DEPARTAMENTO DE LA
FAMILIA
ADMINISTRACIÓN DE
FAMILIAS Y NIÑOS

Technical Specification for

LILA MAYORAL
BUILDING & PARKING LOT



Prepared by:
Ingenium Professional Group PSC
Summit Plaza 1738 Amarillo Street Suite 102, San Juan
Tel. 787-918-5890 | Email: info@ingenium.group

IPG INGENIUM
PROFESSIONAL GROUP

INDEX

SECTION 01330 - SUBMITTAL PROCEDURES 3
SECTION 01400 - QUALITY EQUIREMENTS 11
SECTION 01420 - REFERENCE STANDARDS 16
SECTION 01600 - PRODUCT REQUIREMENTS 19
SECTION 01700 - EXECUTION AND CLOSEOUT REQUIREMENTS 26
SECTION 01731 - CUTTING AND PATCHING 34
SECTION 01732 - SELECTIVE DEMOLITION 39
SECTION 01740 - CONSTRUCTION WASTE MANAGEMENT 42
Site and Building Demolition 50
SECTION 02511 - Concrete Paving 53
Concrete Curbs, Gutters and Walks 59
02830 - Chainlink Fences and Gates 64
SECTION 03350 - CONCRETE FINISHING 69
SECTION 04100 - MASONRY MORTAR AND GROUT 75
SECTION 04200 - CONCRETE UNIT MASONRY 80
SECTION 04810 - UNIT MASONRY ASSEMBLIES 105
SECTION 05120 - STRUCTURAL STEEL FRAMING 113
SECTION 05 21 00 - STEEL JOISTS 117
SECTION 05500 - METAL FABRICATIONS 122
SECTION 05520 - HANDRAILS AND RAILINGS 145
SECTION 057300 - DECORATIVE METAL RAILINGS 151
SECTION 05 30 00 - METAL DECKING 157
07500 - Modified Bituminous Membrane Roofing 164
SECTION 07600 - FLASHING AND SHEET METAL 171
SECTION 07900 - JOINT SEALANTS 180
SECTION 08100 - METAL DOORS AND FRAMES 194
SECTION 08210 - WOOD DOORS 199
SECTION 08700 - FINISH HARDWARE 204
SECTION 09220 - PORTLAND CEMENT PLASTER 212
SECTION 09300 - TILE 216
END OF SECTION 09300 224
SECTION 09510 - ACOUSTICAL CEILING SYSTEMS 225

SECTION 09900 - PAINTING 231
SECTION 10 21 00 - TOILET PARTITIONS 264
SECTION 10440 - SIGNAGE 289
SECTION 10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES 305
SECTION 15100 - VALVES 309
SECTION 15140 - WATER PIPING 319
SECTION 15150 - SANITARY WASTE AND VENT PIPING 328
SECTION 15410 - PLUMBING FIXTURES 335
SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS 355
SECTION 15050 369
BASIC MECHANICAL MATERIALS AND METHODS (HVAC) 369
SECTION 16005 - ELECTRICAL 388
SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS 401
SECTION 16050 - BASIC METHODS AND REQUIREMENTS (ELECTRICAL) 403
SECTION 16110 - ELECTRICAL RACEWAY SYSTEMS 410
SECTION 16120 - ELECTRIC WIRES AND CABLES 419
SECTION 16127 - CABLES, LOW VOLTAGE (600 VOLTS AND BELOW) 424
SECTION 16140 - WIRING DEVICES 431
SECTION 16160 - PANELBOARDS 436
SECTION 16450 - GROUNDING 440
SECTION 16500 - LIGHTING 445
SECTION 16510 - BUILDING LIGHTING, INTERIOR 451
SECTION 16721 - FIRE ALARM SPECIFICATION 463
SECTION 16741 - TELEPHONE 471
SECTION 16900 - ELECTRICAL CONTROLS AND MISCELLANEOUS ELECTRICAL EQUIPMENT 474
SECTION 16950 - ELECTRICAL TESTING 479
SECTION 16999 - FIELD ACCEPTANCE TESTS 487

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals. B. Related Sections include the following:
1. Division 1 Section "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals and for erecting mockups.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsiv e action.

B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Allow 15 days for processing each resubmittal.
4. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

a. Project name. b. Date.
c. Name and address of Architect.
d. Name and address of Contractor.
e. Name and address of subcontractor. f. Name and address of supplier.
g. Name of manufacturer.
h. Unique identifier, including revision number.
i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate. k. Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Use AIA Document G810 or Contractor's standard form, if acceptable to Architect.

2. Transmittal Form: Provide locations on form for the following information:

a. Project name. b. Date.
c. Destination (To:). d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Submittal and transmittal distribution record. i. Remarks.
j. Signature of transmitter.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Number of Copies: Submit seven copies of each submittal, unless otherwise indicated. Architect will return four copies. Retain one returned copy as a Project Record Document.

a. Initial Submittal: Submit a preliminary single copy of each submittal where selection of options, color, pattern, texture, or similar characteristics is required. Architect will return submittal with options selected.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations. b. Manufacturer's product specifications.
c. Manufacturer's installation instructions. d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring. g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operating and maintenance manuals. k. Compliance with recognized trade association standards. l. Compliance with recognized testing agency standards.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings. d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shop manufacturing instructions. g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards. k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.

4. Number of Copies: Submit one correctable, translucent, reproducible print and three blue- or black-line print of each submittal. Architect will return the reproducible print and one blue- or black-line print. Retain returned print as a Project Record Drawing.

D. Samples: Prepare physical units of materials or products, including the following:

1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:

a. Generic description of Sample.

b. Product name or name of manufacturer. c. Sample source.

5. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.

a. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

6. Number of Samples for Initial Selection: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
7. Number of Samples for Verification: Submit three sets of Samples. Architect will retain one Sample set; remainder will be returned. Retain one returned Sample set as a Project Record Sample.
8. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples not incorporated into the Work, or otherwise designated as

Owner's property, are the property of Contractor.

E. Delegated-Design Submittal: Comply with requirements in Division 1 Section "Quality Requirements."

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

B. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Execution and Closeout Requirements."

C. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

D. Manufacturer's Instructions: Prepare written or published information that documents

manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

E. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

F. Material Safety Data Sheets: Submit information directly to Owner. If submitted to Architect, Architect will not review this information but will return it with no action taken.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

C. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION

SECTION 01400 - QUALITY EQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:

1. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
2. Divisions 2 through 22 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.5 SUBMITTALS

A. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

B. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.

8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Ambient conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

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

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

E. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect. .
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.7 QUALITY CONTROL

A. Contractor Responsibilities: Quality-control services are indicated as Contractor's responsibility, Contractor will engage a qualified testing agency to perform these services.

1. Contractor will engage a testing agency and pay for quality-control testing.
2. Contractor will furnish Owner with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
3. Testing agency will notify Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
4. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to Authorities Having Jurisdiction.
5. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
6. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
7. Testing agency will retest and reinspect corrected work.

B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

C. Retesting/Reinspecting: Provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

D. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspecting equipment at Project site.

E. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities. C. Repair and protection are indicated as Contractor's responsibility.

END OF SECTION 01400

SECTION 01420 - REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": The term "approved," when used in conjunction with Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.

D. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is Contractor or another entity engaged by Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.

J. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
a. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. "Project site" is the space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project. The extent of Project site is shown on the Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

B. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

C. Publication Dates: Comply with standards in effect as of the date of the Contract Documents, unless otherwise indicated.

D. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

A. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to Architect for a decision before proceeding.

E. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

A. Where copies of standards are needed to perform a required construction activity, obtain copies directly from the publication source and make them available on request.

F. Abbreviations and Names: Abbreviations and acronyms are frequently used in the Specifications and other Contract Documents to represent the name of a trade association, standards-developing organization, authorities having jurisdiction, or other entity in the context of referencing a standard or publication. Contact the Architect for identification of abbreviations and names and for contact information.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420

SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:

1. Divisions 3 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable or Equivalent Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use Form enclosed herewith.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified material or product cannot be provided. b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to Authorities Having Jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum. k. Contractor's certification that proposed substitution complies with
requirements in the Contract Documents and is appropriate for applications
indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Acceptance: Written notification to Contractor.
b. Use product specified if Architect can not make a decision on use of a proposed substitution within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Comply with requirements in Division 1 Section “Quality Requirements.”

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturers’ written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items

that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

5. Store products to allow for inspection and measurement of quantity or counting of units.

6. Store materials in a manner that will not endanger Project structure.

7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

8. Comply with product manufacturers' written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

9. Protect stored products from damage.

B. Storage: Provide a secure location and enclosure at Project site for storage of materials and equipment. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: Forms are included with the Specifications. Prepare a written document using appropriate form properly executed.

3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Execution and Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Architect Approved Equivalent: Where products are specified by name and accompanied by the term "or Architect Approved Equivalent," comply with provisions in "Comparable or Equivalent Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures: Procedures for product selection include the following:

1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.

a. Substitutions may be considered, unless otherwise indicated.

2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements. a. Substitutions may be considered, unless otherwise indicated.

3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

a. Substitutions may be considered, unless otherwise indicated.
4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.

a. Substitutions may be considered, unless otherwise indicated.

5. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

a. Substitutions may be considered, unless otherwise indicated.

6. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.

a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.

7. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.

a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider Requests for Substitution if received within 30 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction and maintenance by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of Authorities Having Jurisdiction, if applicable.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. Requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all subcontractors involved.

2.3 EQUIVALENT PRODUCTS

A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016

SECTION 01700 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures. B. Final cleaning.
C. Starting of systems.

D. Demonstration and instructions.

E. Testing, adjusting and balancing. F. Protecting installed construction. G. Project record documents.
H. Operation and maintenance data.

I. Manual for materials and finishes.

J. Manual for equipment and systems.

K. Spare parts and maintenance products. L. Product warranties and product bonds. M. Maintenance service.
1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.
B. Provide submittals to Architect/Engineer required by authorities having jurisdiction. C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.

C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.

D. Replace filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems. F. Clean site; sweep paved areas, rake clean landscaped surfaces.
G. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems. B. Notify Architect/Engineer seven days prior to start-up of each item.
C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions, which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative and Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01330 - Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

E. Required instruction time for each item of equipment and system is specified in individual sections.

1.6 TESTING, ADJUSTING AND BALANCING

A. Owner will appoint and employ services of independent firm to perform testing, adjusting of the roof top units to be installed. Contractor shall pay for services. Interior stores A/C ducts and related work, including balancing shall be by tenants.

B. Reports will be submitted by independent firm to Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

1.7 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.8 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed Shop Drawings, Product Data, and Samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner. C. Store record documents separate from documents used for construction.
D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings: The Owner will provide to the Contractor, free of cost, reproducible copies of all drawings. Contractor shall legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

G. Submit documents to Architect/Engineer with claim for final Application for Payment.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11 inch (A4) text pages, three D side ring capacity expansion binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.

2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
a. Significant design criteria.
b. List of equipment.
c. Parts list for each component.

d. Operating instructions.
e. Maintenance instructions for equipment and systems.
f. Maintenance instructions for [special] finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
a. Shop drawings and product data. b. Air and water balance reports.
c. Certificates.
d. Originals of warranties and bonds.

1.10 MANUAL FOR MATERIALS AND FINISHES

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.

F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
H. Additional Requirements: As specified in individual product specification sections. I. Include listing in Table of Contents for design data, with tabbed flysheet and
space for insertion of data.

1.11 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service duringconstruction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

G. Include color-coded wiring diagrams as installed.

H. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.

I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

J. Include servicing and lubrication schedule, and list of lubricants required. K. Include manufacturer's printed operation and maintenance instructions. L. Include sequence of operation by controls manufacturer.
M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

N. Include control diagrams by controls manufacturer as installed.

O. Include Contractor's coordination drawings, with color coded piping diagrams as installed.

P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

R. Include test and balancing reports as specified in Section 01400 - Quality Requirements .S. Additional Requirements: As specified in individual product specification sections.

T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.12 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.13 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized. D. Co-execute submittals when required.

E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.
F. Submit prior to final Application for Payment. G. Time Of Submittals:
1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.14 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in specification sections during warranty period.

B. Examine system components at frequency consistent with reliable operation.
Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components.
Repair or replace parts whenever required. Use parts produced by manufacturerof original component.

