. Sleeves for Pipes Through Non-fire Rated Floors and Walls: 18 gage galvanized steel.
- C. Sleeves for Ductwork: Galvanized steel.

### 2.8 SEALANTS, FIRESTOP INSULATION, PUTTY, AND COMPOUNDS

- A. Firestopping Insulation: Glass fiber type, non-combustible, UL listed.
- B. Firestop Putty: Non-hardening, non-shrinking, UL listed.
- C. Firestop Compounds: Cementitious material, non-shrinking, UL listed.
- D. Sealants:

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1. Non fire/smoke rated partitions: Acrylic or silicone-based caulking.
2. Fire/smoke rated partitions: Silicone based caulking; UL listed.

## 2.9 MECHANICAL SEALS

- A. Mechanical Seals: Modular mechanical type, consisting of interlocking EPDM synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with type 316 stainless steel bolts and reinforced plastic polymer pressure plates which cause rubber sealing elements to expand when tightened, providing a watertight and gas-tight seal and electrical insulation.
1. Provide high-temperature silicone links rated for 400 Deg. F for steam and condensate applications.
  2. A sleeve shall be provided for each mechanical seal.
    - a. Thermoplastic sleeves: Sleeve shall have smooth walls and shall be made of molded non-metallic high-density polyethylene (HDPE) with an integral solid water stop, Advance Products & Systems Model PWS or equivalent.
    - b. Steel sleeves: Sleeve shall have smooth walls, shall be made of Schedule 40 steel with an integral welded solid water stop, and shall have corrosion-resistant coating, Advance Products & Systems Model GWS or equivalent.

## 2.10 PIPE STANDS (ROOF)

- A. General Requirements for Pipe Stands: Shop or field –fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. High-Type, Single-Pipe Stand:
1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  2. Base: Plastic
  3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
  4. Horizontal Member: Cadmium-plated-steel or stainless-steel with plastic or stainless-steel, roller-type pipe support.
- D. High-Type, Multiple-Pipe Stand:
1. Description: Assembly of Bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
  2. Bases: One or more; plastic
  3. Vertical Members: Two or more protective-coated-steel channels.
  4. Horizontal member: Protective-coated-steel channel.
  5. Pipe Supports: galvanized-steel, clevis-type pipe hangers.

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- E. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

### 3. EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

#### 3.2 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

#### 3.3 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Support fire protection systems piping independently from other piping systems. Fire main piping may be trapezed with other piping systems. Coordinate trapeze hangers with the Sprinkler Contractor.
  - 1. Reference sections 21 05 29 and 22 05 29 for additional information regarding fire protection and plumbing piping supports and hangers.
- C. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.
- F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- G. Support vertical piping at every floor and at intervals of no more than 12 ft. Support vertical cast iron pipe at each floor at hub.

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- H. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- I. Support riser piping independently of connected horizontal piping.
- J. Provide copper plated hangers and supports for non-insulated copper pipe.
- K. Design hangers for pipe movement without disengagement of supported pipe.
- L. Prime coat steel hangers and supports in the mechanical room and other exposed areas. Refer to the Architectural reflected ceiling plans for location of exposed ceilings. Hangers and supports located in attic space, crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- M. Adjust hangers to distribute loads equally on attachments and to achieve specified pipe slopes.
- N. Saddles, Shields and Inserts
  - 1. Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
  - 2. Install protective shields MSS Type 40 on cold piping that has vapor barrier. Shields shall span an arc of 180 degrees (360 degrees on trapeze hangers with U-bolt clamps) and shall have dimensions in inches not less than the following:

<u>NPS</u>	<u>LENGTH</u>	<u>THICKNESS</u>
1 through 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 through 14	24	0.075
16 through 24	24	0.105

- 3. Pipes 8 inches and larger shall have wood inserts.
- 4. Insert materials shall be at least as long as the protective shield. Provide manufacturer-recommended saddles, inserts, and/or shields where cellular foam insulation is used. The removal of sections of cellular foam insulation for the purpose of pipe support is not acceptable.

### 3.4 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.

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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.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "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 interval 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.

### 3.5 INSTALLATION OF ANCHORS

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and with AWS Standards D1.1.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to control movement to compensators.
- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

### 3.6 FLASHING

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls and floors.
- B. Seal floor, shower, mop sink, etc. drains watertight to adjacent materials.
- C. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

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### 3.7 SLEEVES

- A. Provide pipe and duct sleeves at all fire/smoke rated partitions, exterior wall penetrations and wall penetrations into exposed areas. Pipe and duct sleeves are not required for penetrations through non-rated concealed partitions.
- B. Wall sleeves shall not be used to support pipes or ducts.
- C. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Size so as to allow for continuous insulation wrapping through sleeve.
- E. Sleeves through floors shall extend a minimum 2" above the finish floor level. Sleeves through walls should be flush with wall surface.
- F. Where piping or ductwork penetrate non-rated ceilings or walls, close off space between pipe or duct and adjacent work with urethane rod stock and caulk airtight.
- G. Seal pipe and duct penetrations through non-rated floors.
  - 1. Where piping is not located in a rated shaft and it penetrates a single non-rated floor, close off space between pipe and adjacent work with urethane rod stock and caulk airtight.
  - 2. Where piping is not located in a rated shaft and it penetrates multiple non-rated floors, close off space between pipe and adjacent work with appropriate fire-rated sealant, insulation, putty, or compound.
  - 3. Where ductwork is not located in a rated shaft and it penetrates a single non-rated floor, close off space between duct and adjacent work with appropriate fire-rated sealant, insulation, putty, or compound.
  - 4. Where ductwork is not located in a rated shaft and it penetrates multiple non-rated floors, close off space between duct and adjacent work with appropriate fire-rated sealant, insulation, putty, or compound. Install fire damper in duct at each floor level. Ductwork containing fume exhaust air shall not be provided with fire dampers.
- H. Where piping or ductwork penetrate rated floor, ceiling, or wall, close off space between pipe or duct with appropriate fire rated sealant, insulation, putty or compound. Refer to the Drawings for fire/smoke rated wall locations and the appropriate ratings.
- I. Provide on ductwork close fitting metal collar or escutcheon covers on the side of penetration that are exposed to view.
- J. Install chrome plated steel escutcheons on piping at finished surfaces.
- K. Provide mechanical seals and sleeves through exterior wall and floor penetrations and 3 hour or higher fire rated partitions.
- L. All ductwork through exterior walls to be installed with flashing and counter flashing.



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### 3.8 HANGER SCHEDULES

- A. Reference International Plumbing Code and International Mechanical Code where applicable.

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HVAC HANGERS  
AND SUPPORTS

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## **23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC**

### GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Testing adjusting, and balancing of air systems.
  - 2. Testing adjusting, and balancing of hydronic systems.
  - 3. Measurement of final operating condition of HVAC systems.
  - 4. Sound measurement of equipment operating conditions.
  - 5. Vibration measurement of equipment operating conditions.

#### 1.2 REFERENCES

- A. Associated Air Balance Council:
  - 1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
  - 1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.
- C. Natural Environmental Balancing Bureau:
  - 1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

#### 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Prior to commencing Work, submit proof of latest calibration date of each instrument.
- C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms.
- D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- E. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and Copy of NEBB Certificate of Conformance Certification.
- F. Submit draft copies of report for review prior to final acceptance of Project.
- G. Furnish reports in binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced

drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of flow measuring stations balancing valves and rough setting.
- C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance ASHRAE 111 NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
- B. Maintain one copy of each document on site.
- C. Prior to commencing Work, calibrate each instrument to be used.

#### 1.6 QUALIFICATIONS

- A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years experience.
- B. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.

#### 1.7 SEQUENCING

- A. Sequence balancing between completion of systems tested and Date of Substantial Completion.

#### 1.8 SCHEDULING

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

### PART 2 PRODUCTS

Not Used.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify systems are complete and operable before commencing work. Verify the following:
  - 1. Systems are started and operating in safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.
  - 3. Proper thermal overload protection is in place for electrical equipment.
  - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  - 5. Duct systems are clean of debris.
  - 6. Fans are rotating correctly.
  - 7. Fire and volume dampers are in place and open.
  - 8. Air coil fins are cleaned and combed.
  - 9. Access doors are closed and duct end caps are in place.
  - 10. Air outlets are installed and connected.
  - 11. Duct system leakage is minimized.
  - 12. Hydronic systems are flushed, filled, and vented.
  - 13. Pumps are rotating correctly.
  - 14. Proper strainer baskets are clean and in place or in normal position.
  - 15. Service and balancing valves are open.

### 3.2 PREPARATION

- A. Furnish instruments required for testing, adjusting, and balancing operations.
- B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

### 3.3 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

### 3.4 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Verify recorded data represents actual measured or observed conditions.

- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
- E. Report defects and deficiencies noted during performance of services, preventing system balance.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.
- H. Check and adjust systems approximately six months after final acceptance and submit report.

### 3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.
- B. Contractor shall verify motor loading (current draw) during full economizer, normal operation, and night operation. This applies to all fan motors supply, return, and power exhaust.
- C. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.
- D. Measure air quantities at air inlets and outlets.
- E. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.
- F. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
- G. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.
- H. Contractor shall replace motor sheaves as required to obtain balance. Contractor shall not be responsible for motor replacement.
- I. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

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- J. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.
- K. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- L. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- M. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.
- N. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near building entries.
- O. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- P. For variable air volume system powered units set volume controller to airflow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable-air-volume temperature control.
- Q. On fan powered VAV boxes, adjust airflow switches for proper operation.

### 3.6 WATER SYSTEM PROCEDURE

- A. Adjust water systems, after air balancing, to obtain design quantities.
- B. Use calibrated fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.
- C. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open or in normal position to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

### 3.7 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing:
  - 1. Fire Pumps.
  - 2. Plumbing Pumps.
  - 3. HVAC Pumps.
  - 4. Air Cooled Water Chillers.
  - 5. Air Coils.
  - 6. Terminal Heat Transfer Units.
  - 7. Air Handling Units.
  - 8. Fans.
  - 9. Air Filters.
  - 10. Air Terminal Units.
  - 11. Air Inlets and Outlets.
  
- B. Report Forms
  - 1. Title Page:
    - a. Name of Testing, Adjusting, and Balancing Agency
    - b. Address of Testing, Adjusting, and Balancing Agency
    - c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
    - d. Project name
    - e. Project location
    - f. Project Architect
    - g. Project Engineer
    - h. Project Contractor
    - i. Project altitude
    - j. Report date
  - 2. Summary Comments:
    - a. Design versus final performance
    - b. Notable characteristics of system
    - c. Description of systems operation sequence
    - d. Summary of outdoor and exhaust flows to indicate building pressurization
    - e. Nomenclature used throughout report
    - f. Test conditions
  - 3. Instrument List:
    - a. Instrument
    - b. Manufacturer
    - c. Model number
    - d. Serial number
    - e. Range
    - f. Calibration date
  - 4. Electric Motors:
    - a. Manufacturer
    - b. Model/Frame
    - c. HP/BHP and kW
    - d. Phase, voltage, amperage; nameplate, actual, no load
    - e. RPM
    - f. Service factor
    - g. Starter size, rating, heater elements



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- h. Sheave Make/Size/Bore
5. V-Belt Drive:
  - a. Identification/location
  - b. Required driven RPM
  - c. Driven sheave, diameter and RPM
  - d. Belt, size and quantity
  - e. Motor sheave diameter and RPM
  - f. Center to center distance, maximum, minimum, and actual
6. Pump Data:
  - a. Identification/number
  - b. Manufacturer
  - c. Size/model
  - d. Impeller
  - e. Service
  - f. Design flow rate, pressure drop, BHP and kW
  - g. Actual flow rate, pressure drop, BHP and kW
  - h. Discharge pressure
  - i. Suction pressure
  - j. Total operating head pressure
  - k. Shut off, discharge and suction pressures
  - l. Shut off, total head pressure
7. Chillers:
  - a. Identification/number
  - b. Manufacturer
  - c. Capacity
  - d. Model number
  - e. Serial number
  - f. Evaporator entering water temperature, design and actual
  - g. Evaporator leaving water temperature, design and actual
  - h. Evaporator pressure drop, design and actual
  - i. Evaporator water flow rate, design and actual
  - j. Condenser entering water temperature, design and actual
  - k. Condenser pressure drop, design and actual
  - l. Condenser water flow rate, design and actual
8. Cooling Coil Data:
  - a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Air flow, design and actual
  - f. Entering air DB temperature, design and actual
  - g. Entering air WB temperature, design and actual
  - h. Leaving air DB temperature, design and actual
  - i. Leaving air WB temperature, design and actual
  - j. Water flow, design and actual
  - k. Water pressure drop, design and actual
  - l. Entering water temperature, design and actual
  - m. Leaving water temperature, design and actual
  - n. Saturated suction temperature, design and actual
  - o. Air pressure drop, design and actual
9. Heating Coil Data:

- a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Air flow, design and actual
  - f. Water flow, design and actual
  - g. Water pressure drop, design and actual
  - h. Entering water temperature, design and actual
  - i. Leaving water temperature, design and actual
  - j. Entering air temperature, design and actual
  - k. Leaving air temperature, design and actual
  - l. Air pressure drop, design and actual
10. Return Air/Outside Air Data:
- a. Identification/location
  - b. Design air flow
  - c. Actual air flow
  - d. Design return air flow
  - e. Actual return air flow
  - f. Design outside air flow
  - g. Actual outside air flow
  - h. Return air temperature
  - i. Outside air temperature
  - j. Required mixed air temperature
  - k. Actual mixed air temperature
  - l. Design outside/return air ratio
  - m. Actual outside/return air ratio
11. Exhaust Fan Data:
- a. Location
  - b. Manufacturer
  - c. Model number
  - d. Serial number
  - e. Air flow, specified and actual
  - f. Total static pressure (total external), specified and actual
  - g. Inlet pressure
  - h. Discharge pressure
  - i. Sheave Make/Size/Bore
  - j. Number of Belts/Make/Size
  - k. Fan RPM
12. Duct Traverse:
- a. System zone/branch
  - b. Duct size
  - c. Area
  - d. Design velocity
  - e. Design air flow
  - f. Test velocity
  - g. Test air flow
  - h. Duct static pressure
  - i. Air temperature
  - j. Air correction factor
13. Duct Leak Test:
- a. Description of ductwork under test

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- b. Duct design operating pressure
  - c. Duct design test static pressure
  - d. Duct capacity, air flow
  - e. Maximum allowable leakage duct capacity times leak factor
  - f. Test apparatus
    - 1) Blower
    - 2) Orifice, tube size
    - 3) Orifice size
    - 4) Calibrated
  - g. Test static pressure
  - h. Test orifice differential pressure
  - i. Leakage
14. Air Monitoring Station Data:
- a. Identification/location
  - b. System
  - c. Size
  - d. Area
  - e. Design velocity
  - f. Design air flow
  - g. Test velocity
  - h. Test air flow
15. Flow Measuring Station:
- a. Identification/number
  - b. Location
  - c. Size
  - d. Manufacturer
  - e. Model number
  - f. Serial number
  - g. Design Flow rate
  - h. Design pressure drop
  - i. Actual/final pressure drop
  - j. Actual/final flow rate
  - k. Station calibrated setting
16. Terminal Unit Data:
- a. Manufacturer
  - b. Type, constant, variable, single, dual duct
  - c. Identification/number
  - d. Location
  - e. Model number
  - f. Size
  - g. Minimum static pressure
  - h. Minimum design air flow
  - i. Maximum design air flow
  - j. Maximum actual air flow
  - k. Inlet static pressure
17. Air Distribution Test Sheet:
- a. Air terminal number
  - b. Room number/location
  - c. Terminal type
  - d. Terminal size
  - e. Area factor

- f. Design velocity
  - g. Design air flow
  - h. Test (final) velocity
  - i. Test (final) air flow
  - j. Percent of design air flow
18. Sound Level Report:
- a. Location
  - b. Octave bands - equipment off
  - c. Octave bands - equipment on
  - d. RC level - equipment on
19. Vibration Test:
- a. Location of points:
    - 1) Fan bearing, drive end
    - 2) Fan bearing, opposite end
    - 3) Motor bearing, center (when applicable)
    - 4) Motor bearing, drive end
    - 5) Motor bearing, opposite end
    - 6) Casing (bottom or top)
    - 7) Casing (side)
    - 8) Duct after flexible connection (discharge)
    - 9) Duct after flexible connection (suction)
  - b. Test readings:
    - 1) Horizontal, velocity and displacement
    - 2) Vertical, velocity and displacement
    - 3) Axial, velocity and displacement
  - c. Normally acceptable readings, velocity and acceleration
  - d. Unusual conditions at time of test
  - e. Vibration source (when non-complying)

END OF SECTION

## 23 07 00 HVAC INSULATION

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. HVAC piping insulation, jackets and accessories.
  - 2. HVAC equipment insulation, jackets and accessories.
  - 3. HVAC ductwork insulation, jackets, and accessories.
  
- B. Related Sections:
  - 1. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
  - 2. Section 09 90 00 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

#### 1.2 REFERENCES

- A. ASTM International:
  - 1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - 2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 3. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
  - 4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
  - 5. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - 6. ASTM C450 - Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
  - 7. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
  - 8. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
  - 9. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
  - 10. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - 11. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  - 12. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
  - 13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
  - 14. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - 15. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

16. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  17. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
  18. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
  19. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
  20. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
  21. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
  22. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  23. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
  24. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- B. Sheet Metal and Air Conditioning Contractors':
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- C. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- D. Underwriters Laboratories Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
  2. UL 1978 - Standard for Safety for Grease Ducts.

### 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### 1.4 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84, and NFPA 255.

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- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Maintain one copy of each document on site.

### 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

### 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

### 1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

### 1.9 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for man made fiber.

## PART 2 PRODUCTS

### 2.1 MANUFACTURER

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
  - 1. CertainTeed.
  - 2. Knauf.
  - 3. Johns Manville.
  - 4. Owens-Corning.
  - 5. .
- B. Manufacturers for Closed Cell Elastomeric Insulation Products:
  - 1. Aeroflex. Aerocell.
  - 2. Armacell, LLC. Armaflex.
  - 3. Nomaco. K-flex.
  - 4. .
- C. Manufacturers for Polyisocyanurate Foam Insulation Products:
  - 1. Dow Chemical Company.
  - 2. .
- D. Manufacturers for Extruded Polystyrene Insulation Products:
  - 1. Dow Chemical Company.
  - 2. .

### 2.2 PIPE INSULATION

- A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.
  - 1. Thermal Conductivity: 0.23 at 75 degrees F (0.034 at 24 degrees C).
  - 2. Operating Temperature Range: 0 to 850 degrees F (minus 18 to 454 degrees C).
  - 3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints. Preformed PVC Jacket on tees, els, and other fittings.
  - 4. Jacket Temperature Limit: minus 20 to 150 degrees F (minus 29 to 66 degrees C).
- B. TYPE P-2: ASTM C547, molded glass fiber pipe insulation.
  - 1. Thermal Conductivity: 0.23 at 75 degrees F (0.034 at 24 degrees C).
  - 2. Operating Temperature Range: 0 to 850 degrees F (minus 18 to 454 degrees C).
- C. TYPE P-3: ASTM C552-07, Cellular glass insulation
  - 1. Thermal Conductivity: 0.29 at 75 degrees F (0.040 at 24 degrees C).
  - 2. Operating Temperature Range:-450 to 900 degrees F
  - 3. Vapor Barrier Jacket: VentureClad 1577CW-E, 6 mil, 0 permability, embossed natural aluminum finish
  - 4. Jacket Temperature Limit: minus 30 to 300 degrees F
- D. TYPE P-4: ASTM C612; semi-rigid, fibrous glass board noncombustible.
  - 1. Thermal Conductivity: 0.27 at 75 degrees F (0.040 at 24 degrees C).



2. Operating Temperature Range: 0 to 650 degrees F (minus 18 to 343 degrees C).
- E. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 25 degrees C).
  2. Operating Temperature Range: Range: Minus 70 to 180 degrees F (minus 57 to 82 degrees C).
- F. TYPE P-6: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.30 at 75 degrees F (0.043 at 24 degrees C).
  2. Maximum Service Temperature: 300 degrees F (149 degrees C).
  3. Operating Temperature Range: Range: Minus 58 to 300 degrees F (minus 50 to 149 degrees C).
- G. TYPE P-7: ASTM C534, Type I, flexible, nonhalogen, closed cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 24 degrees C).
  2. Maximum Service Temperature: 250 degrees F (120 degrees C).
  3. Operating Temperature Range: Range: Minus 58 to 250 degrees F (minus 50 to 120 degrees C).
- H. TYPE P-8: ASTM C547, Type I or II, mineral fiber preformed pipe insulation, noncombustible.
1. Thermal Conductivity: 0.23 at 75 degrees F (0.034 at 24 degrees C).
  2. Maximum Service Temperature: 1200 degrees F (649 degrees C).
  3. Canvas Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric treated with fire retardant lagging adhesive.
- I. TYPE P-9: ASTM C591, Type IV, polyisocyanurate foam insulation, formed into shapes for use as pipe insulation.
1. Density: 2.0 pounds per cubic foot (32 kg per cubic meter).
  2. Thermal Conductivity: 180 day aged value of 0.19 at 75 degrees F (0.027 at 24 degrees C).
  3. Operating Temperature Range: Range: Minus 297 to 300 degrees F (minus 183 to 149 degrees C).
  4. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied film of 6 mils (0.15 mm) thickness and water vapor permeance of 0.02 perms.
- J. TYPE P-10: ASTM C578, Type XIII, extruded polystyrene insulation, formed into shapes for use as pipe insulation.
1. Thermal Conductivity: 180 day aged value of 0.259 at 75 degrees F (0.037 at 24 degrees C).
  2. Operating Temperature Range: Range: Minus 297 to 165 degrees F (minus 183 to 74 degrees C).
  3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied film of 6 mils (0.15 mm) thickness and water vapor permeance of 0.02 perms.

- K. TYPE P-11: ASTM C533; Type I, hydrous calcium silicate pipe insulation, rigid molded white; asbestos free.
  - 1. Thermal Conductivity: 0.45 at 200 degrees F (0.0650 at 93 degrees C).
  - 2. Operating Temperature Range: 140 to 1200 degrees F (60 to 649 degrees C).
  
- L. TYPE P-12: ASTM C547, molded glass fiber pipe insulation.
  - 1. Thermal Conductivity: 0.23 at 75 degrees F (0.034 at 24 degrees C).
  - 2. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
  - 3. Operating Temperature Range: 0 to 850 degrees F (minus 18 to 454 degrees C).
  - 4. Canvas Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric treated with fire retardant lagging adhesive.

### 2.3 PIPE INSULATION JACKETS

- A. Vapor Retarder Jacket:
  - 1. white Kraft paper with glass fiber yarn, bonded to aluminized film.
  - 2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.
  
- B. PVC Plastic Pipe Jacket:
  - 1. Product Description: ASTM D1784, One piece molded type fitting covers and sheet material, off-white color.
  - 2. Thickness: 10 mil (0.25 mm).
  - 3. Connections: Brush on welding adhesive or Pressure sensitive color matching vinyl tape.
  
- C. ABS Plastic Pipe Jacket:
  - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
  - 2. Minimum service temperature: -40 degrees F (-40 degrees C).
  - 3. Maximum service temperature of 180 degrees F (82 degrees C).
  - 4. Moisture vapor transmission: ASTM E96; 0.012 perm-inches.
  - 5. Thickness: 30 mil (0.76 mm).
  - 6. Connections: Brush on welding adhesive.
  
- D. Aluminum Pipe Jacket:
  - 1. ASTM B209.
  - 2. Thickness: 0.016 inch (0.40 mm) thick sheet.
  - 3. Finish: Smooth.
  - 4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
  - 5. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
  - 6. Metal Jacket Bands: 3/8 inch (10 mm) wide;
  - 7. Stainless Steel Pipe Jacket: ASTM A167 Type 302 304 stainless steel.
  - 8. Thickness: 0.010 inch (0.25 mm) thick.
  - 9. Finish: Smooth.

10. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.
- E. Field Applied Glass Fiber Fabric Jacket System:
  1. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
  2. Glass Fiber Fabric:
    - a. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
    - b. Blanket: 1.0 lb/cu ft (16 kg/cu m) density.
    - c. Weave: 5 x 5.
  3. Indoor Vapor Retarder Finish:
    - a. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
    - b. Vinyl emulsion type acrylic, compatible with insulation, color.

## 2.4 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches (40 mm) diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- D. Piping 2 inches (50 mm) diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches (150 mm) long, matching thickness and contour of adjoining insulation.
- E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.
- F. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- G. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- H. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- I. Adhesives: Compatible with insulation.