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION 01700S

SECTION 01731 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching. B. Related Sections include the following:

1. Division 1 Section "Selective Demolition" for demolition of selected portions of the building for alterations.
2. Divisions 2 through 22 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Dates: Indicate when cutting and patching will be performed.
2. Utilities: List utilities that cutting and patching procedures will disturb or affect, if any. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.

3. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in: reducing their capacity to perform as intended, increasing maintenance or decreasing operational life and safety.

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-protection systems.
4. Control systems.
5. Communication systems.
6. Conveying systems.
7. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in: reducing their capacity to perform as intended, increasing maintenance or decreasing operational life andr safety.

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Piping, ductwork, and equipment.
5. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

a. Roofing.
b. Firestopping.
c. Curtain wall system.

d. Portland cement plaster. e. Wall covering.
f. Multicolored interior coatings.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Floors: Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Sidewalk: Patch and repair existing sidewalk as required by demolition and new construction.

END OF SECTION 01731

SECTION 01732 - SELECTIVE DEMOLITION

PART 1 – GENERAL

This section shall consist of the removal of all items and miscellaneous items as indicated on the Plans. The section includes all associated tasks required to dispose of the facilities intended for demolition, and to protect existing facilities, which are to remain. The Contractor shall not demolish or remove any existing work that would result in an interruption of any utility service until that service is relocated either by the Contractor or by others as noted on the Plans or directed by the Engineer.

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: Section 02300.

1.2 SUBMITTALS

A. Quality Control Submittals:

1. Permits: Submit one copy of each permit.

2. Demolition Plan: For information only, submit one copy of the demolition plan required under Quality Assurance Article.

1.3 QUALITY ASSURANCE

A. Permits: Before the Work of this Section is started, obtain all permits required by EPA, EQB, OGPe and/or municipal government for all phases and operations of the Work.

B. Demolition Plan: Before the Work of this Section is started, prepare a detailed demolition plan. The demolition plan shall include, but not be limited to, detailed outline of intended demolition and disposal procedures. The demolition plan will not relieve the Contractor of complete responsibility for the successful performance of the Work in accordance with all applicable Federal, State, and local codes and restrictions.

1.4 PROJECT CONDITIONS

A. Dispose demolition debris.
B. Burning is prohibited.
C. The use of explosives is prohibited.

D. Ensure asbestos containing materials have been previously removed. E. Protect utilities outside limit of project during the Work of this Section. F. Verify the location and status of all utilities within the limit of project.

G. Utilities will be disconnected by the PREPA, PRASA or the owner of the utility as necessary.

H. Do not interrupt utility services to buildings which are to remain.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plugs, Caps, Flanges: As approved by the Engineer. B. Thrust Blocks: Refer to project plans for specification.
C. Selected Fill: AASHTO Soil Classification A-2-6.

PART 3 - EXECUTION

3.1 DEMOLITION AND REMOVAL

Pipe Removal. The Contractor shall excavate and remove storm drainage and abandoned sanitary sewer pipes as indicated on the plans.

Manholes and Drainage Structures. The Contactor shall remove manholes and miscellaneous drainage structures as indicated on the plans.

Where alteration of an existing structure requires removal of portions of the structure, such removal shall be performed with sufficient care as to leave the remaining portion of the structure undamaged. In case of damage to the existing structure, repair or replacement shall be made at the Contractor's expense and to the approval of the Engineer.

3.2 DISPOSAL

A. All excavations caused by pavement, drainage, utility and structure removal shall be backfilled with suitable material AASHTO Soil Classification A-1-a to a smooth level that provides positive drainage and compacted in accordance with Section 310000. The cost of placement, compaction and grading of this material shall be included in the contract unit price the of associated demolition work.

B. Remove demolition debris and excess fill from property as soon as practicable. All salvageable materials produced by the demolition work shall become the property of the Contractor unless specifically noted otherwise in these specifications or in the plans. The

storage or sale of salvageable material produced by this demolition shall not be allowed on the property.

END OF SECTION 01732

SECTION 01740 - CONSTRUCTION WASTE MANAGEMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.

B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.

C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:

1. Waste Management Plan development and implementation.

2. Techniques to minimize waste generation.

3. Sorting and separating of waste materials.

4. Salvage of existing materials and items for reuse or resale.

5. Recycling of materials that cannot be reused or sold.

D. At a minimum the following waste categories shall be diverted from landfills:

1. Soil.

2. Inerts (eg, concrete, masonry and asphalt).

3. Clean dimensional wood and palette wood.

4. Green waste (biodegradable landscaping materials).

5. Engineered wood products (plywood, particle board and I-joists, etc).

6. Metal products (eg, steel, wire, beverage containers, copper, etc).

7. Cardboard, paper and packaging.

8. Bitumen roofing materials.

9. Plastics (eg, ABS, PVC).

10. Carpet and/or pad.

11. Gypsum board.

12. Insulation.

13. Paint.

14. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

C. Lead Paint: Section 02 83 33.13, LEAD BASED PAINT REMOVAL AND DISPOSAL.

1.3 QUALITY ASSURANCE

A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:

1. Excess or unusable construction materials.

2. Packaging used for construction products.

3. Poor planning and/or layout.

4. Construction error.

5. Over ordering.

6. Weather damage.

7. Contamination.

8. Mishandling.

9. Breakage.

B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.

C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.

D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website http://www.wbdg.org/tools/cwm.php provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.

F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.

H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.

B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.

C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.

D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.

E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).

F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.

G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.

H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.

I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.

M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

N. Reuse: Materials that are recovered for use in the same form, on-site or off-site. O. Return: To give back reusable items or unused products to vendors for credit.
P. Salvage: To remove waste materials from the site for resale or re-use by a third party.

Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.

R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.

S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:

B. Prepare and submit to the Resident Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:

1. Procedures to be used for debris management.
2. Techniques to be used to minimize waste generation.
3. Analysis of the estimated job site waste to be generated:
a. List of each material and quantity to be salvaged, reused, recycled. b. List of each material and quantity proposed to be taken to a landfill.
4. Detailed description of the Means/Methods to be used for material handling. a. On site: Material separation, storage, protection where applicable.

b. Off site: Transportation means and destination. Include list of materials.
1) Description of materials to be site-separated and self-hauled to designated facilities.
2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
c. The names and locations of mixed debris reuse and recycling facilities or sites. d. The names and locations of trash disposal landfill facilities or sites.
e. Documentation that the facilities or sites are approved to receive the materials.

C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.

D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.1.6 APPLICABLE PUBLICATIONS

A Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.

B. U.S. Green Building Council (USGBC):
LEED Green Building Rating System for New Construction

1.7 RECORDS

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS

2.1 MATERIALS

A. List of each material and quantity to be salvaged, recycled, reused. B. List of each material and quantity proposed to be taken to a landfill.

C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 – EXECUTION

3.1 COLLECTION

A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.

B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.

C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.

B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.

B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.

C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total

costs for each disposal.

END OF SECTION 01740

Division 2 – Sitework02060

Site and Building Demolition

PART 1 GENERAL

1.1 RELATED DOCUMENTS:
A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section.
B. Plans showing the buildings and utilities being removed, demolished, or modified and the buildings and utilities remaining.

1.2 SECTION INCLUDES:
A. Demolition of designated structures or portions thereof and removal of materials from site.
B. Demolition and removal of foundations and slabs-on-grade.
C. Disconnecting and removal of identified utilities. D. Removal of underground tanks and piping.
E. Salvage of designated items.

1.3 SUBMITTALS:
A. Submit under provisions of Section 01300.

1.4 PROJECT RECORD DOCUMENTS:
A. Accurately record actual locations of capped utilities, subsurface obstructions, and structures.

1.5 REGULATORY REQUIREMENTS:
A. Conform to applicable codes for demolition of structures, safety of adjacent structures, dust control, runoff and erosion control, and disposal of demolished materials.
B. Obtain required permits from authorities having jurisdiction.
C. Notify affected utility companies before starting work and comply with their requirements.
D. Do not close or obstruct roadways, sidewalks, and hydrants, without permits.
E. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials. Contact the Architect-Engineer and Owner immediately.
F. Obtain certification/approval prior to demolition/invasive testing.

1.6 ABATEMENT
A. Follow abatement conditions as established in the Design/Build Contract.

1.7 SALVAGE
A. The Owner has the first right to salvage reusable equipment.

1.8 DEMOLITION

A. Demolition may be accomplished by the Owner or under the general construction contract, as indicated on the drawings.
B. No explosives are allowed during demolition or construction.

PART 2 PRODUCTS

2.1 FILL MATERIALS
A. Fill Material: Type fill as specified in Division 2.

PART 3 EXECUTION

3.1 PREPARATION
A. Provide, erect, and maintain temporary barriers and security devices.

B. Protect existing landscaping materials, appurtenances, structures that are not to be demolished.
C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring. D. Mark location of utilities.

3.2 DEMOLITION REQUIREMENTS
A. Conduct demolition to minimize interference with adjacent structures.
B. Cease operations immediately if adjacent structures appear to be in danger. Notify Architect and Owner. Do not resume operations until directed.
C. Conduct operations with minimum interference to public or private accesses. Maintain egress and access at all times.
D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.
E. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose.

3.3 DEMOLITION
A. Disconnect, remove and cap, and identify designated utilities within demolition areas.
B. Remove foundation walls and footings to a minimum of two feet below finished grade beyond area of new construction.
C. Remove concrete slabs on grade.
D. Empty buried tanks located within demolition area, remove tanks, components, and piping from site. Dispose of materials removed from tanks per applicable codes and regulations
E. Backfill areas excavated as a result of demolition, in accordance with Division 2.
F. Rough grade and compact areas affected by demolition to maintain site grades and contours.
G. Remove demolished materials from site, and dispose of materials per applicable codes and regulations.

H. Do not burn or bury materials on site. Leave site in clean condition. I. Remove temporary work.
J. When possible dispose of material to recycling centers

END OF SECTION

SECTION 02511 - Concrete Paving

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
1. Driveways and roadways.
2. Parking lots.
3. Curbs and gutters.
4. Walkways.

1.2 SUBMITTALS

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

B. Design Mixtures: For each concrete pavement mixture.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with
ASTM C 94/C 94M requirements for production facilities and equipment.

B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet. C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
D. Plain Steel Wire: ASTM A 82, as drawn. E. Deformed-Steel Wire: ASTM A 496.
F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place.

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type I/II, gray. a. Fly Ash: ASTM C 618, Class C.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: ASTM C 494/C 494M, of type suitable for application, certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
2.3 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet. C. Water: Potable.
D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating. F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.
2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1752, cork or self-expanding cork.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 3 minutes.
1. Color: White.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:
1. Compressive Strength (28 Days): 4000 psi.
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 5-1/2 plus or minus 1.5 percent.

B. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd..

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.

2.8 EXTRUDED CONCRETE CURB

A. Meet requirements of City of Seattle and Washington State DOT standard specifications for Road, Bridge and Municipal Construction, and the APWA, Washington Chapter. Refer to Section 8-04(3)(1)A, “Extruded Cement Concrete Curb, Asphalt Curb and Inlets”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

3.2 EDGE FORMS AND SCREED CONSTRUCTION
A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness to match jointing of existing adjacent concrete pavement.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

D. Screed pavement surfaces with a straightedge and strike off.

E. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, curing compound or a combination of these methods.

3.8 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch, no minus.
6. Joint Width: Plus 1/8 inch, no minus.

3.9 PAVEMENT MARKING

A. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
B. Sweep and clean surface to eliminate loose material and dust.
C. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.10 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.

C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION02513

Concrete Curbs, Gutters and Walks

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Materials and accessories. B. Preparation of sub grade. C. Types of construction.
D. Joints.

E. Form removal. F. Finishing.
G. Curing and protection. H. Field quality control.
1.02 RELATED SECTIONS

A. Preparation of sub grade to proper grade for concrete, including compaction, is specified in Section 02200 – Earthwork and Grading

B. Portland cement concrete, concrete reinforcement, and various materials, services, and incidentals pertaining thereto shall conform with Section 03300 - Cast-In-Place Concrete.

1.034 REFERENCES

A. American Concrete Institute (ACI):
1. ACI 117 Standard Specification for Tolerances for Concrete Construction Materials
2. ACI 301 Standard Specifications for Structural Concrete
3. ACI 318 Building Code Requirements for Reinforced Concrete

B. American Society for Testing and Materials (ASTM):
1. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated,Welded and Seamless
2. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
3. ASTM A663 Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties
4. ASTM C260 Specification for Air-Entraining Admixtures for Concrete
5. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
6. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete

1.04 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 – Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Product Data: Submit the respective manufacturer's product data for manufactured products.C. Shop Drawings:

1. Submit drawings that indicate the section profile of curb and gutter, and the locations of joints in concrete, including construction joints, expansion joints, isolation joints, and contraction joints.
2. Submit drawings of extruded curbs and gutters, if proposed, and any modification of the indicated section profile required by the extrusion process.
3. Submit drawings of reinforcing steel, tie bars, and connecting dowels.
1.05 QUALITY ASSURANCE A. Tolerances:
1. Construct concrete surfaces within 1/4 inch of the indicated elevation, and deviating not more than 1/8 inch from a 10-foot straightedge placed anywhere on the surface.
2. Slab tolerances shall be “straightedge tolerance” as specified in ACI 117.

B. Finishes: Slab finishes shall be as specified herein in accordance with the requirements of ACI 301.

PART 2 - PRODUCTS

2.01 MATERIALS AND ACCESSORIES

A. Concrete Reinforcement: Refer to Section 03 20 00 - Concrete Reinforcing, for requirements. B. Portland Cement Concrete: Provide Class of Concrete indicated on the Contract Drawings. C. Benches and Chairs: ACI 318.
D. Tie Bars: ASTM A615, Grade 60, of type and size indicated.

E. Dowels: Plain round bars meeting requirements of ASTM A615, Grade 60, or ASTM A663,Grade 80, epoxy-coated bars, furnished with approved snug-fitting ASTM A53 galvanized pipe sleeve. Provide sleeve with one end closed.

F. Weep Holes: ASTM A53 galvanized pipe of size indicated.

G. Expansion-Joint Filler and Joint Sealing Compound: Refer to Section 03 15 00 – Concrete Accessories, for requirements.

H. Surfacing Material for Nonslip Finish: Refer to Section 03 35 00 - Concrete Finishing, for requirements.

I. Concrete Curing Compound: ASTM C309, Type 1.

J. Epoxy Adhesive: ASTM C881, Type V for load-bearing concrete, Grade and Class as determined by project conditions and requirements.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

A. Excavate for and prepare the sub grade as specified in Section 02200 – Earthwork and Grading true to the indicated grade and cross section.

B. Test completed sub grade for correct grade and cross section by means of template supported on side forms.

C. Dampen sub grade and forms just before placing concrete.

3.02 TYPES OF CONSTRUCTION

A. Provide cast-in-place concrete construction, plain or reinforced as indicated. Curbs and gutters shall be formed accurately to indicated section profile with template screed.

B. Extruded curbs and gutter, placed by an extrusion machine, may be provided where site conditions are suitable and the extrusion process is appropriate for the purpose.

3.03 JOINTS

A. Expansion Joints:
1. Construct 3/8-inch to 1/2-inch thick expansion joints in the following locations:
a. In curb and combination curb and gutter at the locations of expansion joints in the concrete roadway.
b. In curb or combination curb and gutter, at points where curved and tangent sections join.
c. Between curb or combination curb and gutter, and any drain inlet, or similar structure occurring within the limits of the curb or combination curb and gutter. d. At corners in sidewalks, following the projections of the building lines from the corner of the building to the curb.
e. Between sidewalks and any permanent structure. f. Between sidewalk and curb.
g. Through sidewalks at intervals not greater than 15 feet.
h. In sidewalks, encircling fixtures more than 12 inches in diameter.
2. Construct expansion joints as specified in Section 32 13 13 - Concrete Paving, except that load transfer devices will not be required unless indicated. Shape preformed filler to cross section of curbs and combination curb and gutter.

B. Contraction Joints: In sidewalks, provide contraction joints as indicated in uniform intervals not greater than 6 feet, with the edges rounded to a 1/4-inch to 3/8-inch radius.

C. Tooling: Finish joints with an edging tool having 1/4-inch to 3/8-inch radius, leaving joints free of mortar and concrete. In preformed type joints, leave joint filler material exposed for full length of joint with clean and true edges.

D. Joint Sealing:

1. Seal to within 1/8 inch of pavement surface joints in curbs and gutters, including gutter surfaces of combination curb and gutter sections; all joints between curbs and vehicular pavement; all joints between gutters and vehicular pavement; and all other expansion joints. Do not seal other joints unless so indicated.
2. Do not seal joints until concrete curing is complete. Prior to installation of the joint sealing compound, clean the joints of dirt and other foreign material. Joints may be cleaned with compressed air jets provided that the air in such jets is free of oil or water. Do not fill joints when there is any free water in or adjacent to the joints. Joint walls and all surfaces to which the sealing material is to adhere shall be surface dry for at least three hours prior to sealing.
3. Apply with approved pressurized equipment. Perform sealing of joints to make the impervious to water and to prevent the sealing compound from spreading over the surface of the pavement.

3.04 FORM REMOVAL

A. Remove front curb forms not less than two nor more than six hours after placing concrete, but in no case while the concrete is still plastic enough to slump.

B. Remove other forms not less than twelve hours after finishing is completed.

3.05 FINISHING

A. Curb and Combination Curb and Gutter:
1. Trowel the face of curb smooth to a depth of not less than 2 inches below the flow line, or to the flow line of integral curb and gutter, and finish with a steel trowel, all immediately after removal of front curb forms.
2. Finish all curb edges with a radius of 1/2-inch.
3. Provide a final fine brush finish to both top and face of curb with brush strokes parallel to the line of the curb, so that both top and front face present the same uniform appearance.
4. Keep the curb face wet during above finishing operations.
5. Allow no coarse aggregate to show on the finished curb surface.

B. Sidewalk, Island Paving, and Ramps:
1. After the concrete has been placed, consolidated, struck off, leveled, grooved and edged as specified herein and in Section 03300 - Cast-In-Place Concrete,do not work the concrete further until ready for floating.
2. Provide "floated finish" or light "broom finish" as indicated in accordance with the requirements of ACI 301.
3. For pedestrian and wheelchair ramps, and all other surfaces where the Contract Drawings require a non-slip finish, provide a "nonslip finish" in combination with a "floated finish" or "broom finish" in accordance with the requirements of ACI 301.
4. Broom finish shall be applied perpendicular to the direction of traffic flow.

C. Joints and Edges: As soon as the condition of the work permits, perform joint work, edging, and marking. Finish all edges with a radius of 1/4 inch to 3/8 inch.

3.06 CURING AND PROTECTION

A. Comply with the applicable requirements of Section 03 35 00 - Concrete Finishing, for curing concrete with liquid membrane-forming curing compound. Do not permit traffic on new concrete pavement until the concrete has cured a minimum period of ten days.

B. Provide damp curing only, in accordance with Section 03 35 00 - Concrete Finishing, for concrete slab surfaces indicated to be treated with concrete hardener and dust proofer.

3.07 FIELD QUALITY CONTROL

A. The Contractor shall perform inspections and tests as specified herein. The Contractor shall provide such samples and services to facilitate testing as specified.

END OF SECTION

02830 - Chainlink Fences and Gates

This work consists of all labor, materials, and equipment necessary for furnishing and installing chain link fence, gates and accessories in conformance with the lines, grades, and details as shown.
1.2 MANUFACTURER'S QUALIFICATIONS

Fence, gates, and accessories shall be products of manufacturers' regularly engaged in manufacturing items of type specified.
1.3 SUBMITTALS

A. In accordance with Section 01300, SUBMITTAL PROCEDURES, furnish the following:

1. Manufacturer's Literature and Data: Chain link fencing, gates and all accessories.

2. Manufacturer's Certificates: Zinc-coating complies with complies with specifications. B. Shop Drawings
1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. American Society for Testing and Materials (ASTM):

A121-07 .....Metallic Coated Carbon Steel Barbed Wire

A392-07 .....Zinc-Coated Steel Chain-Link Fence Fabric

A817-07 .....Metal-Coated Steel Wire for Chain-Link Fence Fabric and

Marcelled Tension Wire

C94/C94M–07 .....Ready-Mixed Concrete

F567-07 .....Installation of Chain-Link Fence

F626-(R2003) .....Fence Fittings

F900-05 .....Industrial and Commercial Swing Gates

F1043-06 .....Strength and Protective Coatings on Metal Industrial Chain- Link Fence Framework
F1083-08 .....Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for

Fence Structures. C. Federal Specifications (Fed. Spec.):
FF-P-110J .....Padlock, Changeable Combination

PART 2 - PRODUCTS

2.1 GENERAL

Materials shall conform to ASTM F1083 and ASTM A392 ferrous metals, zinc-coated; and detailed specifications forming the various parts thereto; and other requirements specified herein. Zinc-coat metal members (including fabric, gates, posts, rails, hardware and other ferrous metal items) after fabrication shall be reasonably free of excessive roughness, blisters and sal-ammoniac spots.
2.2 CHAIN-LINK FABRIC

ASTM A392 9 gauge wire woven in a 50 mm (2 inch) mesh. Top and bottom selvage shall have twisted and barbed finish. Zinc-coating weight shall be // 340 // 570 // grams/m2 (// 1.2 // 2.0 // ounces per square foot).

2.3 POST, FOR GATES AND FENCING

ASTM F1083, Grade SK-40A, round, zinc-coated steel. Dimensions and weights of posts shall conform to the tables in the ASTM Specification. Provide post braces and truss rods for each gate, corner, pull or end post. Provide truss rods with turnbuckles or other equivalent provisions for adjustment.
2.4 TOP RAIL AND BOTTOM RAIL

ASTM F1083, Grade SK-40A, round, zinc-coated steel. Dimensions and weights of posts shall conform to the tables in the ASTM Specification; fitted with suitable expansion sleeves and means for securing rail to each gate, corner, and end posts.
2.5 TOP AND BOTTOM TENSION WIRE

ASTM A817 and ASTM F626, zinc-coated, having minimum coating the same as the fence fabric.
2.6 ACCESSORIES

Accessories as necessary caps, rail and brace ends, wire ties or clips, braces and tension bands, tension bars, truss rods, and miscellaneous accessories conforming to ASTM F626
2.7 BARBED WIRE SUPPORT ARMS

ASTM F626, single arm type, steel or malleable iron.

2.8 BARBED WIRE

ASTM A121, zinc-coated steel wire and barbs; standard size and construction: 2.51 mm (0.099 inch) diameter line wire with 2.03 cm (0.080 inch) diameter, 2-point barbs.

2.9 GATES

ASTM F900, type as shown. Gate framing, bracing, latches, and other hardware zinc-coating weight shall be the same as the FABRIC. Gate leaves more than 2400 mm (8 feet) wide shall have either intermediate members and diagonal truss rods, or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gates less than 2400 mm (8 feet) wide shall have truss rods or intermediate braces. Attach gate fabric to the gate frame by method standard with the manufacturer, except that welding will not be permitted. Arrange latches for padlocking so that padlock will be accessible from both sides of the gate regardless of the latching arrangement. When required, extend each end member of gate frame sufficiently above the top member or provide three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.

2.10 GATE HARDWARE

A. Manufacturer's standard products, installed complete. The type of hinges shall allow gates to swing through 180 degrees, from closed to open position. Hang and secure gates in such a manner that, when locked, they cannot be lifted off hinges.

B. Provide stops and keepers for all double gates. Latches shall have a plunger-bar arranged to engage the center stop. Arrange latches for locking. Center stops shall consist of a device arranged to be set in concrete and to engage a plunger bar. Keepers shall consist of a mechanical device for securing the free end of the gate when in full open position.

C. Equip gate openings with padlock conforming to Fed Spec FF-P-110H, Type EPC, size 50 mm

(2 inch). Padlocks shall have chains that are securely attached to the gate or gate post. Before padlocks are delivered to project, submit sample to Resident Engineer for approval. Approved sample may be incorporated in work. Key padlock as directed by the Resident Engineer.

2.11 CONCRETE

ASTM C94/C94M, using 19 mm (3/4 inch) maximum-size aggregate, and having minimum compressive strength of 25 mPa (3000 psig) at 28 days. Non-shrinking grout shall consist of one part Portland cement to three parts clean, well-graded sand, non-shrinking grout additive and the minimum amount of water to produce a workable mix.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fence by properly trained crew, on previously prepared surfaces, to line and grade as shown. Install fence in accordance with ASTM F567 and with the manufacturer's printed installation instructions, except as modified herein or as shown. Maintain all equipment, tools, and machinery while on the project in sufficient quantities and capacities for proper installation of posts, chain links and accessories.