## 2.5 EQUIPMENT INSULATION

- A. TYPE E-1: ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.
  1. Thermal Conductivity: 0.24 at 75 degrees F ( 0.032 at 24 degrees C).
  2. Operating Temperature Range: 0 to 450 degrees F (minus 18 to 232 degrees C).
  3. Density: 1.5 pound per cubic foot (24 kilogram per cubic meter).
- B. TYPE E-2: ASTM C612; glass fiber, rigid board, noncombustible with factory applied kraft aluminum foil jacket.

1. Thermal Conductivity: 0.24 at 75 degrees F (0.035 at 24 degrees C).
  2. Operating Temperature Range: 0 to 450 degrees F (minus 18 to 232 degrees C).
  3. Density: 3.0 pound per cubic foot (48 kilogram per cubic meter).
  4. Jacket Temperature Limit: minus 20 to 150 degrees F (minus 29 to 66 degrees C).
- C. TYPE E-3: ASTM C612; semi-rigid, fibrous glass board noncombustible, end grain adhered to jacket.
1. Thermal Conductivity: 0.27 at 75 degrees F (0.040 at 24 degrees C).
  2. Operating Temperature Range: 0 to 650 degrees F (minus 18 to 343 degrees C).
  3. Vapor Barrier Jacket: ASTM C1136, Type II, factory applied reinforced foil kraft with self-sealing adhesive joints.
  4. Jacket Temperature Limit: minus 20 to 150 degrees F (minus 29 to 66 degrees C).
- D. TYPE E-4: ASTM C612; semi-rigid, fibrous glass board noncombustible.
1. Thermal Conductivity: 0.27 at 75 degrees F (0.040 at 24 degrees C).
  2. Operating Temperature Range: 0 to 650 degrees F (minus 18 to 343 degrees C).
- E. TYPE E-5: ASTM C612; glass fiber, semi-rigid board, noncombustible.
1. Thermal Conductivity: 0.23 at 75 degrees F (0.033 at 24 degrees C).
  2. Maximum Operating Temperature: 850 degrees F (450 degrees C).
  3. Density: 3.0 pound per cubic foot (48 kilogram per cubic meter).
- F. TYPE E-6: ASTM C553; mineral fiber blanket, Type I.
1. Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 24 degrees C).
  2. Maximum Operating Temperature: 1000 degrees F (538 degrees C).
  3. Density: 1.0 pound per cubic foot (16 kilogram per cubic meter).
- G. TYPE E-7: ASTM C533; Type II, hydrous calcium silicate block insulation, asbestos free.
1. Thermal Conductivity: 0.45 at 200 degrees F (0.0650 at 93 degrees C).
  2. Operating Temperature Range: 140 to 1200 degrees F (60 to 649 degrees C).
- H. TYPE E-8: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
1. Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 25 degrees C).
  2. Operating Temperature Range: Range: Minus 70 to 220 degrees F (minus 57 to 105 degrees C).
- I. TYPE E-9: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
1. Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 25 degrees C).
  2. Operating Temperature Range: Range: Minus 70 to 220 degrees F (minus 57 to 105 degrees C).
  3. Vapor Barrier Jacket: VentureClad 1577CW-E, 6 mil, 0 permability, embossed natural aluminum finish

4. Jacket Temperature Limit: minus 30 to 300 degrees F

## 2.6 EQUIPMENT INSULATION JACKETS

- A. PVC Plastic Equipment Jacket:
  1. Product Description: ASTM D1784, sheet material, off-white color.
  2. Minimum Service Temperature: -40 degrees F (-40 degrees C).
  3. Maximum Service Temperature: 150 degrees F (66 degrees C).
  4. Moisture Vapor Transmission: ASTM E96; 0.002 perm-inches.
  5. Thickness: 10 mil (0.25 mm).
  6. Connections: Brush on welding adhesive Pressure sensitive color matching vinyl tape.
- B. Aluminum Equipment Jacket:
  1. ASTM B209.
  2. Thickness: 0.016 inch (0.40 mm) thick sheet.
  3. Finish: Smooth.
  4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
  5. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
  6. Metal Jacket Bands: 3/8 inch (10 mm) wide;
- C. Stainless Steel Equipment Jacket:
  1. ASTM A167 Type 302 304 stainless steel.
  2. Thickness: 0.010 inch (0.25 mm) thick.
  3. Finish: Smooth.
  4. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.
- D. Canvas Equipment Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.
- E. Vapor Retarder Jacket:
  1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
  2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.
- F. Field Applied Glass Fiber Fabric Jacket System:
  1. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
  2. Glass Fiber Fabric:
    - a. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
    - b. Blanket: 1.0 lb/cu ft (16 kg/cu m) density.
    - c. Weave: 5 x 5.
  3. Indoor Vapor Retarder Finish:
    - a. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
    - b. Vinyl emulsion type acrylic, compatible with insulation, black color.

## 2.7 EQUIPMENT INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.

- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- E. Adhesives: Compatible with insulation.

## 2.8 DUCTWORK INSULATION

- A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
  - 1. Thermal Conductivity: 0.30 at 75 degrees F (0.043 at 24 degrees C).
  - 2. Maximum Operating Temperature: 250 degrees F (121 degrees C).
  - 3. Density: 0.75 pound per cubic foot (12 kilogram per cubic meter).
- B. TYPE D-2: ASTM C612, Type IA or IB, rigid glass fiber, with factory applied all service facing meeting ASTM C1136, Type II.
  - 1. Thermal Conductivity: 0.24 at 75 degrees F ( 0.035 at 24 degrees C).
  - 2. Density: 1.6 pound per cubic foot (26 kilogram per cubic meter).
- C. TYPE D-3: ASTM C612, Type IA or IB, rigid glass fiber, no facing.
  - 1. Thermal Conductivity: 0.24 at 75 degrees F (0.035 at 24 degrees C).
  - 2. Density: 1.6 pound per cubic foot (26 kilogram per cubic meter).
- D. TYPE D-4: ASTM C1071, Type I, flexible, glass fiber duct liner with coated air side.
  - 1. Thermal Conductivity: 0.28 at 75 degrees F (0.040 at 24 degrees C).
  - 2. Density: 1.5 pound per cubic foot (24 kilogram per cubic meter).
  - 3. Maximum Operating Temperature: 250 degrees F (121 degrees C).
  - 4. Maximum Air Velocity: 6,000 feet per minute (30.5 meter per second).
- E. TYPE D-5: ASTM C1071, Type II, rigid, glass fiber duct liner with coated air side.
  - 1. Thermal Conductivity: 0.23 at 75 degrees F (0.033 at 24 degrees C).
  - 2. Density: 3.0 pound per cubic foot (48 kilogram per cubic meter).
  - 3. Maximum Operating Temperature: 250 degrees F (121 degrees C).
  - 4. Maximum Air Velocity: 4,000 feet per minute (20.3 meter per second).
- F. TYPE D-6: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
  - 1. Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 24 degrees C).
  - 2. Service Temperature Range: Range: Minus 58 to 180 degrees F (minus 50 to 82 degrees C).
- G. TYPE D-7: ASTM C518, Owens Corning "Thermapink" Extruded Polystyrene insulation
  - 1. Thermal Conductivity: 0.20 at 75 degrees F (0.039 at 24 degrees C).
  - 2. Service Temperature Range: Range: -10 to 150 degrees F

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3. Vapor Barrier Jacket: VentureClad 1577CW-E, 6 mil, 0 permability, embossed natural aluminum finish
  4. Jacket Temperature Limit: minus 30 to 300 degrees F
- H. TYPE D-8: Inorganic blanket encapsulated with scrim reinforced foil meeting UL 1978.
1. Thermal Conductivity: 0.42 at 500 degrees F
  2. Weight: 130 pound per 1000 square foot per inch
  3. Flame spread rating of 0 and smoke developed rating of 0 in accordance with ASTM E84.
- I. TYPE D-9: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
1. Thermal Conductivity: 0.30 at 75 degrees F (0.043 at 24 degrees C).
  2. Maximum Operating Temperature: 250 degrees F (121 degrees C).
  3. Density: 0.75 pound per cubic foot (12 kilogram per cubic meter).
  4. Canvas Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric treated with fire retardant lagging adhesive.
- J. Acoustical Liner. Refer to drawings.

### 2.9 DUCTWORK INSULATION JACKETS

- A. Aluminum Duct Jacket:
1. ASTM B209.
  2. Thickness: 0.016 inch (0.40 mm) thick sheet.
  3. Finish: Smooth.
  4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
  5. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
  6. Metal Jacket Bands: 3/8 inch (10 mm) wide;
- B. Vapor Retarder Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film 0.0032 inch (0.081 mm) vinyl.
  2. Moisture vapor transmission: ASTM E96; 0.02 perm.
  3. Secure with pressure sensitive tape.
- C. Canvas Duct Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.
- D. Outdoor Duct Jacket: VentureClad self adhesive aluminum jacketing system.
- E. Membrane Duct Jacket: ASTM D4637; Type I, EPDM; non-reinforced, 0.045 inch ( mm) thick, 48 inch (1220 mm) wide roll; white color.

## 2.10 DUCTWORK INSULATION ACCESSORIES

- A. Vapor Retarder Tape:
  - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- B. Vapor Retarder Lap Adhesive: Compatible with insulation.
- C. Adhesive: Waterproof, ASTM E162 fire-retardant type.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.
- E. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- F. Lagging Adhesive: Fire resistive to ASTM E84 NFPA 255 UL 723.
- G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
- H. Adhesives: Compatible with insulation.
- I. Membrane Adhesives: As recommended by membrane manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

### 3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
  - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
  - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing



- longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. Glass Fiber Board Insulation:
1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
  2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
  3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.
- E. Polyisocyanurate Foam Insulation Extruded Polystyrene Insulation:
1. Wrap elbows and fitting with vapor retarder tape.
  2. Seal butt joints with vapor retarder tape.
- F. Hot Piping Systems less than 140 degrees F (60 degrees C):
1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
  2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
  3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
- G. Hot Piping Systems greater than 140 degrees F (60 degrees C):
1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
  2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
  3. Insulate flanges and unions at equipment.
- H. Inserts and Shields:
1. Piping 1-1/2 inches (40 mm) Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
  2. Piping 2 inches (50 mm) Diameter and Larger: Install insert between support shield and piping and under finish jacket.
    - a. Insert Configuration: Minimum 6 inches (150 mm) long, of thickness and contour matching adjoining insulation; may be factory fabricated.
    - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
  3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

- I. Insulation Terminating Points:
  - 1. Coil Branch Piping 1 inch (25 mm) and Smaller: Terminate hot water piping at union upstream of the coil control valve.
  - 2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
  - 3. Condensate Piping: Insulate entire piping system and components to prevent condensation.
  
- J. Closed Cell Elastomeric Insulation:
  - 1. Push insulation on to piping.
  - 2. Miter joints at elbows.
  - 3. Seal seams and butt joints with manufacturer's recommended adhesive.
  - 4. When application requires multiple layers, apply with joints staggered.
  - 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
  
- K. High Temperature Pipe Insulation:
  - 1. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
  
- L. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with PVC jacket and fitting covers.
  
- M. Piping Exterior to Building: Provide vapor retarder jacket (Ventureclad). Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.
  
- N. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.
  
- O. Heat Traced Piping Interior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer.
  
- P. Heat Traced Piping Exterior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water.

### 3.3 INSTALLATION - EQUIPMENT

- A. Factory Insulated Equipment: Do not insulate.

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- B. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- D. Equipment Containing Fluids Below Ambient Temperature:
  - 1. Insulate entire equipment surfaces.
  - 2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
  - 3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
  - 4. Finish insulation at supports, protrusions, and interruptions.
- E. Equipment Containing Fluids 140 degrees F (60 degrees C) Or Less:
  - 1. Do not insulate flanges and unions, but bevel and seal ends of insulation.
  - 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
  - 3. Finish insulation at supports, protrusions, and interruptions.
- F. Equipment Containing Fluids Over 140 degrees F (60 degrees C):
  - 1. Insulate flanges and unions with removable sections and jackets.
  - 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
  - 3. Finish insulation at supports, protrusions, and interruptions.
- G. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.
- H. Equipment Located Exterior to Building: Install vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.
- I. Cover glass fiber cellular glass hydrous calcium silicate cellular foam insulation with aluminum jacket.
- J. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.
- K. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- L. Prepare equipment insulation for finish painting. Refer to Section 09 90 00.

### 3.4 INSTALLATION - DUCTWORK SYSTEMS

- A. Duct dimensions indicated on Drawings are finished inside dimensions.