3.2 EXCAVATION

Excavation for concrete-embedded items shall be of the dimensions shown, except in bedrock. If bedrock is encountered before reaching the required depth, continue the excavation to the depth shown or 450 mm (18 inches) into the bedrock, whichever is less, and provide a minimum of 50 mm (2 inches) larger diameter than the outside diameter of the

post. Clear loose material from post holes. Grade area around finished concrete footings as shown and dispose of excess earth as directed by the Resident Engineer.

3.3 POST SETTING

Install posts plumb and in alignment. Set post in concrete footings of dimensions as shown, except in bedrock. Thoroughly compact concrete so as it to be free of voids and finished in a slope or dome to divert water running down the post away from the footing. Install posts in bedrock with a minimum of 25 mm (one inch) of non-shrinking grout around each post. Thoroughly work non-shrinking grout into the hole so as to be free of voids and finished in a slope or dome. Cure concrete and grout a minimum of 72 hours before any further work is done on the posts.

3.4 POST SETTING IN STRUCTURES

Install post in retaining walls, curbs, concrete slabs, or similar construction in proper size galvanized pipe sleeves set into the concrete or built into the masonry as shown. Set sleeves plumb and 13 mm (1/2 inch) above the finished structure. Fill space solidly between sleeve and post with non-shrinking grout, molten lead, or sulphur, and finish to divert water running down the post away from the post base.

3.5 POST CAPS

Fit all exposed ends of post with caps. Provide caps that fit snugly and are weathertight. Where top rail is used, provide caps to accommodate the top rail. Install post caps as recommended by the manufacturer and as shown.

3.6 SUPPORTING ARMS

Design supporting arms, when required, to be weathertight. Where top rail is used, provide arms to accommodate the top rail. Install supporting arms as recommended by the manufacturer and as shown.

3.7 TOP RAILS AND BOTTOM RAILS

Install rails before installing chain link fabric. Provide suitable means for securing rail ends to terminal and intermediate post. Top rails shall pass through intermediate post supporting arms or caps as shown. The rails shall have expansion couplings (rail sleeves) spaced as recommended by the manufacturer. Where fence is located on top of a wall, install expansion couplings over expansion joints in wall.

3.8 TOP AND BOTTOM TENSION WIRE

Install and pull taut tension wire before installing the chain-link fabric.

3.9 ACCESSORIES

Supply accessories (posts braces, tension bands, tension bars, truss rods, and miscellaneous accessories), as required and recommended by the manufacturer, to accommodate the installation of a complete fence, with fabric that is taut and attached properly to posts, rails, and tension wire.

3.10 FABRIC

Pull fabric taut and secured with wire ties or clips to the top rail and tension wire close to both sides of each post and at intervals of not more than 600 mm (24 inches) on centers. Secure fabric to posts using stretcher bars and ties or clips.

3.11 BARBED WIRE

Install barbed wire, when required, on supporting arms above the fence posts. Extend each end member of gate frames sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence. Pull each strand taut and securely fasten to each supporting arm and extended member.

3.12 GATES

Install gates plumb, level, and secure for full opening without interference. Set keepers, stops and other accessories into concrete as required by the manufacturer and as shown. Adjust hardware for smooth operation and lubricate where necessary.

3.13 REPAIR OF GALVANIZED SURFACES

Use galvanized repair compound, stick form, or other method, where galvanized surfaces need field or shop repair. Repair surfaces in accordance with the manufacturer's printed directions.

3.14 FINAL CLEAN-UP

Remove all debris, rubbish and excess material from the station.

END OF SECTION

Division 3 - Concrete
SECTION 03350 - CONCRETE FINISHING

1. GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exposed Concrete floor and wall surface treatment.
2. Smooth Fine Aggregate Concrete wall surface treatment.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.

B. ASTM International:
1. ASTM E1155 - Standard Test Method for Determining Floor Flatness and of Levelness Using the F-number System.
2. ASTM C-642-06 Standard Test Method for Density, Absorption, and Voids in Hardened Concrete.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit data on concrete hardener, sealer, curing compounds and slip resistant treatment, compatibilities, and limitations.

C. Manufacturer's Quality Assurance: Submit manufacturer's certification that treatment complies with specified requirements and is suitable for intended application.

D. Indicate installation procedures and interface required with adjacent construction.

E. Provide Manufacturers Maintenance Instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 302.1.

B. Perform Work in accordance with International Building Code and Authorities

Having Jurisdiction.

C. Product certificates signed by the manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 QUALIFICATIONS

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

B. Installer: Company specializing in performing work of this section with minimum five years, documented experience.

C. Pre-installation Conference: Conduct a pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirement.

1.6 MOCK-UP

A. Construct mock-up areas for each type of concrete finish (exposed, polished, and smooth fine aggregate, as specified on Drawings Finish Schedule) under conditions similar to those which will exist during actual placing, two (2) feet long by two (2) feet wide, with specified finishes, and coatings applied.

B. Mock-up will be used to evaluate concrete substrate preparation, material application, color selection, and shine.

C. Locate where directed by Architect/Engineer.

D. When approved, Mock-up will demonstrate minimum standard of quality requirements for proceeding with this work.

E. Incorporate accepted mockup as part of Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements.

B. Deliver materials in manufacturer's packaging including application instructions. C. Store material in dry, enclosed area protected from exposure to moisture.

D. Keep containers closed and upright to prevent leakage.

E. Dispense special concrete finish material from factory numbered and sealed containers.

F. Maintain record of lot numbers.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Temporary Lighting: Minimum 200 W light source, placed 8 feet (2.5 m) above floor surface, for each 425 sq ft (40 sq m) of floor being finished.

C. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.9 COORDINATION

A. Section 01300 - Administrative Requirements.

B. Coordinate the Work with concrete floor placement and concrete floor curing.

2. PRODUCTS

2.1 MANUFACTURERS

A. Available manufacturers are subject to compliance with requirements.
Manufacturers offering products that may be incorporated into the Work include but are not limited to the manufacturers listed herewith.

B. Substitutions allowed according to Architect’s approval via Substitution Request Forms provided as attachments to Section 01 60 00: Product Requirements.

C. Manufacturers:
1. Master Builders Inc.
2. Certi-Shine
3. Scofield: L M Scofield Co.
4. Sika Corp.

2.2 SLIP RESISTANT TREATMENT

A. Slip Resistant Finish: Silica sand. Color as selected from manufacturer's standard range.

B. Abrasive Aggregate: 95 percent minimum fused homogeneous aluminum oxide.

3. EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements.
B. Verify floor and wall surfaces are acceptable to receive the Work of this section. C. Installer and manufacturer's representative will examine surfaces receiving
concrete finish and polishing system.
1. Verify that surfaces conform to product manufacturers requirements for substrate conditions.
2. Verify surfaces are free of curing membrane, bond-breaker, concrete laitance, and will absorb water per water absorbency test.

3.2 CONCRETE PREPARATION

A. Complete surface preparation per manufacturer's written instructions. B. Power sweep area, blow out corners and column footings.
C. Initial grind should clean the concrete surface, removing all coatings, dirt, oil and laitance.

D. If grinding does not remove oil spots, treat oil spots with emulsifier and oil absorber materials. Detail scrub with high pH detergent.

E. Inspect the concrete surface.
F. Complete surface preparation per manufacturer's written instructions. G. Perform water absorbency test.
1. Repeat any steps as necessary to prepare for polishing.

3.3 FLOOR AND WALL FINISHING (As Applicable per Drawings Finish Schedule)

A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.

B. Wood float surfaces receiving quarry tile, marble, porcelain or ceramic tile with full bed setting system, as indicated on Drawings.

C. Steel trowel surfaces receiving thin set quarry tile, thin set marble, porcelain or ceramic tile, as indicated on Drawings.

D. Steel trowel surfaces which are scheduled to be exposed.

E. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 1/4 inch per foot (20 mm per m) nominal, or as indicated on Drawings.

3.4 FLOOR SURFACE TREATMENT (As Applicable per Drawings Finish Schedule)

A. Apply liquid hardener as scheduled on floor surfaces.

B. Apply slip resistant finish as scheduled on floor surfaces. C. Apply sealer as scheduled on floor surfaces.

D. Apply retarder to exposed aggregate or troweled finish, as scheduled on floor surfaces.

3.5 CONCRETE FINISH APPLICATION AND POLISHING (As applicable per Drawing Finish Schedule)

A. Immediately following cleaning operation, install concrete polishing material(s) per manufacturer's instructions.

B. Perform polishing operation to the specified polish level.

3.6 JOINT FILLER

A. Prime and fill with manufacturer's approved epoxy joint sealant those joints that require the application of joint sealant after the application of the finishing system or as directed by the manufacturer.

3.7 PROTECTION

A. Protect finished surfaces from damage and soiling and other construction activities.

B. Without damaging completed work, provide protective cover.

3.8 TOLERANCES

A. Section 01400 - Quality Requirements.

B. Maximum Variation of Surface Flatness For Exposed Concrete Floors: 1/8 inch.

C. Maximum Variation of Surface Flatness Under Wood Flooring: 1/8 inch (6 mm) in 10 3 m).

D. Measure for F(F) and F(L) tolerances for floors in accordance with ASTM E1155, within 48 hours after slab installation.

E. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

END OF SECTION 03350

Division 4 – Masonry

SECTION 04100 - MASONRY MORTAR AND GROUT

PART 1 - GENERAL

1.01 SUMMARY

A. RELATED SECTIONS

1. Section 03300, “Cast In Place Concrete”

2. Section 04200, “Concrete Masonry Units”

3. Section 05500, “Metal Fabrications”

4. Section 09900, “Painting”

1.02 REFERENCES

B. American Society for Testing and Materials (ASTM)

1. C143 Test for Slump of Portland Cement Concrete
2. C144-93 Specification for Aggregate for Masonry Mortar
3. C270 Mortar for Unit Masonry
4. C404 Specification for Aggregates for Masonry Grout
5. C476 Mortar and Grout for Reinforced Masonry
6. C780-02 Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
7. C1019 Standard Test Method for Sampling and Testing Grout

C. Masonry Codes and Specifications

D. National Concrete Masonry Association (NCMA)

E. International Building Code (IBC): Chapter 21 Masonry 04050-2

1.03 SUBMITTALS

Submit the following in accordance with conditions of Contract and Section 01330, "Submittal Procedures":

A. Test reports: Testing laboratory shall submit test reports indicating compression, yield and slump of mortar and grout.

B. Asbestos-free and lead-free certification for all masonry mortar and grout.

C. Samples: Colored masonry mortar samples showing full extent of colors available.

D. Material certificates: Certificates signed by manufacturer and Contractor certifying that each material complies with requirements, for each different cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.

1.04 1.04 ENVIRONMENTAL REQUIREMENTS

A. Heat mixing water when air temperature is below 40 degrees F and heat aggregates when air temperature is below 32 degrees F, to assure mortar and grout temperatures between 40 degrees F and 120 degrees F until installed. Do not heat water or aggregates above 120 degrees F.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Mortar: Mortar mix shall comply with proportion specifications of ASTM C270 for job-mixed mortar. Masonry cement shall not be used for mortar.

1. Aggregate ratio shall be not less than 2 1/4 and not more than 3 times the sum of the separate volumes of cementitious materials.
2. Exterior Walls Above Grade: Type S, 1/4 to 1/2 part hydrated lime to 1 part Portland cement by volume.
3. Exterior Walls At or Below Grade: Type M, 1/4 part hydrated lime to 1 part Portland cement by volume.
4. Interior Walls: Type S, 1/4 to 1/2 part hydrated lime to 1 part Portland cement by volume.

B. Grout: Grout shall comply with proportion requirements of ASTM C476.

1 part Portland cement

1/10 part hydrated lime

3 parts sand

2 parts coarse aggregate (for coarse grout only, omit for fine grout)

C. Slump: Unless otherwise indicated, mix grout to a consistency, which has a slump between 8 and 10 inches (203 and 254 mm).

D. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or gray cement as required to produce required mortar color.

E. Hydrated Lime: ASTM C207, Type S.

F. Fine aggregate: ASTM C144, except for joints less than 1/4 inch (6.35 mm) use aggregate graded with 100% passing the No. 16 sieve.