- B. Insulated ductwork conveying air below ambient temperature:
  - 1. Provide insulation with vapor retarder jackets.
  - 2. Finish with tape and vapor retarder jacket.
  - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
  
- C. Insulated ductwork conveying air above ambient temperature:
  - 1. Provide with or without standard vapor retarder jacket.
  - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
  
- D. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet (3 meters) above finished floor): Finish with aluminum jacket.
  
- E. External Glass Fiber Duct Insulation:
  - 1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
  - 2. Secure insulation without vapor retarder with staples, tape, or wires.
  - 3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
  - 4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
  - 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
  
- F. External Elastomeric Duct Insulation:
  - 1. Adhere to clean oil-free surfaces with full coverage of adhesive.
  - 2. Seal seams and butt joints with manufacturer's recommended adhesive.
  - 3. When application requires multiple layers, apply with joints staggered.
  - 4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
  - 5. Lift ductwork off trapeze hangers and insert spacers.
  
- G. Duct Liner:
  - 1. Adhere insulation with adhesive for 100 percent coverage.
  - 2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
  - 3. Seal and smooth joints. Seal and coat transverse joints.
  - 4. Seal liner surface penetrations with adhesive.
  - 5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.
  
- H. Kitchen Exhaust Ductwork:
  - 1. Cover duct by wrapping with insulation using butt joint with collar method.
  - 2. Overlap seams of each method by 3 inches (76 mm).
  - 3. Attach insulation using steel banding or by welded pins and clips.

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4. Install insulation without sag on underside of ductwork. Use additional fasteners to prevent sagging.
- I. Ducts Exterior to Building:
    1. Install insulation according to external duct insulation paragraph above.
    2. Provide external insulation with vapor retarder jacket. Cover with with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
    3. Finish with mineral fiber outdoor duct jacket or aluminum duct jacket or membrane duct jacket.
    4. Calk seams at flanges and joints. Located major longitudinal seams on bottom side of horizontal duct sections.
  - J. Prepare duct insulation for finish painting. Refer to Section 09 90 00.

## 3.5 SCHEDULES

## A. Ductwork Insulation Schedule:

SYSTEM	INSULATION TYPE	INSULATION THICKNESS inches (mm)
Indoor Supply Ducts (externally insulated)	D-1	2.0 (50)
Indoor Return Ducts (externally insulated)	D-1	2.0 (50)
Indoor exhaust duct	none	none
Supply Air, Return Air, Exhaust Air duct exterior to building	D-6 (w/ VentureClad Jacket)	3.0 (75)
Hydronic Heating pipe, ½" to 1.5"	P-1	1"
Hydronic Heating pipe 2" and larger	P-1	2"
Hydronic Buffer Tank	E-8	2"

Refer to schedule on drawings for specific applications as some ductwork does not require insulation (exposed to conditioned space), and some ductwork shall require special acoustic liner.

END OF SECTION

## 23 33 00 AIR DUCT ACCESSORIES

### 1.1 GENERAL

#### A. Summary:

1. Section Includes:
  - a. Back-draft dampers.
  - b. Combination fire-and-smoke dampers.
  - c. Duct access doors.
  - d. Dynamic fire dampers.
  - e. Static fire dampers.
  - f. Ceiling fire dampers.
  - g. Smoke dampers.
  - h. Volume control dampers.
  - i. Flexible duct connections.
  - j. Duct test holes.
  - k. Dial thermometers.
  - l. Static pressure gages.

#### B. References:

1. Air Movement and Control Association International, Inc.:
  - a. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
2. ASTM International:
  - a. ASTM E1 - Standard Specification for ASTM Thermometers.
3. National Fire Protection Association:
  - a. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
  - b. NFPA 92A - Recommended Practice for Smoke-Control Systems.
4. Sheet Metal and Air Conditioning Contractors:
  - a. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
5. Underwriters Laboratories Inc.:
  - a. UL 555 - Standard for Safety for Fire Dampers.
  - b. UL 555C - Standard for Safety for Ceiling Dampers.
  - c. UL 555S - Standard for Safety for Smoke Dampers.

#### C. Submittals:

1. Section 01 33 00 - Submittal Procedures: Submittal procedures.
2. Product Data: Submit data for shop fabricated assemblies and hardware used.
3. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
  - a. Fire dampers including locations and ratings.
  - b. Smoke dampers including locations and ratings.
  - c. Backdraft dampers.
  - d. Flexible duct connections.
  - e. Volume control dampers.
  - f. Duct access doors.

- g. Duct test holes.
- 4. Product Data: For fire dampers smoke dampers combination fire and smoke dampers submit the following:
  - a. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
  - b. Indicate materials, construction, dimensions, and installation details.
  - c. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.
- 5. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.
- 6. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- D. Closeout Submittals:
  - 1. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
  - 2. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.
- E. Quality Assurance:
  - 1. Dampers tested, rated and labeled in accordance with the latest UL requirements.
  - 2. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.
  - 3. Maintain one copy of each document on site.
- F. Qualifications:
  - 1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- G. Delivery, Storage, and Handling:
  - 1. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
  - 2. Protect dampers from damage to operating linkages and blades.
  - 3. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
  - 4. Storage: Store materials in a dry area indoor, protected from damage.
  - 5. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.
- H. Field Measurements: Verify field measurements prior to fabrication.
- I. Coordination:
  - 1. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
  - 2. Coordinate Work where appropriate with building control Work.



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- J. Warranty:
1. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
  2. Furnish one year manufacturer warranty for duct accessories.

### 1.2. PRODUCTS

- A. Back-Draft Dampers:
1. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel. Blades, maximum 6 inch width, center pivoted, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.
- B. Static Fire Dampers: Product description. Multi Blade steel shutter gravity actuated, fusible link held, rated assembly.

### 1.3. EXECUTION

- A. Examination:
1. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
  2. Verify rated walls are ready for fire damper installation.
  3. Verify ducts and equipment installation are ready for accessories.
  4. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.
- B. Installation:
1. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.
  2. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside.
  3. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and. Review locations prior to fabrication.
    - a. Mark access doors for fire and smoke dampers on outside surface, with minimum 1/2 inch high letters reading: FIRE/SMOKE DAMPER, SMOKE DAMPER, OR FIRE DAMPER.
  4. Install temporary duct test holes and required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

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END 23 33 00.

## **23 36 00 AIR TERMINALS**

### **A. RELATED DOCUMENTS**

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### **B. SUMMARY**

1. This Section includes the following:
  - a. Single-duct air terminals.

### **C. SUBMITTALS**

1. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated. Include a schedule showing drawing designation, room location, number furnished, model number, size, and accessories furnished.
2. Maintenance Data: List of parts for each type of air terminal and troubleshooting maintenance guide to include in the maintenance manuals specified in Division 1.

### **D. QUALITY ASSURANCE**

1. Product Options: Drawings and schedules indicate requirements of air terminals and are based on specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
2. Listing and Labeling: Provide electrically operated air terminals specified in this Section that are listed and labeled.
  - a. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
3. NFPA Compliance: Install air terminals according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
4. Comply with NFPA 70 for electrical components and installation.

## **PART 2 - PRODUCTS**

### **A. MANUFACTURERS**

1. Manufacturers: Subject to compliance with requirements, provide air terminals by one of the following:
  - a. Acutherm.
  - b. Air System Components; Krueger Div.

- c. Anemostat Products Div.
- d. Carnes Co., Inc.
- e. Carrier Corp.
- f. Environmental Technologies.
- g. Nailor Industries Inc.
- h. Titus.
- i. Trane Co. (The).
- j. York International Corp.

**B. SINGLE-DUCT AIR TERMINALS**

1. Configuration: Volume-damper assembly inside unit casing. Locate control components inside protective metal shroud.
2. Casings: Steel or aluminum sheet metal of the following minimum thicknesses:
  - a. Upstream Pressure Side: 0.0239-inch (0.6-mm) steel.
  - b. Downstream Pressure Side: 0.0179-inch (0.45-mm) steel.
  - c. Upstream Pressure Side: 0.032-inch (0.8-mm) aluminum.
  - d. Downstream Pressure Side: 0.025-inch (0.63-mm) aluminum.
3. Casing Lining: Minimum of 1/2-inch- (13-mm-) thick, neoprene- or vinyl-coated, fibrous-glass insulation; 1.5-lb/cu. ft. (24-kg/cu. m) density, complying with NFPA 90A requirements and UL 181 erosion requirements. Secure lining to prevent delamination, sagging, or settling.
  - a. Coat liner surfaces and edges with erosion-resistant coating or cover with perforated metal; or other approved material.
4. Plenum Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
5. Plenum Air Outlets: S-slip and drive connections.
6. Access: Removable panels to permit access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
7. Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings.
  - a. Maximum Damper Leakage: 2 percent of nominal airflow at 1-inch wg (250-Pa) inlet static pressure.
  - b. Damper Position: Normally closed.
8. Attenuator Section: Line with 2-inch- (50-mm-) thick, neoprene- or vinyl-coated, fibrous-glass insulation.
9. Hot-Water Heating Coil: 1/2-inch (13-mm) copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig (1380 kPa); and factory installed.

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10. Controls: Damper operator, thermostat, and other devices compatible with temperature controls specified in other Division 23 Sections.
11. Electric Controls: 24-V damper actuator with wall-mounted electric thermostat and appropriate mounting hardware.
12. Electronic Controls: Bidirectional damper operator and microprocessor-based controller with integral airflow transducer and room sensor provide control with the following features:
  - a. Proportional plus integral control of room temperature.
  - b. Time-proportional reheat-coil control.
  - c. Occupied/unoccupied operating mode.
  - d. Remote reset of airflow or temperature set points.
  - e. Adjusting and monitoring with portable terminal.
  - f. Communication with temperature-control system specified in other Division 15 Sections.

### C. SOURCE QUALITY CONTROL

1. Testing Requirements: Test and rate air terminals according to ARI 880, "Industry Standard for Air Terminals."
2. Identification: Label each air terminal with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

## PART 3 - EXECUTION

### A. INSTALLATION

1. Install air terminals level and plumb, according to manufacturer's written instructions, rough-in drawings, original design, and referenced standards; and maintain sufficient clearance for normal service and maintenance.
2. Connect ductwork to air terminals according to Division 15 ductwork Sections.

### B. CONNECTIONS

1. Install piping adjacent to air terminals to allow service and maintenance.
2. Hot-Water Piping: In addition to requirements in Division 15 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
3. Electrical: Comply with applicable requirements in Division 16 Sections.

4. Ground equipment.
  - a. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

C. FIELD QUALITY CONTROL

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. CLEANING

1. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

E. COMMISSIONING

1. Verify that installation of each air terminal is according to the Contract Documents.
2. Check that inlet duct connections are as recommended by air terminal manufacturer to achieve proper performance.
3. Check that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Check that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

F. DEMONSTRATION

1. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
  - a. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
  - b. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
  - c. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
  - d. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

## SECTION 23 89 00 METAL DUCTS

### 1.1 GENERAL

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Summary: This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg.
- C. Definitions:
  - 1. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula  $Btu \times in./h \times sq. \text{ ft.} \times deg \text{ F}$  or  $W/m \times K$  at the temperature differences specified. Values are expressed as Btu or W.
    - a. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.
- D. System Description: Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.
- E. Submittals:
  - 1. Product Data: For duct liner and sealing materials.
  - 2. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
  - 3. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.
- F. Quality Assurance:
  - 1. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.
  - 2. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.
- G. Delivery, Storage, and Handling:
  - 1. Deliver sealant materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
  - 2. Store and handle sealant materials according to manufacturer's written recommendations.

### 1.2 PRODUCTS

- A. Sheet Metal Materials:
1. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
  2. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
  3. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).
  4. Aluminum Sheets: ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14, sheet form with standard, one-side bright finish for ducts exposed to view and with mill finish for concealed ducts.
  5. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.
  6. Stainless Steel: ASTM A 480/A 480M, Type 316, sheet form with No. 4 finish for surfaces of ducts exposed to view; and Type 304, sheet form with No. 1 finish for concealed ducts.
- B. Duct Liner: allowed only where specifically called for by the drawings.
- C. Sealant Materials:
1. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
    - a. Joint and Seam Tape: 2 inches wide; glass-fiber fabric reinforced.
    - b. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
    - c. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
    - d. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- D. Hangers and Supports:
1. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for building materials.
    - a. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
    - b. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
  2. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
    - a. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
    - b. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.