1. Gray Mortar Aggregates: Gray sand or ground gray stone.
2. Colored Mortar Aggregates: Ground marble, granite, or other sound stone, as indicated.
G. Coarse aggregate: ASTM C404, maximum size 3/8” sieve.

H. Admixtures: The use of admixtures including color pigments, accelerators, retarders, water repellent agents, or other admixtures shall not be permitted except as specified or as directed by the SDR.

1. No air-entraining admixtures or materials containing air-entraining admixtures may be used for mortar.

2. No antifreeze compounds shall be added to mortar or grout.

3. No admixtures containing chlorides shall be added to mortar or grout.

I. Water: Water shall be clean, potable and free of deleterious quantities of acids, alkalis, and organic materials.

J. Colored Mortar Pigments: Mortar pigment shall conform to ASTM C979.

1. Natural and synthetic iron oxides, chromium oxides and carbon black, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in masonry mortars.

2. Mineral oxide pigment shall not exceed 10% of the weight of Portland cement.

3. Carbon black shall not exceed 2% of the weight of Portland cement.

PART 3 – EXECUTION

3.01 PREPARATION OF MIXES

A. Mortar: Mix mortar materials in a mechanical mixer with approximately onehalf (½) of the water and fine aggregate placed into the mixer first. Cementitious materials, and remaining water and sand should then be added and mixed for not less than 5 minutes. Hand mixing shall not be used unless specifically approved by Architect.

B. Grout: Proportion and mix grout in accordance with the requirements of ASTM C476. The mixture shall be fluid as possible without segregation of materials. Consistency of grout shall have a slump of 8 to 10 inches, as determined by ASTM C-143, at time of placement.

3.02 USAGE

A. Use mortar and grout within 1-hour of initial mixing. Discard mortar and grout that have begun to set. If mortar stiffens from evaporation or absorption of mixing water, temper by adding water and remixing. Mortar or grout mixture shall not only be re-tempered once.

3.03 APPLICATION

A. Use as specified in Section 04220, “Concrete Masonry Units”.

3.04 FIELD QUALITY CONTROL

A. The Contractor shall employ the services of a qualified testing laboratory to perform tests and submit test reports.

B. Provide daily field tests for mortar per IBC standards.

C. Grout slump per ASTM C143 for each set of compressive strength test specimens.

D. Compression Test Specimens: Obtain and test grout samples per ASTM C119 on a daily basis during grouting operation. When volume of grout utilized exceeds 25 cubic yards in one day increase test frequency to provide tests for every 25 cubic yards of fraction thereof.

END OF SECTION 04100

SECTION 04200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1 .1 RELATED DOCUMENTS

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

1 .2 SUMMARY

A. This Section includes the following.

1. Concrete unit masonry.
2. Reinforced unit masonry.
3. Insulation in masonry walls.

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

1. Division 7 Section "Joint Sealants" for sealing joint in mockup.

C. Products furnished but not installed under this Section include the following:

1. Dovetail slots for masonry anchors installed under Division 3 Section "Cast-in-Place Concrete."
2. Anchor sections of adjustable masonry anchors for connecting to structural frame installed under Division 5 Section "Structural Steel."

D. Products installed but not furnished under this Section include the following:

1. Manufactured reglets in masonry joints for metal flashing specified in Division 7 Section "Sheet Metal Flashing and Trim."

1 .3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following installed compressive strengths (f'm) at 28
days.
1. For Concrete Unit Masonry: As follows, based on net area:
a. rm = 1500 psi (10.3 MPa). b. As indicated.

1 .4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each different masonry unit, accessory, and other manufactured product specified.
C. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.

D. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to specifically identify exact materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only Neither receipt of list nor acceptance of mockup constitutes approval of deviations from Contract Documents unless such deviations are specifically brought to the attention of the Architect and approved in writing.

E. Material certificates for the following, signed by manufacturer and Contractor, certifying that each material complies with requirements.

1. Each different cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
2. Each material and grade indicated for reinforcing bars.
3. Each type and size of joint reinforcement.
4. Each type and size of anchors, ties, and metal accessories.

F. Material test reports from a qualified independent testing agency, employed and paid by Contractor or manufacturer, indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:

1. Mortar complying with property requirements of ASTM C 270.
2. Mortar complying with BIA M1.
3. Grout mixes. Include description of type and proportions of grout ingredients.
4. Masonry units.

G. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project

names and addresses, names and addresses of architects and owners, and other information specified.

1 .5 QUALITY ASSURANCE

A. Contractor shall employ and pay a qualified professional engineer to provide a survey and inspection of foundations for compliance with dimensional tolerances.

B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C 1093, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

B. Pre-construction Testing: Employ and pay a qualified independent testing agency to perform the following pre-construction testing to establish compliance of proposed materials and construction with specified requirements.
1. Clay Masonry Unit Test: For each different clay masonry unit indicated, test units per ASTM C 67.
2. Concrete Masonry Unit Test. For each different concrete masonry unit indicated, test units for strength, absorption, and moisture content per ASTM C 140.
3. Test mortar properties per test methods of ASTM C 270
4. Test grout compressive strength per ASTM C 1019.

D. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.

E. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

F. Mockup: Prior to installing unit masonry, construct sample wall panels to verify selections made under sample submittals and to demonstrate aesthetic effects of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

G. Mockup: Prior to installing unit masonry, construct sample wall panels to verify selections made under sample submittals and to demonstrate aesthetic effects as well as other qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Build mockup of typical wall area as shown on Drawings.

a. Include exterior face brick wall with window opening framed with stone trim.
b. Include window complying with requirements of Division 8 Section "Aluminum- Framed Fixed and Operable Windows."
c. Seal perimeter of window complying with requirements of Division 7 Section "Joint Sealants."
d. Include gutter and downspout complying with requirements of Division 7 Section "Sheet Metal Flashing and Trim."
e. Include sealant-filled joint complying with requirements of Division 7 Section "Joint Sealants."

2. Build mockups for the following types of masonry in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness, including face and back-up wythes as well as accessories. Include a sealant-filled joint at least 16 inches (400 mm) long in each mockup.

a. Typical exterior face brick wall with through-wall flashing installed for a 24-inch (600-mm) length in corner of mockup approximately 16 inches (400 mm) down from top of mockup with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
b. Typical interior unit masonry wall.

3. Clean exposed faces of mockups with masonry cleaner indicated.

4. Notify Architect one week in advance of the dates and times when mockups will be constructed.
5. Protect accepted mockups from the elements with weather-resistant membrane.

6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.

a. Acceptance of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors 10 masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
b. Acceptance of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
c. Accepted mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1 .6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes If units become wet, do not install until they are in an air-dried condition.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1 .7 PROJECT CONDITIONS

A. Protection of Masonry: During erection, Cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least
3 days after building masonry walls or columns C.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.

D. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and graout. Provide

artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and above.

PART2 - PRODUCTS

2 .1 MANUFACTURERS

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

1. Concrete Masonry Units:
a. Manufacturers subject to compliance with requirements.

2. Portland Cement, Mortar Cement, Masonry Cement, and Lime:
a. Quikrete.

3. Joint Reinforcement, Ties, and Anchors:
a. Dur-O-Wa!, Inc.
b. Heckman Building Products, Inc. c. Hohmann & Bamard, Inc.
d. Masonry Reinforcing Corp. of America. e. Puerto Rico Wire Products Industries.
f. Southern Construction Products.

2 .2 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows for each form of concrete masonry unit required.

1. Provide square-edged units for outside corners, except where indicated as bullnose. B. Concrete Masonry Units: ASTM C 90 and as follows:
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength indicated below:

a. 1900 psi (13.1 MPa).
b. Not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.

2. Weight Classification: As indicated in drawings.

3. Aggregates: Do not use aggregates made from pumice, scoria, or tuff.
4. Provide Type 1, moisture-controlled units.

5. Size: Manufactured to the actual dimensions listed below (within tolerances specified in the applicable referenced ASTM specification) for the corresponding nominal sizes indicated on Drawings:

a. 4 inch (100 mm) nominal: 3-5/8 inch (92 mm) actual b. 6 inch (150 mm) nominal: 5-5/8 inch (143 mm) actual. c. 8 inch (200 mm) nominal: 7-5/8 inch (194 mm) actual. d. 10 inch (250 mm) nominal: 9-5/8 inch (244 mm) actual.
e. 12 inch (300 mm) nominal: 11-518 inch (295 mm) actual. f. 16 inch (400 mm) nominal: 15-5/8 inch (397 mm) actual.

2 .3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type l or Type III, and hydrated lime complying with ASTM C 207

1. For pigmented mortars, use colored portland cement-Iime mix of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations. Pigments shall not exceed 10 percent of portland cement by weight for mineral oxides nor 2 percent for carbon black.

D. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm), use aggregate graded with 100 percent passing the No.16 (1.18 mm) sieve.

E. Aggregate for Grout: ASTM C 404.

F. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this Article; combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.

G. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for, and approved by manufacturer of, structural clay tile facing units; in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMU, containing integral water repellent by same manufacturer.

I. Water: Potable.

J. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
1. Water-Repellent Admixture:
a. Dry-Block Mortar Admixture; Grace: W.R. Grace & Co.

2 .4 REINFORCING STEEL

A. Steel Reinforcing Bars: Material and grade as follows:

1. Billet steel complying with ASTM A 615 (ASTM A 615 M)
2. Epoxy-coated billet steel complying with ASTM A 615 (ASTM A 615M) and ASTM A 775 (ASTM A 775M).
a. Grade 60 (Grade 400).

B. Deformed Reinforcing Wire: ASTM A 496, with ASTM A 153, Class 8-2 zinc coating. C. Welded-Wire Fabric: ASTM A 185.
2 .5 JOINT REINFORCEMENT

A. General: Provide joint reinforcement formed from the following, or as indicated in drawings:

1. Galvanized carbon-steel wire, coating class as follows. .
a. ASTM A 641 (ASTM A 641 M), Class 1, for interior walls; and ASTM A 153, Class B-2, for exterior walls.
b. ASTM A 153, Class 8-2, for both interior and exterior walls.

2. Stainless-steel wire, ASTM A 580, Type 304 or 316, for exterior walls; and galvanized carbon-steel wire for interior walls; coating class as follows.
a. ASTM A 641 (ASTM A 641M), Class 1. b. ASTM A 153, Class 8-2.

3. Stainless-steel wire, ASTM A 580, Type 304 or 316.

B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet (3 m), with prefabricated corner and tee units, and complying with requirements indicated below, or as indicated in drawings:

1. Wire Diameter for Side Rods: 0.1483 inch (3.8 mm).
2. Wire Diameter for Side Rods: 0.1875 inch (4.8 mm).

3. Wire Diameter for Cross Rods: 0.1483 inch (3.8 mm).
4. Wire Diameter for Cross Rods: 0.1875 inch (4.8 mm).

C. For single-way the masonry , provide type as follows with single pair of side rods:

1. Ladder design with perpendicular cross rods spaced not more than 16 inches (407 mm) o.c.
2. Truss design with continuous diagonal cross rods spaced not more than 16 inches (407 mm) o.c.

D. For multi way the masonry, provide type as follows:

1. Ladder design with perpendicular cross rods spaced not more than 16 inches (407 mm) o.c.
2. Truss design with continuous diagonal cross rods spaced not more than 16 inches (407 mm) o.c.

a. Number of Side rods for multiwythe concrete masonry: One side rod for each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod for each wythe of masonry 4 inches (100 mm) or less in width.
b. Provide integral drips on cross rods at cavity walls.

3. Tab design with single pair of side rods and rectangular box-type cross ties spaced not more than 16 inches (407 mm) o.c., with side rods spaced for embedment within each face shell of back-up way the and ties extended to engage the outer way the by at least 1- 1/2 inches (38 mm).

5. Adjustable (2-piece) tab design with single pair of side rods and rectangular box-type cross ties spaced not more than 16 inches (407 mm) o.c., with side rods spaced for embedment within each face shell of back-up way the and with separate adjustable ties engaging the cross ties and extended to engage the outer way the by at least 1-1/2 inches (38 mm) and spaced not more than 16 inches (407 mm) o.c.

a. Use where horizontal joints of facing way the do not align with those of back- up and where indicated.

2 .6 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of this Article, unless otherwise indicated.