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3. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
  4. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
    - a. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
    - b. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
    - c. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.
- E. Rectangular Duct Fabrication:
1. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
    - a. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
    - b. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
  2. Fabricate range hood exhaust ducts with 0.0598-inch- (1.5-mm-) thick, carbon-steel sheet for concealed ducts and 0.0500-inch- (1.3-mm-) thick stainless steel for exposed ducts. Weld and flange seams and joints. Comply with NFPA 96.
  3. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
    - a. Supply Ducts: 3-inch wg.
    - b. Return Ducts: 2-inch wg, negative pressure.
    - c. Exhaust Ducts: 2-inch wg, negative pressure.
  4. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of unbraced panel area, unless ducts are lined.
- F. Round and Flat-Oval Supply and Exhaust Fitting Fabrication:
1. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal seam straight duct.
  2. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.

### 1.3. EXECUTION

- A. Duct Installation, General:
1. Drawings indicate general arrangement of ducts, fittings, and accessories.
  2. Construct and install each duct system for the specific duct pressure classification indicated.
  3. Install round and flat-oval ducts in lengths not less than eight feet, unless interrupted by fittings.
  4. Install ducts with fewest possible joints.
  5. Install fabricated fittings for changes in directions, changes in size and shape, and connections.
  6. Install couplings tight to duct wall surface with a minimum of projections into duct.

7. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
  8. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
  9. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
  10. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
  11. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- B. Ductwork Material Application:
1. Unless noted otherwise, galvanized ductwork shall be used. Refer to the drawings for rectangular, spiral round or other types.
  2. Exhaust ductwork in locker room areas (concealed and exposed) shall be fabricated from aluminum materials, in accordance with current Smacna standards. Refer to the drawings for rectangular, spiral round or other types.
- C. Seam and Joint Sealing:
1. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and as compliant with IECC 2018 code requirements.
- D. Hanging and Supporting:
1. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
  2. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
  3. Support vertical ducts at a maximum interval of 16 feet and at each floor.
  4. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
  5. Install concrete inserts before placing concrete.
  6. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
- E. Connections:
1. Connect equipment with flexible connectors.
  2. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- F. Field Quality Control:
1. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.
  2. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg.
  3. Remake leaking joints and retest until leakage is less than maximum allowable.
  4. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

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- G. Adjusting:
  - 1. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.
  - 2. Refer to Section "Testing, Adjusting, and Balancing" for detailed procedures.
  
- H. Cleaning: After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

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END OF SECTION

## 23 93 00 DIFFUSERS, REGISTERS, AND GRILLES

### 1.1 GENERAL

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Summary: This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.
- C. Definitions:
  - 1. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.
  - 2. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.
  - 3. Register: A combination grille and damper assembly over an air opening.
- D. Submittals:
  - 1. Product Data: For each model indicated, include the following:
    - a. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
    - b. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
- E. Quality Assurance:
  - 1. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
  - 2. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

### 1.2. PRODUCTS

- A. Manufactured Units: Diffusers, registers, and grilles are scheduled on Drawings.
- B. Source Quality Control:
  - 1. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

### 1.3. EXECUTION

- A. Examination: Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting

performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

- B. Installation:
  - 1. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
  - 2. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- C. Adjusting: After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.
- D. Cleaning: After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

## 26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

### 1.1 GENERAL

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Summary: This Section includes the following:
  - 1. Supporting devices for electrical components.
  - 2. Electrical identification.
  - 3. Electricity-metering components.
  - 4. Concrete equipment bases.
  - 5. Electrical demolition.
  - 6. Cutting and patching for electrical construction.
  - 7. Touchup painting.
- C. Definitions:
  - 1. EMT: Electrical metallic tubing.
  - 2. FMC: Flexible metal conduit.
  - 3. IMC: Intermediate metal conduit.
  - 4. LFMC: Liquidtight flexible metal conduit.
  - 5. RNC: Rigid nonmetallic conduit.
  - 6. RGSC: Rigid, heavywall, galvanized steel conduct.
- D. Submittals:
  - 1. Product Data: For electricity-metering equipment.
  - 2. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
  - 3. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Quality Assurance:
  - 1. 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.
  - 2. Comply with NFPA 70.
- F. Coordination:
  - 1. 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.
    - a. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
  - 2. 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.
  - 3. Coordinate electrical service connections to components furnished by utility companies.

- a. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
  - b. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
4. 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 "Access Doors."
  5. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
  6. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

## 1.2. PRODUCTS

### A. Supporting Devices:

1. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
2. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
3. 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.
4. Slotted-Steel Channel Supports: Comply with Division 5 Section "Metal Fabrications" for slotted channel framing.
  - a. Channel Thickness: Selected to suit structural loading.
  - b. Fittings and Accessories: Products of the same manufacturer as channel supports.
5. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (203 mm) o.c., in at least one surface.
  - a. Fittings and Accessories: Products of the same manufacturer as channels and angles.
  - b. Fittings and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
6. 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.
7. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
8. 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.
9. Expansion Anchors: Carbon-steel wedge or sleeve type.
10. Toggle Bolts: All-steel springhead type.



11. Powder-Driven Threaded Studs: Heat-treated steel.
- B. Electrical Identification:
1. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
  2. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.
    - a. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
    - b. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
    - c. Color: Black letters on orange background.
    - d. Legend: Indicates voltage.
  3. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick (25 mm wide by 0.08 mm thick).
  4. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
    - a. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
    - b. Compounded for permanent direct-burial service.
    - c. Embedded continuous metallic strip or core.
    - d. Printed legend that indicates type of underground line.
  5. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
  6. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
  7. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.
  8. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
  9. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6-mm) grommets in corners for mounting.
  10. 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.
- C. Equipment for Utility Company's Electricity Metering:
1. not used

- D. Equipment for Electricity Metering by Owner: Not used.
- E. Concrete Bases:
  - 1. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
  - 2. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."
- F. Touch-up Paint:
  - 1. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
  - 2. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

### 1.3. EXECUTION

- A. Electrical Equipment Installation:
  - 1. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
  - 2. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
  - 3. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
  - 4. Right of Way: Give to raceways and piping systems installed at a required slope.
- B. Electrical Supporting Device Application:
  - 1. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
  - 2. Dry Locations: Steel materials.
  - 3. Support Clamps for PVC Raceways: Click-type clamp system.
  - 4. Selection of Supports: Comply with manufacturer's written instructions.
  - 5. 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.
- C. Support Installation:
  - 1. Install support devices to securely and permanently fasten and support electrical components.
  - 2. 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.
  - 3. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
  - 4. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
  - 5. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
  - 6. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.
  - 7. 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.

8. 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.
  9. Simultaneously install vertical conductor supports with conductors.
  10. 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.
  11. 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.
  12. 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.
  13. 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:
    - a. Wood: Fasten with wood screws or screw-type nails.
    - b. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
    - c. New Concrete: Concrete inserts with machine screws and bolts.
    - d. Existing Concrete: Expansion bolts.
    - e. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
    - f. Steel: Welded threaded studs or spring-tension clamps on steel.
      - 1) Field Welding: Comply with AWS D1.1.
    - g. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
    - h. Light Steel: Sheet-metal screws.
    - i. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.
- D. Identification Materials and Devices:
1. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
  2. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
  3. Self-Adhesive Identification Products: Clean surfaces before applying.
  4. Identify raceways and cables with color banding as follows:
    - a. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. 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.
- b. 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 (8-m) maximum intervals in congested areas.
  - c. Colors: As follows:
    - 1) Fire Alarm System: Red
    - 2) Security System: Blue and yellow.
    - 3) Telecommunication System: Green and yellow.
- 5. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
  - 6. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. If 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.
  - 7. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
    - a. Phase A: Black
    - b. Phase B: Red
    - c. Phase C: Blue
    - d. Neutral: White
    - e. Ground: Green
  - 8. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
    - a. Phase A: Yellow
    - b. Phase B: Brown
    - c. Phase C: Orange
    - d. Neutral: Grey
    - e. Ground: Green with white trace.
  - 9. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed 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.
  - 10. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- E. Utility Company Electricity-Metering Equipment: refer to drawings
  - F. Firestopping: Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

- G. Concrete Bases: Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."
- H. Cutting and Patching:
1. 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.
  2. 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.
- I. Field Quality Control: 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. Electrical demolition.
  8. Cutting and patching for electrical construction.
  9. Touchup painting.
- J. Refinishing and Touchup Painting: Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
  2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
  3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
- K. Cleaning and Protection:
1. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
  2. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

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END OF SECTION

## **26 05 19 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

### **PART 1 GENERAL**

#### **A. SUMMARY**

- a. Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.

#### **B. REFERENCES**

1. International Electrical Testing Association:
  - a. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
2. National Fire Protection Association:
  - a. NFPA 70 - National Electrical Code.
  - b. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
3. Underwriters Laboratories, Inc.:
  - a. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

#### **C. SYSTEM DESCRIPTION**

1. Product Requirements: Provide products as follows:
  - a. Solid conductor for feeders and branch circuits 10 AWG and smaller.
  - b. Stranded conductors for control circuits.
  - c. Conductor not smaller than 12 AWG for power and lighting circuits.
  - d. Conductor not smaller than 14 AWG for control circuits.
  - e. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.
2. Wiring Methods: Provide the following wiring methods:
  - a. Concealed Dry Interior Locations: Use only building wire in raceway.
  - b. Exposed Dry Interior Locations: Use only building wire in raceway.
  - c. Above Accessible Ceilings: Use only building wire in raceway.
  - d. Wet or Damp Interior Locations: Use only building wire in raceway.
  - e. Exterior Locations: Use only building wire in raceway.

#### **D. DESIGN REQUIREMENTS**

1. Conductor sizes are based on copper unless indicated as aluminum or "AL".
2. When aluminum conductor is substituted for copper conductor, size to match circuit requirements, terminations, conductor ampacity and voltage drop.

E. SUBMITTALS

1. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
2. Product Data: Submit for building wire and each cable assembly type.
3. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.
4. Test Reports: Indicate procedures and values obtained.

F. CLOSEOUT SUBMITTALS

1. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
2. Project Record Documents: Record actual locations of components and circuits.

G. QUALITY ASSURANCE

1. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.
2. Perform Work in accordance with
3. Maintain one copy of each document on site.

H. QUALIFICATIONS

1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

I. FIELD MEASUREMENTS

1. Verify field measurements are as indicated on Drawings.

J. COORDINATION

1. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
2. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.
3. Wire and cable routing indicated is approximate unless dimensioned.

**PART 2 PRODUCTS**

A. BUILDING WIRE

1. Manufacturers:



## #2310 KC PSB - North Employee Washroom Remodel

- a. AETNA
  - b. American Insulated Wire Corp.
  - c. Colonial Wire
  - d. Encore Wire
  - e. General Cable Co.
  - f. Republic Wire
  - g. Rome Cable
  - h. Service Wire Co.
  - i. Southwire Model
  - j. Superior Essex
2. Product Description: Single conductor insulated wire.
  3. Conductor: Copper.
  4. Insulation Voltage Rating: 600 volts.
  5. Insulation Temperature Rating: 75 degrees C.
  6. Insulation Material: Thermoplastic.
- B. SERVICE ENTRANCE CABLE**
1. Manufacturers:
    - a. Diamond Wire & Cable Co.
    - b. Essex Group Inc.
    - c. General Cable Co.
  2. Conductor: Copper.
  3. Insulation Voltage Rating: 600 volts.
  4. Insulation: Type.
- C. TERMINATIONS**
1. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.
  2. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

## **PART 3 EXECUTION**

### **A. EXAMINATION**

1. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
2. Verify interior of building has been protected from weather.

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3. Verify mechanical work likely to damage wire and cable has been completed.
4. Verify raceway installation is complete and supported.

B. PREPARATION

1. Completely and thoroughly swab raceway before installing wire.

C. EXISTING WORK

1. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.
2. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.
3. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.
4. Extend existing circuits using materials and methods as specified.
5. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

D. INSTALLATION

1. Route wire and cable to meet Project conditions.
2. Neatly train and lace wiring inside boxes, equipment, and panelboards.
3. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.
4. Special Techniques--Building Wire in Raceway:
  - a. Pull conductors into raceway at same time.
  - b. Install building wire 4 AWG and larger with pulling equipment.
5. Special Techniques - Cable:
  - a. Protect exposed cable from damage.
  - b. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
  - c. Use suitable cable fittings and connectors.
6. Special Techniques - Wiring Connections:
  - a. Clean conductor surfaces before installing lugs and connectors.
  - b. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

## #2310 KC PSB - North Employee Washroom Remodel

- c. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
  - d. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
  - e. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
  - f. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
  - g. Install suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.
7. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
  8. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.
  9. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.
  10. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

### E. WIRE COLOR

1. General:
  - a. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
    - 1.) Black and red for single phase circuits at 120/240 volts.
    - 2.) Black, red, and blue for circuits at 120/208 volts single or three phase.
    - 3.) Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
  - b. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
    - 1.) Black and red for single phase circuits at 120/240 volts.
    - 2.) Black, red, and blue for circuits at 120/208 volts single or three phase.
    - 3.) Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
2. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.
3. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

4. Feeder Circuit Conductors: Uniquely color code each phase.
5. Ground Conductors:
  - a. For 6 AWG and smaller: Green.
  - b. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

F. FIELD QUALITY CONTROL

1. Section: Field inspecting, testing, adjusting, and balancing.
2. Inspect and test in accordance with NETA ATS, except Section 4.
3. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

## 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### 1.1 GENERAL

- A. Summary: This Section includes:
  - 1. Rod electrodes.
  - 2. Mechanical connectors.
  - 3. Exothermic connections.
  
- B. References:
  - 1. Institute of Electrical and Electronics Engineers:
    - a. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
    - b. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.
  
  - 2. International Electrical Testing Association:
    - a. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
  
  - 3. National Fire Protection Association:
    - a. NFPA 70 - National Electrical Code.
    - b. NFPA 99 - Standard for Health Care Facilities.
  
- C. System Description:
  - 1. Grounding systems use the following elements as grounding electrodes:
    - a. Metal underground water pipe.
    - b. Concrete-encased electrode.
    - c. Rod electrode.
  
- D. Performance Requirements:
  - 1. Grounding System Resistance: 5 ohms maximum.
  
- E. Submittals:
  - 1. Product Data: Submit data on grounding electrodes and connections.
  - 2. Test Reports: Indicate overall resistance to ground.
  
- F. Closeout Submittals:
  - 1. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
  - 2. Project Record Documents: Record actual locations of components and grounding electrodes.
  
- G. Quality Assurance:
  - 1. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.
  - 2. Perform Work in accordance with

- H. Qualifications:
  - 1. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
  - 2. Installer: Company specializing in performing work of this section with minimum years experience.
  
- I. Delivery, Storage, and Handling:
  - 1. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
  - 2. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
  - 3. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.
  - 4. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.
  
- J. Coordination:
  - 1. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
  - 2. Complete grounding and bonding of building reinforcing steel prior concrete placement.

## 1.2. PRODUCTS

- A. Rod Electrodes:
  - 1. Manufacturers:
    - a. Erico, Inc.
    - b. O-Z Gedney Co.
    - c. Thomas & Betts, Electrical
  - 2. Product Description:
    - a. Material: Copper-clad steel or Copper.
    - b. Diameter: 3/4 inch.
    - c. Length: 10 feet.
  - 3. Connector: Connector for exothermic welded connection. or U-bolt clamp.
  
- B. Wire:
  - 1. Material: Stranded copper.
  - 2. Foundation Electrodes: 4 AWG.
  - 3. Grounding Electrode Conductor: Copper conductor bare.
  - 4. Bonding Conductor: Copper conductor insulated.
  
- C. Mechanical Connectors:
  - 1. Manufacturers:
    - a. Erico, Inc.
    - b. ILSCO Corporation
    - c. O-Z Gedney Co.
    - d. Thomas & Betts, Electrical

2. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.
- D. Exothermic Connections:
1. Manufacturers:
    - a. Copperweld, Inc.
    - b. ILSCO Corporation
    - c. O-Z Gedney Co.
    - d. Thomas & Betts, Electrical
  2. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

### 1.3. EXECUTION

- A. Examination:
1. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
  2. Verify final backfill and compaction has been completed before driving rod electrodes.
- B. Preparation: Remove paint, rust, mill oils, surface contaminants at connection points.
- C. Existing Work:
1. Modify existing grounding system to maintain continuity to accommodate renovations.
  2. Extend existing grounding system using materials and methods compatible with existing electrical installations, or as specified.
- D. Installation:
1. Install in accordance with IEEE 142
  2. Install rod electrodes at indicated
  3. Install grounding and bonding conductors concealed from view.
  4. Install grounding well pipe with cover at. Install well pipe top flush with finished grade.
  5. Install 4 AWG bare copper wire in foundation footing.
  6. Bond together metal siding not attached to grounded structure; bond to ground.
  7. Bond together reinforcing steel and metal accessories in structures.
  8. Bond together each metallic raceway, pipe, duct and other metal object entering. Install AWG bare copper bonding conductor.
  9. Install isolated grounding conductor for circuits supplying in accordance with IEEE 1100.
  10. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
  11. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available,

install artificial station ground by means of driven rods or buried electrodes.

12. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
13. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.
14. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.
15. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.
16. Permanently attach equipment and grounding conductors prior to energizing equipment.

E. Field Quality Control:

1. Inspect and test in accordance with NETA ATS, except Section 4.
2. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.
3. Perform ground resistance testing in accordance with IEEE 142.
4. Perform leakage current tests in accordance with NFPA 99.
5. Perform continuity testing in accordance with IEEE 142.
6. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION



## 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Conduit supports.
  - 2. Formed steel channel.
  - 3. Spring steel clips.
  - 4. Sleeves.
  - 5. Mechanical sleeve seals.
  - 6. Fire stopping relating to electrical work.
  - 7. fire stopping accessories.
  - 8. Equipment bases and supports.
  
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
  - 2. Section 27 05 29 - Hangers and Supports for Communications Systems.
  - 3. Section 28 05 29 - Hangers and Supports for Electronic Safety and Security.

#### 1.2 REFERENCES

- A. ASTM International:
  - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
  - 3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
  - 4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
  
- B. FM Global:
  - 1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
  
- C. National Fire Protection Association:
  - 1. NFPA 70 - National Electrical Code.
  
- D. Underwriters Laboratories Inc.:
  - 1. UL 263 - Fire Tests of Building Construction and Materials.
  - 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
  - 3. UL 1479 - Fire Tests of Through-Penetration Firestops.
  - 4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
  - 5. UL - Fire Resistance Directory.
  
- E. Intertek Testing Services (Warnock Hersey Listed):
  - 1. WH - Certification Listings.

### 1.3 DEFINITIONS

- A. Fire stopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

### 1.4 SYSTEM DESCRIPTION

- A. Fire stopping Materials: ASTM E119, ASTM E814, to achieve fire ratings
- B. Surface Burning: ASTM E84 with maximum flame spread / smoke developed rating of 25/450.
- C. Firestop interruptions to fire rated assemblies, materials, and components.

### 1.5 PERFORMANCE REQUIREMENTS

- A. Fire stopping: Conform to applicable code FM for fire resistance ratings and surface burning characteristics.
- B. Fire stopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

### 1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data:
  - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
  - 2. Fire stopping: Submit data on product characteristics, performance and limitation criteria.
- D. Fire stopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.
- F. Manufacturer's Installation Instructions:
  - 1. Hangers and Supports: Submit special procedures and assembly of components.
  - 2. Fire stopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

- H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

#### 1.7 QUALITY ASSURANCE

- A. Through Penetration Fire stopping of Fire Rated Assemblies: ASTM E814 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
  - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
  - 2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
    - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.
- B. Through Penetration Fire stopping of Non-Fire Rated Floor Assemblies: Materials to resist free passage of flame and products of combustion.
  - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
  - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with
- G. Maintain one copy of each document on site.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing work of this section with minimum years' experience.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

#### 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not apply fire stopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of fire stopping materials.
- D. Provide ventilation in areas to receive solvent cured materials.

### **PART 2 PRODUCTS**

#### 2.1 CONDUIT SUPPORTS

- A. Manufacturers:
  - 1. Allied Tube & Conduit Corp.
  - 2. Electroline Manufacturing Company
  - 3. O-Z Gedney Co. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- D. Conduit clamps - general purpose: One-hole malleable iron for surface mounted conduits.
- E. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

#### 2.2 FORMED STEEL CHANNEL

- A. Manufacturers:
  - 1. Allied Tube & Conduit Corp.
  - 2. B-Line Systems
  - 3. Midland Ross Corporation, Electrical Products Division
  - 4. Unistrut Corp.
- B. Product Description: Galvanized 12 gage) thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

- A. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

- A. Furnish materials in accordance with
- B. Sleeves for Through Non-Fire Rated Floors: 18 gage thick galvanized steel.
- C. Sleeves for Through Non-Fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- D. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- E. Stuffing Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
  - 1. Thunderline Link-Seal, Inc.
  - 2. NMP Corporation
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

- A. Manufacturers:
  - 1. Dow Corning Corp.
  - 2. Fire Trak Corp.
  - 3. Hilti Corp.
  - 4. International Protective Coating Corp.
  - 5. 3M fire Protection Products
  - 6. Specified Technology, Inc.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
  - 1. Silicone fire stopping Elastomeric fire stopping: Single component silicone elastomeric compound and compatible silicone sealant.
  - 2. Foam Fire stopping Compounds: Single component foam compound.
  - 3. Formulated Fire stopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
  - 4. Fiber Stuffing and Sealant Fire stopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.

5. Mechanical fire stopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent fire stopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: Dark gray.

## 2.7 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by fire stopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
  1. Mineral fiberboard.
  2. Mineral fiber matting.
  3. Sheet metal.
  4. Plywood or particle board.
  5. Alumina silicate fire board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
  1. Furnish UL listed products.
  2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
  1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
  2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive fire stopping.

### 3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of fire stopping material.
- B. Remove incompatible materials affecting bond.
- C. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- D. Obtain permission from Architect/Engineer before drilling or cutting structural members.

### 3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
  - 1. Concrete Structural Elements: Provide precast inserts, powder actuated anchors and preset inserts.
  - 2. Steel Structural Elements: Provide beam clamps.
  - 3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
  - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide hollow wall fasteners.
  - 5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
  - 6. Sheet Metal: Provide sheet metal screws.
  - 7. Wood Elements: Provide wood screws.
- B. Inserts:
  - 1. Install inserts for placement in concrete forms.
  - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
  - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
  - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- C. Install conduit and raceway support and spacing in accordance with NEC.
- D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- E. Install multiple conduit runs on common hangers.
- F. Supports:
  - 1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
  - 2. Install surface mounted cabinets and panelboards with minimum of four anchors.
  - 3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

4. Support vertical conduit at every other floor.

G. Install Work in accordance with

### 3.4 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring fire stopping.
- B. Apply primer where recommended by manufacturer for type of fire stopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply fire stopping material in sufficient thickness to achieve required fire and smoke rating.
- D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
- E. Place intumescent coating in sufficient coats to achieve rating required.
- F. Remove dam material after fire stopping material has cured.
- G. Fire Rated Surface:
  - 1. Seal opening at floor, ceiling, as follows:
    - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
    - b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
    - c. Pack void with backing material.
    - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
  - 2. Where cable tray, bus, cable bus, conduit, wireway, trough, penetrates fire rated surface, install fire stopping product in accordance with manufacturer's instructions.
- H. Non-Rated Surfaces:
  - 1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
    - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
    - b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
    - c. Install type of fire stopping material recommended by manufacturer.
  - 2. Install escutcheons floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.



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3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

### 3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

### 3.6 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
- B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with stuffing insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- G. Install chrome plated steel escutcheons at finished surfaces.

### 3.7 FIELD QUALITY CONTROL

- A. Section: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed fire stopping for compliance with specifications and submitted schedule.

### 3.8 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of fire stopping materials.

3.9 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

## 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

### 1.1 GENERAL

- A. Summary: Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
- B. References:
1. American National Standards Institute:
    - a. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
    - b. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
    - c. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).
  2. National Electrical Manufacturers Association:
    - a. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
    - b. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
    - c. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
    - d. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
    - e. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
    - f. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
    - g. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- C. System Description:
1. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
  2. Underground More than 5 feet outside Foundation Wall: Provide rigid steel conduit or non-metallic conduit. Provide cast metal boxes or nonmetallic handhole.
  3. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit, or nonmetallic conduit. Provide cast metal or nonmetallic boxes.
  4. In or Under Slab on Grade: Provide rigid steel conduit, thickwall nonmetallic conduit. Provide cast or nonmetallic metal boxes. Conduit penetrating a floor slab shall be rigid steel only (transition to rigid below slab).
  5. Outdoor Locations, Above Grade: Provide, intermediate metal conduit or rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
  6. In Slab Above Grade: Provide, intermediate metal conduit, or electrical metallic tubing. Provide cast boxes.