B. Wire: As follows, or as indicated in drawings:

1. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class 8-2 coating.
2. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class 8-2 coating for wire ties and anchors in exterior walls.
3. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 641 (ASTM A 641 M), Class 1 coating for wire ties and anchors in interior walls.
4. Stainless-Steel Wire: ASTM A 580, Type 304, for wire ties and anchors in exterior walls.
5. Stainless-Steel Wire: ASTM A 580, Type 304.
6. Wire Diameter: 0.1875 inch (4.8 mm).
7. Wire Diameter: 0.25 inch (6.4 mm).
8. Wire Diameter: As indicated.

C. Steel Sheet: As follows, or as indicated in drawings:

1. Galvanized Steel Sheet: ASTM A 526, G 60 (ASTM A 526M, Z 180) (commercial quality), steel sheet zinc coated by hot-dip process on continuous lines prior to fabrication, for sheet-metal ties and anchors in interior walls and in exterior walls when completely embedded in mortar.

2. Galvanized Steel Sheet: ASTM A 366 (ASTM A 366M) (commercial quality) cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153, Class 8-2 or 8-3, as applicable, for sheet-metal ties and anchors in exterior walls not completely embedded in mortar and grout.
3. Galvanized Steel Sheet: ASTM A 366 (ASTM A 366M) (commercial quality) cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153, Class 8-2 or 8-3, as applicable, for sheet-metal ties and anchors.

4. Stainless-Steel Sheet: Stainless-steel sheet, ASTM A 167, Type 304 or 316, for sheet- metal ties and anchors in exterior walls; and galvanized steel sheet, ASTM A 526, G 60 (ASTM A 526M, Z 180) (commercial quality), for other applications.

5. Stainless-Steel Sheet: ASTM A 167, Type 304 or 316.

D. Galvanized Steel Sheet Thickness: For steel sheet hot-dip galvanized by continuous process prior to fabrication.

1. 0.0635 inch (1.6 mm)
2. 0.0785 inch (2.0 mm)
3. 0.1084 inch (2.8 mm)

E. Thickness of Steel Sheet Galvanized After Fabrication: Uncoated thickness of steel sheet for hot- dip galvanizing after fabrication:

1. 0.0598 inch (1.5mm).

2. 0.0747 inch (1.9 mm).
3. 0.1046 inch (2.7 mm).

F. Stainless-Steel Sheet Thickness: As follows:
1. 0.0625 inch (1.6 mm).
2. 0.0781 inch (2.0 mm).
3. 0.1094 inch (2.8 mm).

F. Galvanized Heavy- Thickness Steel Sheet: ASTM A 635 (ASTM A 635M) (commercial quality) hot- rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153, Class B-2 or B-3, as applicable, for rigid anchors fabricated from steel sheet or strip with a thickness of
0.180 inch (4.6 mm) and greater.

H. Steel Plates and Bars: ASTM A 36 (ASTM A 36M), hot-dip galvanized to comply with ASTM A 153, Class B-1, B-2, or B-3, as applicable to size and form indicated.

I. Stainless-Steel Plates, Bars, and Dowels: ASTM A 167, ASTM A 276, or ASTM A 666, Type 304 or
316; temper as required to support loads imposed without exceeding allowable design stresses.

2 .7 BENT WIRE TIES

A. Individual units prefabricated from bent wire to comply with requirements indicated below:

1. Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with closed ends and not less than 4 inches (100 mm) wide.

2. Type for Masonry Where Coursing Between Way the Aligns: Unit ties bent from one piece of wire.
3. Type for Masonry Where Coursing Between Way the Does Not Align: Adjustable ties composed of 2 parts; one with pint fees, the other with eyes; maximum misalignment of 1-1/4 inches (32 mm).

2 .8 ADJUSTABLE ANCHORS FOR CONNECTING TO STRUCTURAL FRAME

A. General: Provide 2-piece assemblies as described be/ow, allowing vertical or horizontal differential movement between wall and frame parallel to plane of wall but resisting tension and compression forces perpendicular to it.

1. For anchorage to concrete, provide manufacturer's standard anchors with

dovetail anchor section formed from sheet metal and triangular-shaped wire tie section sized to extend within 1 inch (25 mm) of masonry face and as follows, or as indicated in drawings:

a. Wire Diameter: 0.1875 inch (4.8 mm)
b. Wire Diameter 0.25 inch (6.4 mm)

2. For anchorage to steel framing, provide manufacturer's standard anchors with crimped ¼ inch (6.4 mm) diameter wire anchor section for welding to steel and triangular- shaped wire tie section sized to extend within 1 inch (25 mm) of masonry face and as follows, or as indicated in drawings.

a. Wire Diameter: 0.1875 inch (4.8 mm). b. Wire Diameter. 0.25 inch (6.4 mm).

2 .9 RIGID ANCHORS

A. General: Fabricate from steel bars as follows:
1. 1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (600 mm) long, with ends turned up 2 inches (50 mm) or with cross pins.
2. Or as indicated, in drawings.

2 .10 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron inserts of type and size indicated.

B. Dovetail Slots: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.0336- inch (0.85-mm), galvanized steel sheet.

B. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

1. Headed bolts.
3. Nonheaded bolts, straight.
4. Nonheaded bolts, bent in manner indicated.

D. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
1. Type: Chemical anchors.
2. Type: Expansion anchors.
3. Type: Undercut anchors.
4. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B

633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
5. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 167 or ASTM A 276, Type 304 or 316, for anchors.
6. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to 4 times the loads imposed by masonry.
7. For Postinstalled Anchors in Grouted Concrete Masonry Units: Capability to sustain, without failure, a load equal to 6 times the loads imposed by masonry.

2 .11 EMBEDDED FLASHING MA TERIALS

A. Sheet Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section “Sheet Metal Flashing and Trim” and below.

1. Stainless Steel: 0.0156 inch (0.4 mm) thick.
2. Fabricate through-wall metal flashing embedded in masonry as follows
a. With ribs formed in dovetail pattern at 3-inch (75-mm) intervals along length of flashing to provide a 3-way integral mortar bond and weep-hole drainage.
b. With ribs formed in saw tooth pattern at 3-inch (75-mm) intervals along length of flashing to provide a 3-way integral mortar bond and weep-hole drainage.

3. Fabricate metal expansion-joint strips from sheet metal indicated above, formed to shape indicated.

4. Application: Use where flashing is fully or party concealed in masonry wall.

B. Solder and Sealants for Sheet-Metal Flashings: As specified in Division 7 Section "Sheet Metal
Flashing and Trim "

C. Adhesive for Flashings: Of type recommended by manufacturer of flashing material for use indicated.

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

1. Metal Flashing:
a. Cheney Flashing (Dovetail); Cheney Flashing Company, Inc. b. Cheney Flashing (Sawtooth); Cheney Flashing Company, Inc.
c. Keystone 3-Way Interlocking Thruwall Flashing; Keystone Flashing Co.

2 .12 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM a 1056, Type 2, Class A, Grade
1; compressible up to 35 percent; of width and thickness indicated; formulated from the following material:

1. Urethane.
2. Polyvinyl chloride.
C. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Styrene-8utadiene Rubber Compound: ASTM D 2000, Designation M2AA-805.
2. Polyvinyl Chloride: ASTM a 2287, General Purpose Grade, Type PVC-65406.

D. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No.15 asphalt felt).

D. Weep Holes: Provide the following:

1. Round Plastic Tubing: Medium-density polyethylene, 318-inch (9-mm) outside diameter by 4 inches (100 mm) long.
2. Rectangular Plastic Tubing Clear butyrate. 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm).
3. Wicking Material: Material as indicated below, in length required to produce 2-inch (50 mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes.

a. Cotton sash cord b. Fibrous glass rope.

4. Aluminum Weep Hole/Vent: One-piece, L-shaped units made from sheet aluminum to fit in a vertical mortar joint and consisting of a vertical channel with louvers stamped in web and a flat horizontal; painted to comply with Division 9 Section "Painting and Coating," prior to installation, in color approved by Architect to match that of mortar.
5. Plastic Weep Hole/Vent: One-piece, flexible extrusion manufactured from ultraviolet-resistant polypropylene copolymer, designed to weep moisture in masonry cavity to exterior, sized to fill head joints with outside face held back 1/8 inch (3 mm) from exterior face of masonry, in color selected from manufacturer's standard.
6. Vinyl Weep Hole/Vent: One-piece, offset, T -shaped units formed to fit in a vertical mortar joint by injection molding of flexible polyvinyl chloride and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and top flap; in color approved by Architect to match that of mortar.
7. Available Products: Subject to compliance with requirements, weep hole/ventilators that may be incorporated in the Work include, but are not limited to the following:
8. Products: Subject to compliance with requirements, provide one of the following weep hole/ventilators.

a. Aluminum Weep HoleNent:
1) Wilko Weephole Ventilators; Hohmann & Barnard, Inc b. Plastic Weep HoleNent:
1) Cell Vent; Dur-O-Wal, Inc. c. Vinyl Weep HoleNent:
1) Williams-Goodco Brick Vent; Williams Products, Inc.

E. Cavity Drainage Material: 1-inch- (25-mm-) thick, reticulated, nonabsorbent mesh, made from polyethylene strands and shaped to maintain drainage at weep holes without being clogged by mortar droppings.

1. Product: Subject to compliance with requirements, provide "Mortar Net" by Mortar Net USA,Ltd.
2 .13 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Add cold-weather admixture (if used) at the same rate for all mor1ar, regardless of weather conditions, in order to ensure that mortar color is consistent

B. Mortar for Unit Masonry: Comply with ASTM C 270. Proportion Specification, for types of mortar indicated below.

C. Mortar for Unit Masonry: Comply with ASTM C270. Proportion Specification for job-mixed mortar: and ASTM C 1142 for ready-mixed mortar, of types indicated below.

1. Limit cementitious materials in mortar for exterior use to Portland cement and lime.
2. For masonry below grade, in contact with earth, and where indicated, use type indicated below:

a. Type: S.
b. Type: S or RS. c. Type: M.

3. For reinforced masonry and where indicated, use type indicated below:

a. Type: S.
b. Type: S or RS.

4. For exterior, above-grade, Joad-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions, and for other applications where another type is not indicated, use type indicated below:

a. Type: N.
b. Type: Nor RN.

C. Grout for Unit Masonry: Comply with ASTM C 476. Use grout of consistency indicated or, if not otherwise indicated, of consistency (fine or coarse) at time of placement that will completely fill spaces intended to receive grout.

1. Use fine grout in grout spaces less than 2 inches (50 mm) in horizontal dimension, unless otherwise indicated.
2. Use coarse grout in grout spaces 2 inches (50 mm) or more in least horizontal dimension, unless otherwise indicated.

E. Epoxy Pointing Mortar: Mix epoxy-pointing mortar to comply with mortar manufacturer's directions.

2 .14 SOURCE QUALITY CONTROL

A. The Owner will engage and pay for the services of an independent testing agency to perform the following testing for Source quality control. Payment for these services will be made from the Inspection and Testing Allowance, as authorized by Change Orders. Retesting of materials
failing to meet specified requirements shall be done at Contractor's expense.

B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested for strength, absorption, and moisture content per ASTM C 140.

PART 3 - EXECUTION

3 .1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.1. For the record, prepare written report, endorsed by Installer testing conditions detrimental to performance of unit masonry.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3 .2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown, Build single-wythe walls to the actual thickness of the masonry units, using units of thickness indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections of the Specifications.

C. Leave openings for equipment to be installed before completion of masonry, after installing equipment, complete masonry to match construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, un-chipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where Possible, Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified- Install cut units with cut surfaces and, where possible, cut edges concealed,

E. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

3 .3 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces of columns, walls, and arrises, do not exceed
1/4 inch in 10 feet (6 mm in 3 m), nor 3/8 inch in 20 feet (10 mm in 6 m), nor 1/2 inch in 40 feet (12 mm in 12 m) or more. For external corners, expansion joints, control joints-, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch in 40 feet (12 mm in 12 m) or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m), nor
1/2 inch in 40 feet (12 mm in 12 m) or more, For top surface of bearing walls, do not exceed 1/8 inch (3 mm) in 10 feet (3 m), nor 1/16 inch (1.5 mm) within width of a single unit.

C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls, and partitions, do not exceed 1/2 inch in 20 feet (12 mm in 6 m), nor 3/4 inch in 40 feet (19 mm in 12 m) or more.

D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch (6 mm) nor plus 1/2 inch (12 mm).

E. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 112 inch (12 mm). Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8 inch (3mm). Do not vary from head-joint thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary head-joint thickness from adjacent head-joint thickness by more than 1/8 inch (3 mm). Do not vary from collar-joint thickness indicated by more than minus ¼ inch (6 mm) or plus 3/8 inch (10 mm).