7. Wet and Damp Locations: Provide rigid steel conduit, or thickwall nonmetallic conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
  8. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
  9. Exposed Dry Locations: Provide, electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
  10. Indoor or Outdoor High Corrosion Locations (such as salt storage or processing areas). Provide PVC sch40 conduit and PVC boxes.
- D. Design Requirements:
1. Minimum Raceway Size: 3/4 inch unless otherwise specified.
- E. Submittals:
1. Section 01 33 00 - Submittal Procedures: Submittal procedures.
  2. Product Data: Submit for the following:
    - a. Flexible metal conduit.
    - b. Liquidtight flexible metal conduit.
    - c. Nonmetallic conduit.
    - d. Flexible nonmetallic conduit.
    - e. Nonmetallic tubing.
    - f. Raceway fittings.
    - g. Conduit bodies.
    - h. Surface raceway.
    - i. Wireway
    - j. Pull and junction boxes.
    - k. Handholes
  3. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
- F. Closeout Submittals:
1. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
  2. Project Record Documents:
    - a. Record actual routing of conduits larger than 2 inch.
    - b. Record actual locations and mounting heights of outlet, pull, and junction boxes.
- G. Delivery, Storage, and Handling:
1. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
  2. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
  3. Protect PVC conduit from sunlight.

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- H. Coordination:
  - 1. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
  - 2. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

### 1.2. PRODUCTS

- A. Metal Conduit:
  - 1. Manufacturers:
    - a. Carlon Electrical Products
    - b. Hubbell Wiring Devices
    - c. Thomas & Betts Corp.
    - d. Walker Systems Inc.
    - e. The Wiremold Co.
  - 2. Rigid Steel Conduit: ANSI C80.1.
  - 3. Rigid Aluminum Conduit: ANSI C80.5.
  - 4. Intermediate Metal Conduit (IMC): Rigid steel.
  - 5. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.
- B. Flexible Metal Conduit
  - 1. Manufacturers:
    - a. Carlon Electrical Products
    - b. Hubbell Wiring Devices
    - c. Thomas & Betts Corp.
    - d. Walker Systems Inc.
    - e. The Wiremold Co.
    - f. Substitutions
  - 2. Product Description: Interlocked steel construction.
  - 3. Fittings: NEMA FB 1.
- C. Liquidtight Flexible Metal Conduit:
  - 1. Manufacturers:
    - a. Carlon Electrical Products
    - b. Hubbell Wiring Devices
    - c. Thomas & Betts Corp.
    - d. Walker Systems Inc.
    - e. The Wiremold Co. Product Description: Interlocked steel construction with PVC jacket.
  - 2. Fittings: NEMA FB 1.
- D. Electrical Metallic Tubing (EMT):
  - 1. Manufacturers:
    - a. Carlon Electrical Products
    - b. Hubbell Wiring Devices
    - c. Thomas & Betts Corp.
    - d. Walker Systems Inc.

- e. The Wiremold Co.
  - 2. Product Description: ANSI C80.3; galvanized tubing.
  - 3. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, compression type.
- E. Nonmetallic Conduit:
- 1. Manufacturers:
    - a. Carlon Electrical Products
    - b. Hubbell Wiring Devices
    - c. Thomas & Betts Corp.
    - d. Walker Systems Inc.
    - e. The Wiremold Co.
  - 2. Product Description: NEMA TC 2; Schedule 40 PVC.
  - 3. Fittings and Conduit Bodies: NEMA TC 3.
- F. Surface Metal Raceway:
- 1. Manufacturers:
    - a. Carlon Electrical Products
    - b. Hubbell Wiring Devices
    - c. Thomas & Betts Corp.
    - d. Walker Systems Inc.
    - e. The Wiremold Co.
  - 2. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
  - 3. Finish: Gray enamel.
  - 4. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.
- G. Surface Nonmetal Raceway:
- 1. Manufacturers:
    - a. Carlon Electrical Products
    - b. Hubbell Wiring Devices
    - c. Thomas & Betts Corp.
    - d. Walker Systems Inc.
    - e. The Wiremold Co. M
  - 2. Product Description: Plastic channel with fitted cover, suitable for use as surface raceway.
  - 3. Finish: Gray.
  - 4. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories, finish to match raceway.
- H. Wireway:
- 1. Manufacturers:
    - a. Carlon Electrical Products
    - b. Hubbell Wiring Devices
    - c. Thomas & Betts Corp.
    - d. Walker Systems Inc.

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- e. The Wiremold Co.
  - 2. Product Description: General purpose type wireway.
  - 3. Knockouts: Manufacturer's standard.
  - 4. Size: 6 x 6 inch 8 x 8 inch; length as indicated on Drawings.
  - 5. Cover: Screw cover
  - 6. Connector: Slip-in.
  - 7. Fittings: Lay-in type with removable top, bottom, and side; captive screws.
  - 8. Finish: Rust inhibiting primer coating with gray enamel finish.
- I. Outlet Boxes:
  - 1. Manufacturers:
    - a. Carlon Electrical Products
    - b. Hubbell Wiring Devices
    - c. Thomas & Betts Corp.
    - d. Walker Systems Inc.
    - e. The Wiremold Co.
  - 2. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
    - a. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
    - b. Concrete Ceiling Boxes: Concrete type.
  - 3. Nonmetallic Outlet Boxes: NEMA OS 2.
  - 4. Cast Boxes: NEMA FB 1, Type FD. Furnish gasketed cover by box manufacturer.
  - 5. Wall Plates for Unfinished Areas: Furnish gasketed cover.
- J. Pull and Junction Boxes:
  - 1. Manufacturers:
    - a. Carlon Electrical Products
    - b. Hubbell Wiring Devices
    - c. Thomas & Betts Corp.
    - d. Walker Systems Inc.
    - e. The Wiremold Co. Model
  - 2. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
  - 3. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- K. Adjusting:
  - 1. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
  - 2. Adjust flush-mounting outlets to make front flush with finished wall material.
  - 3. Install knockout closures in unused openings in boxes.
- L. Cleaning:
  - 1. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

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2. Clean interior of boxes to remove dust, debris, and other material.
3. Clean exposed surfaces and restore finish.

END OF SECTION



## **26 05 53 IDENTIFICATIONS FOR ELECTRICAL SYSTEMS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Nameplates.
  - 2. Labels.
  - 3. Wire markers.
  - 4. Conduit markers.
  - 5. Stencils.
  - 6. Underground Warning Tape.
  - 7. Lockout Devices.

#### **1.2 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data:
  - 1. Submit manufacturer's catalog literature for each product required.
  - 2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.
- C. Samples:
  - 1. Submit two tags, actual size.
  - 2. Submit two labels, actual size.
  - 3. Submit samples of each type of identification products applicable to project.
  - 4. Submit nameplates, 4 x 4 inch ( mm) in size illustrating materials and engraving quality.
- D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

#### **1.4 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section three years' experience.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept identification products on site in original containers. Inspect for damage.
- C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

## 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Install labels only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

## PART 2 PRODUCTS

### 2.1 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.
- B. Letter Size:
  - 1. 1/8 inch (3 mm) high letters for identifying individual equipment and loads.
  - 2. 1/4 inch (6 mm) high letters for identifying grouped equipment and loads.
- C. Minimum nameplate thickness: 1/8 inch (3 mm).

### 2.2 LABELS

- A. Labels: Embossed adhesive tape, with 3/16 inch (5 mm) white letters on black background.

### 2.3 WIRE MARKERS

- A. Description: Cloth tape, split sleeve, or tubing type wire markers.
- B. Legend:
  - 1. Power and Lighting Circuits: Branch circuit or feeder number.
  - 2. :

### 2.4 CONDUIT AND RACEWAY MARKERS

- A. Description: Nameplate fastened with adhesive Labels fastened with adhesive.

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- B. Color:
  - 1. Medium Voltage System:
  - 2. 480 Volt System: Black lettering on white background.
  - 3. 208 Volt System: Black lettering on white background.

- C. Legend:
  - 1. Medium Voltage System: HIGH VOLTAGE.
  - 2. 480 Volt System: 480 VOLTS.
  - 3. 208 Volt System: 208 VOLTS.
  - 4. System:

### 2.5 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
  - 1. Up to 2 inches (50 mm) Outside Diameter of Raceway: 1/2 inch (13 mm) high letters.
  - 2. 2-1/2 to 6 inches (64 to 150 mm) Outside Diameter of Raceway: 1 inch (25 mm) high letters.
- B. Stencil Paint: As specified in Section, semi-gloss enamel, colors conforming to the following:
  - 1. Black lettering on white background.

### 2.6 UNDERGROUND WARNING TAPE

- A. Description: 4 inch (100 mm) wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

### 3.2 EXISTING WORK

- A. Install identification on existing equipment to remain in accordance with this section.
- B. Install identification on unmarked existing equipment.
- C. Replace lost nameplates markers.
- D. Re-stencil existing equipment.

### 3.3 INSTALLATION

- A. Install identifying devices after completion of painting.

- B. Nameplate Installation:
  - 1. Install nameplate parallel to equipment lines.
  - 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
  - 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
  - 4. Secure nameplate to equipment front using screws, rivets, or adhesive.
  - 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
  - 6. Install nameplates for the following:
    - a. Switchboards.
    - b. Panelboards.
    - c. Transformers.
    - d. Service Disconnects.
    - e. .
  
- C. Label Installation:
  - 1. Install label parallel to equipment lines.
  - 2. Install label for identification of individual control device stations, and.
  - 3. Install labels for permanent adhesion and seal with clear lacquer.
  
- D. Wire Marker Installation:
  - 1. Install wire marker for each conductor at each load connection.
  - 2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
  - 3. Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.
  
- E. Conduit Raceway Marker Installation:
  - 1. Install conduit raceway marker for each conduit raceway longer than 6 feet (2000 mm).
  - 2. Conduit Raceway Marker Spacing: 20 feet (6000 mm) on center.
  
- F. Underground Warning Tape Installation:
  - 1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

## 26 09 23 LIGHTING CONTROL DEVICES

### 1.1

#### GENERAL

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Summary: Section includes photoelectric sensors, and occupancy sensors.
- C. Submittals:
  - 1. Product Data: Include dimensions and data on features, components, and ratings for lighting control devices.
  - 2. Maintenance Data: For lighting control devices to include in maintenance manuals specified in Division 1.
- D. Quality Assurance:
  - 1. Source Limitations: Obtain lighting control devices from a single source with total responsibility for compatibility of lighting control system components specified in this Section.
  - 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use and installation conditions by a testing agency acceptable to authorities having jurisdiction.
  - 3. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
  - 4. Comply with NFPA 70.
- E. Coordination: Coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions.

### 1.2. PRODUCTS

- A. Manufacturers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Photoelectric Sensors:
      - 1) Allen-Bradley/Rockwell Automation
      - 2) Area Lighting Research, Inc.
      - 3) Fisher Pierce
      - 4) Grasslin Controls, Corp.
      - 5) Intermatic, Inc.
      - 6) Paragon Electric Co., Inc.
      - 7) Rhodes: M H Rhodes, Inc.
      - 8) SSAC, Inc.
      - 9) Tork, Inc.
    - b. Occupancy Sensors:
      - 1) Arrow Hart Wiring Devices
      - 2) BRK Electronics
      - 3) Bryant Electric

- 4) Honeywell, Inc.; Home and Building Controls
- 5) Hubbell Lighting, Inc.
- 6) Lightolier
- 7) Lithonia Control Systems
- 8) MyTech Corporation
- 9) Novitas, Inc.
- 10) RAB Electric Manufacturing Co., Inc.
- 11) SenTec, Inc.
- 12) Sterner Lighting Systems, Inc.
- 13) Tork, Inc.
- 14) Touchplate
- 15) Unenco Electronics (A Hubbell Co.)
- 16) Watt Stopper, Inc. (The)

B. General Lighting Control Device Requirements:

1. Line-Voltage Surge Protection: Include in all 120- and 277-V solid-state equipment. Comply with UL 1449 and with ANSI C62.41 for Category A locations.

C. Photoelectric Sensors:

1. Description: Solid state, complying with UL 773A.
2. Light-Level Monitoring Range: 0 to 3500 fc (0 to 37 673 lx).
3. Indoor Ceiling- or Wall-Mounting Units: Semiflush, calibrated to detect adequacy of daylighting in perimeter locations, and arranged to turn artificial illumination on and off to suit varying intensities of available daylighting.
4. Outdoor Sealed Units: Weathertight housing, resistant to high temperatures and equipped with sun-glare shield and ice preventer.