3 .4 LAYING MASONRY WALLS

A. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at comers or jambs.

1. As indicated on Drawings.

D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

E. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar prior to laying fresh masonry.

E. Built-in Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

G. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

I. ill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

J. Build non load-bearing interior partitions full height of story to underside of solid floor or roof structure above and as follows:

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

3 .5 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows.

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
4. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8-inch (10-mm) joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
1. For glazed masonry units, use a nonmetallic jointer 3/4 inch (19 mm) or more in width. C. Cut joints flush for masonry walls that are to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

1. Interior walls and partitions.

3 .6 STRUCTURAL BONDING OF MULTIWYTHE MASONRY

A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties as shown, but not less than 1 metal tie for 4 sq. ft. (0.37 sq. m) of wall area spaced not to exceed 24 inches (610 mm) o.c. horizontally and vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.

B. Use continuous horizontal-joint reinforcement installed in horizontal mortar joints for bond tie between wythes.

C. Use either of the structural bonding systems specified above. D. Use structural bonding system indicated on Drawings.
E. Corners: Provide interlocking masonry unit bond in each course at corners, unless other-wise shown.
1. Provide continuity with horizontal-joint reinforcement at comers by using prefabricated "L" units in addition to masonry bonding.

F. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:

1. Provide individual metal ties not more than 16 inches (406 mm) o.c.
2. Provide continuity with horizontal-joint reinforcement by using prefabricated "T" units.
3. Provide rigid metal anchors not more than 24 inches .(610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3 .7 HORIZONTAL-JOINT REINFORCEMENT

A. General: Provide continuous horizontal-joint reinforcement as Indicated Install entire length of
longitudinal side rods in mortar with a minimum cover of 5/8 inch(16 mm) on exterior side of walls,
1/2 inch (13 mm) elsewhere. Lap reinforcing a minimum of 6 inches (150 mm)

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
5. Provide reinforcement in mortar joint 1 block course above and below wall openings and extending 12 inches (305 mm) beyond opening.
6.
a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections.
Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3 .8 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of block units on one side of control joint. Fill the resultant core with grout and rake joints in exposed faces.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
4. Install temporary foam plastic filler in head joints and remove when unit masonry is complete.

C. Build-in horizontal pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants".
3 .9 LINTELS

A. Install steel lintels where indicated

B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick size units and 24 inches (610 mm) for block size units are shown without structural steel or other supporting lintels.

1. Provide prefabricated or built-in-place masonry lintels. Use specially formed bond beam units with reinforcement bars placed as indicated and filled with coarse grout. Cure pre-cast lintels before handling and installing. Temporarily suppOr1 built-in-place lintels until cured.

C. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

3 .10 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.

B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer before covering with mortar

C. Install flashing as follows:

1. At composite masonry walls, including cavity walls, extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches (100 mm), and through the inner wythe to within 1/2 inch (13 mm) of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2 inches (50 mm), unless otherwise indicated.
2. At lintels and shelf angles, extend flashing a minimum of 4 inches (100 mm) into masonry at each end. At heads and sills, extend flashing 4 inches (100 mm) at ends and turn up not less than 2 inches (50 mm) to form a pan.
3. Interlock end joints of ribbed sheet-metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements of Division 7 Section " Joint Sealants" for application indicated.
4. Extend sheet-metal flashing 1/2 inch (13 mm) beyond face of masonry at exterior and turn down to form a drip.
5. Cut off flashing flush with face of wall after masonry wall construction is completed.

D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:

1. Form weep holes by keeping head joints free and clear of mor1ar.
2. Space weep holes 24 inches (600 mm) o.c.
3. In cavities, place pea gravel to a height equal to height of first course, but not less than 2 inches (50 mm), immediately above top of flashing embedded in the wall, as masonry construction progresses, to splatter mor1ar droppings and to maintain drainage.
4. Place cavity drainage material immediately above flashing in cavities.
E. Trim wicking material used in weep holes flush with outside face of wall after mor1ar has set. F. Install vents in vertical head joints at the top of each continuous cavity. Space vents and close off cavities vertically and horizontally with blocking as indicated:

1. Install through-wall flashing and weep holes above horizontal blocking.

G. Install reglets and nailers for flashing and other related construction where shown to be built into masonry.

3 .11 INSTALLATION OF REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain Position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Do not exceed the following pour heights for fine grout.
a. For minimum widths of grout spaces of 3/4 inch (19 mm) or for minimum grout space of hollow unit cells of 1-1/2 by 2 inches (38 by 51 mm), pour height of 12 inches (305 mm).
b. For minimum widths of grout spaces of 2 inches (51 mm) or for minimum grout space of hollow unit cells of 2 by 3 inches (51 by 76 mm), pour height of 60 inches (1524 mm).
c. For minimum widths of grout spaces of 2-1/2 inches (63 mm) or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches (63 by 76 mm), pour height of 12 feet (3.6 m).
d. For minimum widths of grout spaces of 3 inches (76 mm) or for minimum grout space of hollow unit cells of 3 by 3 inches (76 by 76 mm), pour height of 24 feet (7.3 m).
2. Do not exceed the following pour heights for coarse grout:
a. For minimum widths of grout spaces of 1-1/2 inches (38 mm) or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches (38 by 76 mm), pour height of 12 inches (305 mm).
b. For minimum widths of grout spaces of 2 inches (51 mm) or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches (63 by 76 mm), pour height of 60 inches (1524 mm).
c. For minimum widths of grout spaces of 2-1/2 inches (63 mm) or for minimum grout space of hollow unit cells of 3 by 3 inches (76 by 76 mm), pour height of 12 feet (3.6 m).
d. For minimum widths of grout spaces of 3 inches (76 mm) or for minimum grout space of hollow unit cells of 3 by 4 inches (76 by 101 mm), pour height of 24 feet (7.3 m).
3. Provide cleanout holes at least 3 inches (76 mm) in least dimension for grout pours over 60 inches (1524 mm) in height.
a. Provide cleanout holes at each vertical reinforcing bar.
b. At solid grouted masonry, provide cleanout holes at not more than 32 inches (813 mm) o. c.

3 .12 FIELD QUALITY CONTROL

A. The Owner will engage and pay for the services of an independent testing agency to perform the following testing for field quality control. Payment for these services will be made from the Inspection and Testing Allowance, as authorized by Change Orders. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. (460 sq. m) of wall area or portion thereof.

B. Mortar composition and properties will be evaluated per ASTM C 780.

D. Grout will be sampled and tested for compressive strength per ASTM C 1019.

F. Evaluation of Quality-Control Tests: In the absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality- control tests comply with minimum requirements indicated.

3 .13 PARGING

A. Parge pre-damped masonry walls, where indicated, with Type S or Type N mortar applied in 2 uniform coats to a total thickness of 3/4 inch (19 mm). Scarify first parging coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form awash at top of parging and a cove at bottom.

B. Damp cure parging for at least 24 hours and protect until cured.

3 .14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.
D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel: one half of panel un-cleaned for comparison purposes. Obtain Architect’s approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

D. Protection: Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3 .15 MASONRY WASTE DISPOSAL

A. Recycling: Undamaged, excess masonry materials are Contractor's property and shall be removed from the Project site for his use.

B. Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches (100 mm) in greatest dimension.
2. Mix masonry waste with at least 2 parts specified fill material for each part masonry waste. Fill material is specified in Division 2 Section "Earthwork."
3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste and legally dispose of off Owner's property.

END OF SECTION 04200

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Decorative concrete masonry units.

B. See Division 5 Section "Structural Steel" for installing anchor sections of adjustable masonry anchors for connecting to structural frame.

1.2 QUALITY ASSURANCE

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on each type of unit required per test method indicated. 1. Concrete Masonry Units: ASTM C 140.
2. Mortar: For properties per ASTM C 270.
3. Grout: For compressive strength per ASTM C 1019.

B. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.3 PROJECT CONDITIONS

A. Hot-Weather Requirements: When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 COLORS AND TEXTURES

A. Exposed Masonry Units: To match Sto Corporation No. NA01-0048.

2.3 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners.

B. Concrete Masonry Units: ASTM C 90.
1. Unit Compressive Strength: 1900-psi- minimum, average net-area compressive strength.
2. Weight Classification: Normal weight.
3. Provide type: I, moisture-controlled units.
4. Provide type II, nonmoisture-controlled units (may only be used above grade).
5. Exposed Faces of Decorative Units: Normal-weight aggregate, split-face finish.
6. Special Shapes: Provide for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

C. CMU Wainscot
1. Manufacturer: Provide products by one of the following:
a. Angelus Block Co., Inc.
Contact: Richard Carey at (714) 637-8594.
2. Size: Manufactured to following dimensions:
a. Solid Precision (Smooth): 4” x 8” x 16” Nominal, (3-13/16” x 7 5/8” x 15 5/8” Actual.)
b. Solid Split Face 1-Side: 4” x 8” x 16” Nominal, (3-13/16” x 7 5/8” x 15 5/8” Actual.)
c. Solid Precision “L”: 4” x 8” x 16” Nominal, (3-13/16” x 7 5/8” x 15 5/8” Actual.)
d. Solid Split Face “L” 1-side 1-end: Nominal, (3-13/16” x 7 5/8” x 15 5/8” Actual.)
3. Color: As specified in drawings
4. Chamfer: Burnish Chamber as Specified in Drawings

2.4 MORTAR AND GROUT MATERIALS A. Mortar Cement: ASTM C 1329.
1. Products:
a. Blue Circle Cement; Magnolia Superbond Mortar Cement. b. Lafarge Corporation; Lafarge Mortar Cement.

2. Colored Masonry Cement:

a. Products:

1) Blue Circle Cement; Magnolia Masonry Cement.
2) Lafarge Corporation; Centurion Colorbond. B. Water: Potable.
C. Wainscot Mortar Color: Refer to the Exterior Finish Schedule.

2.5 REINFORCING

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60.

B. Masonry Joint Reinforcement: ASTM A 951; mill galvanized hot-dip galvanized, carbon-steel wire for exterior walls.

2.6 TIES AND ANCHORS

A. Materials, General: As follows, unless otherwise indicated:

1. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating for exterior walls and Class 1 coating for interior walls.
2. Galvanized Steel Sheet: ASTM A 366/A366M .

B. Bent Wire Ties: Rectangular units with closed ends and not less than 4 inches wide, made from 3/16-inch- diameter, galvanized steel wire.

2.7 EMBEDDED FLASHING MATERIALS

A. Contractor's Option for Concealed Flashing: For flashing partly exposed to the exterior, use metal flashing specified above. For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: Manufacturer's standard laminated flashing consisting of 5-oz./sq. ft. sheet copper bonded with asphalt between 2 layers of glass-fiber cloth. a. Products:
1) Advanced Building Products, Inc.; Copper Fabric Flashing.
2) AFCO Products, Inc.; Copper Fabric.
3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
4) Phoenix Building Products; Type FCC-Fabric Covered Copper.

2. Rubberized-Asphalt Flashing: Manufacturer's standard composite flashing product consisting of a pliable and highly adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of 0.030 inch.

a. Products:

1) Dur-O-Wal, Inc.; Dur-O-Barrier.
2) Grace, W. R. & Co., Construction Products Division; Perm-A-Barrier Wall Flashing.
3) Hohmann & Barnard, Inc.; Textroflash.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Designed to fit standard sash block and to maintain lateral stability in masonry wall. Made from styrene-butadiene-rubber compound complying with ASTM D 2000, Designation M2AA-805.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.9 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, unless otherwise indicated. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.

1. Extended-Life Mortar for Unit Masonry: Mortar complying with ASTM C 1142 may be used instead of mortar specified above, at Contractor's option.
2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.

3. For masonry below grade, in contact with earth, and where indicated, use Type S.
4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

C. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

2.11 SOURCE QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below. Payment for these services will be made by Owner.

B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cut masonry units with motor-driven saws. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

C. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

1. For conspicuous vertical lines, such as external corners, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
2. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

3.2 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in bond pattern indicated; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

D. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.3 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

3.4 MASONRY JOINT REINFORCEMENT

A. Provide continuous masonry joint reinforcement as indicated. Install with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

B. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections.