D. Occupancy/Vacancy Sensors:

1. Ceiling-Mounting Units: Unit receives 24-V dc power from a remote source and, on sensing occupancy, closes contacts that provide signal input to a remote microprocessor-based lighting control system.
2. Switch-Box-Mounting Units: Unit receives power directly from switch leg of the 120- or 277-V ac circuit it controls and operates integral power switching contacts rated 800 W at 120-V ac, and 1000 W at 277-V ac, minimum.
3. Operation: Refer to lighting control scope of work on drawings.
4. Dual-Technology Type: Uses a combination of passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for area covered. Particular technology or combination of technologies that controls each function (on or off) is selectable in the field by operating controls on unit.

### 1.3. EXECUTION

A. Installation:

1. Install equipment level and plumb and according to manufacturer's written instructions.
2. Mount lighting control devices according to manufacturer's written instructions and requirements in Division 26 Section "Common Work Results for Electrical."
3. Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounting devices.

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B. Control Wiring Installation:

1. Install wiring between sensing and control devices according to manufacturer's written instructions and as specified in Division 26 Section "Conductors and Cables" for low-voltage connections and Division 26 Section "Voice and Data Systems" for digital circuits.
2. Wiring Method: Install all wiring in raceway as specified in Division 26 Section "Raceways and Boxes."
3. Wiring Method: Install all wiring in raceway as specified in Division 26 Section "Raceways and Boxes," unless run in accessible ceiling space and gypsum board partitions.
4. Bundle, train, and support wiring in enclosures.
5. Ground equipment.
6. Connections: 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.

C. Identification:

1. Identify components and power and control wiring according to Division 26 Section "Common Work Results for Electrical."

D. Field Quality Control:

1. Schedule visual and mechanical inspections and electrical tests with at least seven days' advance notice.
2. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.
3. Check tightness of electrical connections with torque wrench calibrated within previous six months. Use manufacturers recommended torque values.
4. Verify settings of photoelectric devices with photometer calibrated within previous six months.
5. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:
  - a. Continuity tests of circuits.
  - b. Operational Tests: Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
    - 1) Include testing of devices under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
6. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
7. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
8. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

E. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

F. Demonstration: Train Owner's maintenance personnel as specified below:

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1. Train Owner's maintenance personnel on troubleshooting, servicing, adjusting, and preventive maintenance. Provide a minimum of three hours' training.
2. Training Aid: Use the approved final version of maintenance manuals as a training aid.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION



## 26 14 10 WIRING DEVICES

### 1.1 GENERAL

- A. Work Includes:
  - 1. Base Bid:
    - a. Electrical Contractor:
      - 1) Receptacles, connectors, switches, and finish plates.
- B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Definitions:
  - 1. GFCI: Ground-fault circuit interrupter.
  - 2. TVSS: Transient voltage surge suppressor.
- D. Submittals:
  - 1. See Section 01 33 00 – Shop Drawings, Product Data and Samples, for submittal procedures.
  - 2. Product Data: For each product specified.
  - 3. Shop Drawings: Legends for receptacles and switch plates.
  - 4. Samples: For devices and device plates for color selection and evaluation of technical features.
  - 5. Maintenance Data: For materials and products to include in maintenance manuals specified in Section 01 73 00.
- E. Quality Assurance:
  - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
  - 2. Comply with NEMA WD 1.
  - 3. Comply with NFPA 70.
- F. Coordination:
  - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
    - a. Cord and Plug Sets: Match equipment requirements.

### 1.2. PRODUCTS

- A. Manufacturers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Wiring Devices:
      - 1) Bryant Electric, Inc.
      - 2) Eagle Electric Manufacturing Co., Inc.
      - 3) GE Company; GE Wiring Devices
      - 4) Hubbell, Inc.; Wiring Devices Div.
      - 5) Killark Electric Manufacturing Co.
      - 6) Pass & Seymour/Legrand; Wiring Devices Div.
    - b. Wiring Devices for Hazardous (Classified) Locations:

- 1) Crouse-Hinds Electrical Co.; Distribution Equipment Div.
  - 2) Killark Electric Manufacturing Co.
  - 3) Pyle-National, Inc.; an Amphenol Co.
  - 4) Appleton Electric
- c. Multi-outlet Assemblies:
- 1) Airey-Thompson Co.
  - 2) Wiremold
2. Finishes. As directed by Architect.
- B. Receptacles:
1. Straight-Blade and Locking Receptacles: Specification grade.
  2. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter.
  3. Isolated-Ground Receptacles: Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap.
    - a. Devices: Listed and labeled as isolated-ground receptacles.
    - b. Isolation Method: Integral to receptacle construction and not dependent on removable parts.
  4. TVSS Receptacles: Duplex type, NEMA WD 6, Configuration 5-20R, with integral TVSS in line to ground, line to neutral, and neutral to ground.
    - a. TVSS Components: Multiple metal-oxide varistors; rated a nominal clamp level of 500 transient-suppression voltage and minimum single transient pulse energy dissipation of 140 J line to neutral, and 70 J line to ground and neutral to ground.
    - b. Active TVSS Indication: Light visible in face of device to indicate device as "active" or "no longer active."
    - c. Identification: Distinctive marking on face of device denotes TVSS-type unit.
  5. Industrial Heavy-Duty Receptacle: Comply with IEC 309-1.
  6. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.
  7. Arc Fault Receptacles. Comply with Nema WD6, Ansi C73, UL498. 20a 5-20r two pole, three wire. Specification Grade.
- C. Cord and Plug Sets:
1. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
    - a. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
    - b. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.
- D. Switches:
1. Snap Switches: Specification grade, quiet type.
  2. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.

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- a. Switch: 20 A, 120/277-V ac.
  - b. Receptacle: NEMA WD 6, Configuration 5-20R.
3. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters.
    - a. Control: Continuously adjustable slide, or toggle. Single-pole or three-way switch to suit connections.
    - b. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable rotary knob, toggle, or slide; single pole with soft tap or other quiet switch; electromagnetic filter to eliminate noise, RF, and TV interference; and 5-inch (130-mm) wire connecting leads.
    - c. LED Lamp Dimmers: Modular; compatible with drivers capable of consistent dimming to a maximum of 1 percent of full brightness.
- E. Wall Plates: Single and combination types match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: Heavy plastic, specification grade, color/finish as directed by Architect.
  3. Material for Unfinished Spaces: Galvanized steel.
- F. Floor Service Fittings:
1. Type: Modular, flush-type, dual-service units suitable for wiring method used.
  2. Type: Modular, above-floor, dual-service units suitable for wiring method used.
  3. Compartmentation: Barrier separates power and signal compartments.
  4. Housing Material: Die-cast aluminum, satin finished.
  5. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
  6. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.
- G. Multioutlet Assemblies:
1. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
  2. Raceway Material: Metal, with manufacturer's standard finish.
  3. Wire: as indicated by drawings. Refer to drawings for additional specification
- H. Telephone/Power Service Poles:
1. Poles: Nominal 2.5-inch- (65-mm-) square cross section with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and separate channels for power and signal wiring.
  2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports, and pole foot with carpet pad attachment.
  3. Finishes: One of manufacturers standard finish and trim combinations, including painted and satin anodized-aluminum finishes and wood-grain-type trim.
  4. Wiring: as indicated by drawings.

### 1.3. EXECUTION

- A. Installation:
1. Install devices and assemblies' plumb and secure.
  2. Install wall plates when painting is complete.

3. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.
  4. Do not share neutral conductor on load side of dimmers.
  5. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
  6. Protect devices and assemblies during painting.
  7. Adjust locations at which floor service outlets are installed to suit arrangement of partitions and furnishings.
- B. Identification:
1. Comply with Section 26 05 00 - "Common Work Results for Electrical."
    - a. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
    - b. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.
- C. Connections:
1. Connect wiring device grounding terminal to outlet box with bonding jumper.
  2. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.
  3. 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.
- D. Field Quality Control:
1. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
  2. Check TVSS receptacle indicating lights for normal indication.
  3. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
  4. Replace damaged or defective components.
- E. Cleaning: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

## 26 51 00 INTERIOR LIGHTING

### 1.1 GENERAL

- A. Work Includes:
  - 1. Base Bid: Electrical contractor.
  - 2. Provide and install all interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.
  
- B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
  
- C. Submittals:
  - 1. See Section 01 33 00 – Shop Drawings, Product Data and Samples, for submittal procedures.
  - 2. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
    - a. Dimensions of fixtures.
    - b. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
    - c. Certified results of laboratory tests for fixtures and lamps for photometric performance.
    - d. Emergency lighting unit battery and charger.
    - e. Fluorescent and high-intensity-discharge ballasts.
    - f. Air and Thermal Performance Data: For air-handling fixtures. Furnish data required in "Submittals" Article in Section 23 33 00 - "Diffusers, Registers, and Grilles."
    - g. Sound Performance Data: For air-handling fixtures. Indicate sound power level and sound transmission class in test reports certified according to ADC.
    - h. Types of lamps.
  - 3. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.
    - a. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.
  
- D. Quality Assurance:
  - 1. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
  - 2. Comply with NFPA 70.
  - 3. FM Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.
  - 4. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.
  
- E. Coordination:

1. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

F. Warranty:

1. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

## 1.2. PRODUCTS

A. Manufacturers:

1. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Interior Lighting Fixture Schedule

B. Fixtures and Fixture Components, General:

1. Metal Parts: Free from burrs, sharp corners, and edges.
2. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
3. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
4. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
  - a. White Surfaces: 85 percent.
  - b. Specular Surfaces: 83 percent.
  - c. Diffusing Specular Surfaces: 75 percent.
  - d. Laminated Silver Metallized Film: 90 percent.
5. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
  - a. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
  - b. Lens Thickness: 0.125 inch (3mm) minimum, unless greater thickness is indicated.

C. LED Fixtures

1. Fixtures shall be UP or Intertek ETL listed.
2. Drivers shall be capable of accepting the voltage indicated on the plans or schedule and capable of dimming if required. The driver shall be class A sound less than 20 percent, rated for operation between -40C to 40C. Driver shall contain no PCB's.
3. All LED fixtures shall be tested to IES LM-79 and IES LM-80.
4. Fixtures shall have efficacy of 60 lumens per watt or greater.

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5. Color Accuracy, CRI of 70 or greater. See schedule for light color. All fixtures shall have the same light color unless specifically called out otherwise.
  6. Outdoor fixtures shall be IP65 rated.
  7. LED driver and components shall have a system lifetime of 50000 hours or more at 25 Celsius.
  8. Fixture shall have a minimum of five year warranty on all components and finishes.
- D. Exit Signs:
1. General Requirements: Comply with UL 924 and the following:
    - a. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.
  2. Internally Lighted Signs: As follows:
    - a. Lamps for AC Operation: LED
  3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    - 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 unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
- E. Emergency Lighting Units:
1. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:
    - a. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
    - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    - c. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
    - d. Wire Guard: Where indicated, heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.
    - e. Integral Time-Delay Relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.
- F. Lamps:
1. Fluorescent Color Temperature and Minimum Color-Rendering Index: 3000 K and 85 CRI, unless otherwise indicated.
  2. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid-start circuits.
- G. Fixture Support Components:

1. Comply with Section 260500 - "Basic Electrical Materials and Methods," for channel- and angle-iron supports and nonmetallic channel and angle supports.
2. Single-Stem Hangers: 1/2-inch (12-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
3. Twin-Stem Hangers: Two, 1/2-inch (12mm) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.
4. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
5. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
6. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

H. Finishes:

1. Fixtures: Manufacturer's standard, unless otherwise indicated.
  - a. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
  - b. Metallic Finish: Corrosion resistant.

### 1.3. EXECUTION

A. Installation:

1. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
2. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
  - a. 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.
  - b. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
  - c. Fixtures of Sizes Less Than Ceiling Grid: Arrange 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.
3. Suspended Fixture Support: As follows:
  - a. Pendants and Rods: Where longer than 48 inches (1200), brace to limit swinging.
  - b. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
  - c. 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. Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions and details on Drawings.
4. Air-Handling Fixtures: Install with dampers closed.

B. Connections:

1. Ground Equipment: 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.



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- C. Field Quality Control:
  - 1. Inspect each installed fixture for damage. Replace damaged fixtures and components.
  - 2. Advance Notice: Give dates and times for field tests.
  - 3. Provide instruments to make and record test results.
  - 4. Tests: As follows:
    - a. Verify normal operation of each fixture after installation.
    - b. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
    - c. Verify normal transfer to battery source and retransfer to normal.
    - d. Report results in writing.
  - 5. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
  - 6. Corrosive Fixtures: Replace during warranty period.
- D. Cleaning and Adjusting:
  - 1. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.
  - 2. Adjust aimable fixtures to provide required light intensities.
- E. Interior Lighting Fixture Schedule: See contract drawings.

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END OF SECTION