3.5 ANCHORING MASONRY

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated.
2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

3.6 LINTELS

A. Provide masonry lintels where shown. Provide precast lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated.

3.7 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

1. Extend flashing 4 inches at ends and turn flashing up not less than 2 inches to form a pan.
2. Install metal drip edges beneath flashing at exterior face of wall. Stop flashing 1/2 inch back from outside face of wall and adhere flashing to top of metal drip edge.
3. Install metal flashing termination beneath flashing at exterior face of wall. Stop flashing 1/2 inch back from outside face of wall and adhere flashing to top of metal flashing termination.

3.8 FIELD QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform field quality-control testing indicated below. Payment for these services will be made by Owner.

1. Testing Frequency: Tests and Evaluations listed in these subparagraphs will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.
2. Mortar: Properties will be tested per ASTM C 780.
3. Grout: Sampled and tested for compressive strength per ASTM C 1019.
4. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

3.9 PARGING

A. Parge predampened masonry walls, where indicated, with Type S or Type N mortar applied in 2 uniform coats to a total thickness of 3/4 inch with a steel-trowel finish. Form a wash at top of parging and a cove at bottom. Damp-cure parging for at least 24 hours.

3.10 CLEANING

A. Clean unit masonry by dry brushing to remove mortar fins and smears before tooling joints, as work progresses.

B. After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Protect adjacent surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
4. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

3.11 MASONRY WASTE DISPOSAL

A. Masonry Waste Disposal: Remove masonry waste and legally dispose of off Owner’s property.

END OF SECTION 04810

Division 5 - Metals

SECTION 05120 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural plates.
2. Steel stiffners.
3. Hollow structural sections.
4. High-strength threaded rods.
5. Bolts, washers and anchors.

1.2 REFERENCES (As applicable)

A. American Institute of Steel Construction:
1. AISC Code of Standard Practice for Steel Buildings and Bridges.
2. AISC Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings.
3. AISC Load and Resistance Factor Design Specification for Single-Angle Members.
4. AISC Seismic Provisions for Structural Steel Buildings.
5. AISC Specification for Allowable Stress Design of Single-Angle Members.
6. AISC Specification for the Design of Steel Hollow Structural Sections.
7. AISC Specification for Structural Steel Buildings Allowable Stress Design, and Plastic Design.

B. ASTM International:
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
3. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

C. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.

D. Research Council on Structural Connections:
1. RCSC - Specification for Structural Joints Using ASTM A325 or A490 Bolts.

1.3 SUBMITTALS

A. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, attachments, and fasteners.
2. Connections.
3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

B. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.

C. Manufacturer's Mill Certificate: Certify products meet or exceed specified requirements.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.4 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this section with documented experience.

B. Erector: Company specializing in performing Work of this section documented with .

C. Welders and Welding Procedures: AWS D1.1 qualified within previous 12 months.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

A. All steel members shall be galvanized.

B. Angles: Size as specified.

C. Hollow Structural Sections: ASTM A500. D. Structural Plates: Size as specified.

2.2 FASTENERS, CONNECTORS, AND ANCHORS

A. High Strength Bolts: ASTM A325; Type 3.
1. Size: As indicated in Drawings.
2. Finish: As selected by Engineer.

B. Washers: Steel Plates.
1. Size: As indicated in Drawings.
2. Finish: As selected by Engineer.

2.3 WELDING MATERIALS

A. Welding Materials: AWS D1.1; type required for materials being welded.

2.4 FINISH

A. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted, as indicated on Drawings.

2.5 SOURCE QUALITY CONTROL AND TESTS

A. Shop test bolted and welded connections as specified for field quality control tests.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify high-strength threaded and anchors rods are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

A. Furnish templates for installation of anchor rods and embedments in concrete work.

3.3 ERECTION

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

B. Field weld components and shear connectors, as indicated on Drawings. C. Field connect members with threaded rods; torque to required resistance.
D. Do not field cut or alter structural members without prior approval of Engineer.

3.4 ERECTION TOLERANCES

A. Maximum Variation From Plumb: ¼ inch, non-cumulative. B. Maximum Offset From Alignment: ¼ inch.
3.5 FIELD QUALITY CONTROL

A. Bolted Connections: Inspect in accordance with AISC specifications.

1. Visually inspect all bolted connections.

B. Welding: Inspect welds in accordance with AWS D1.1.
1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Visually inspect all welds.
3. Ultrasonic Inspection: ASTM E164; perform on all full penetration welds.
4. Liquid Penetrant Inspection: ASTM E165.
5. Magnetic Particle Inspection: ASTM E709.
6. Radiographic Inspection: ASTM E94.

C. Correct defective bolted connections and welds.

END OF SECTION 05120

SECTION 05 21 00 - STEEL JOISTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Open Web Steel Joists and Joist Girders.

1.2 RELATED SECTIONS

A. Section 03 63 00 - Epoxy Grouting.

B. Section 05 12 16 - Fabricated Fireproofed Steel Columns. C. Section 05 31 13 - Steel Floor Decking.
D. Section 05 31 00 - Steel Decking.

E. Section 05 50 00 - Metal Fabrications.

F. Section 06 11 16 - Mechanically Graded Lumber. G. Section 07 81 33 - Mineral-Fiber Fireproofing.
H. Section 09 90 00 - Painting and Coating.

1.3 REFERENCES

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges. B. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.
C. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

D. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

E. ASTM A 563 - Standard Specification for Carbon and Alloy Steel Nuts.

F. ASTM B 695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

G. ASTM F 436 - Standard Specification for Hardened Steel Washers.

H. ASTM F 568M - Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

I. AWS D1.1 - Structural Welding Code - Steel

J. Steel Joist Institute (SJI) - Standard Specifications, Load Tables & Weight Tables for Steel Joists and Joist Girders.

K. SJI - Code of Standard Practice.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Show steel joists and joist girders and related work, showing sizes, details of fabrication and construction, locations of hardware, anchors, bridging and accessories, and erection and installation details.

D. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within previous 12 months.

E. Certification: Submit evidence of SJI membership and that joists and joist girders have been designed in accordance with SJI requirements.

F. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
1. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation including percentages by weight of post consumer and preconsumer recycled content
a. Include statement indicating costs for each product having recycled content.
2. Product Data for Credit MR 5.1 and Credit MR 5.2: Submit data, including location and distance from Project of material manufacturer and point of extraction, harvest or recovery for main raw material.
a. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

G. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Member of the Steel Joist Institute who regularly produces steel joists of the K, LH, or DLH Series, or joist girders conforming to SJI's Specifications and Load Tables and whose designs have been checked and accepted by the Steel Joist Institute.

B. Design connections under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

C. Perform Work in accordance with SJI, Standard Specification, Code of Standard Practice, Load Tables, and Weight Tables, including headers and other supplementary framing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation. B. Deliver, store and handle as recommended by the SJI Specifications and Code of Standard Practice,

1.7 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress. PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: New Millennium Building Systems

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 PRODUCTS

A. Provide Steel Joists in conformance with SJI - Standard Specifications, Load Tables & Weight Tables for Steel Joists and Joist Girders.

B. Open Web Joists Members: SJI Type

1. Open Web Steel Joists (K Series).
2. Longspan Steel Joists (LH Series).
3. Deep Longspan Steel Joists (DLH Series).
4. Joist Girders.
5. Composite Joist (CJ Series).

C. Bridging: Provide bridging of material, size, and type required by SJI Standard Specifications for type of joist, chord size, spacing, and span.

D. Furnish ceiling extensions, where indicated on the Drawings, either extended bottom-chord elements or a separate extension unit to support ceiling construction load indicated on the Drawings. Extend ends to within 1 inch (25 mm) of finished wall surface unless otherwise indicated.

E. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
1. Finish: Plain, uncoated.
2. Finish: Hot-dip zinc coating, ASTMA153/A153M, Class C
3. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

F. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
1. Finish: Plain, uncoated.
2. Finish: Hot-dip zinc coating, ASTMA153/A153M, Class C
3. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

H. Welding Materials: AWS D1.1; type required for materials being welded.

2.3 FINISH

A. Steel joists and joist girders shall be properly cleaned and primed with one coat of manufacturer's standard shop primer in accordance with the SJI Standard Specifications. PART 3 EXECUTION
3.1 EXAMINATION

A. Do not install joists until supporting construction is in place.

B. If supporting construction is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions in accordance with SJI Standard Specifications.

3.3 INSTALLATION

A. Install in accordance with SJI Standard Specifications.

B. Erect steel joists and joist girders as indicated and in accordance with the reviewed and accepted submittals and the SJI Standard Specifications and Code of Standard Practice for the type of joists and joist girders indicated. Conform also with applicable requirements of AISC Specifications for Structural Steel Buildings - Allowable Stress Design and Plastic Design.

C. Align and adjust joists and joist girders accurately before fastening. Tolerances shall conform with AISC Code of Standard Practice for Steel Buildings and Bridges. Fastening of splices of compression members shall be performed after the abutting surfaces have been brought into contact. Bearing surfaces and surfaces that will be in permanent contact shall be cleaned before the members are assembled. Splices will be permitted only where indicated.

D. Set joists and joist girders accurately at the established lines and levels. Joists and joist girders shall be plumb and level (with indicated allowance for camber) before bolting is commenced. Temporary bracing shall be provided as required and shall be kept in position until completion of erection, anchorage, and bridging installation.

E. Frame openings greater than 18 inches (450 mm) with supplementary framing. F. Do not permit erection of decking until joists are properly bridged and secured.
G. Install horizontal bridging for top and bottom chords as indicated and in accordance with the SJI Standard Specifications and Code of Standard Practice.

H. Do not field cut or alter structural members without approval of Architect/Engineer.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements.

3.5 TOUCH UP AND CLEANING

A. After erection, spot prime and touch up all field bolts, field welds, and abrasions to the shop coat. Clean surfaces properly as required for primer adherence and as required toprevent corrosion. Use same primer as was used for shop priming.

3.6 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes the following metal fabrications:

Rough hardware
Ladders
Ladder safety cages
Loose bearing and leveling plates
Loose steel lintels
Miscellaneous framing, supports and trim
Shelf and ledger angles
Metal bar gratings
Floor plates
Tread plates
Steel pipe guardrails and handrails
Cast nosings and treads
Metal stairs
Pipe bollards

B. Related Sections: Refer to Section 052000, "Structural Steel Framing" for structural steel framing components.

1.02 REFERENCES

A. Aluminum Association (AA)

B. American National Standards Institute (ANSI) A14.3 Safety Requirements for Fixed Ladders
C. American Society of Testing and Materials (ASTM)

A27 Specification for Steel Castings, Carbon, for General Application

A36 Specification for Structural Steel

A47 Specification for Ferritic Malleable Iron Castings

A48 Specification for Gray Iron Castings

A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

A276 Specification for Stainless and Heat-Resisting Steel Bars and Shapes
A307 Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength A366 Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality A446 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip
Process, Structural (Physical) Quality

A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

A510 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

A526 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality

A569 Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality

A570 Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

A780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

A786 Specification for Rolled Steel Floor Plates

B221 Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B632 Specification for Aluminum-Alloy Rolled Tread Plate

C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) E985 Specification for Permanent Metal Railing Systems and Rails for Building

D. American Welding Society (AWS)

D1.1 Structural Welding Code - Steel

D1.3 Structural Welding Code - Sheet Steel

E. Code of Federal Regulations (CFR)

Title 29 Part 1910 Labor-Occupational Safety and Health Standards

F. Corps of Engineers (CE)

CRD C621 Specification for Nonshrink Grout

G. Federal Specifications (FS)

FF-B-561 Bolts, Screw, Lag

FF-B-588 Bolt, Toggle, and Expansion Sleeve, Screw

FF-S-92 Screw, Machine, Slotted, Cross-Recessed or Hexagon Head

FF-S-111 Screw, Wood

FF-S-325 Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)

FF-W-84 Washers, Lock (Spring) FF-W-92 Washer, Flat (Plain)
TT-P-664 Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant

TT-P-645 Primer, Paint, Zinc Chromate, Alkyd Type

H. Military Standardization Documents (MIL)

P-21035 Paint, High Zinc Dust Content, Galvanizing Repair

I. National Association of Architectural Metal Manufacturers (NAAMM) AMP 500 Metal Finishes Manual
AMP 510 Metal Stair Manual

MBG 531 Metal Bar Grating Manual

MBG 532 Heavy Duty Metal Bar Grating Manual and Pipe Railing Manual

J. National Fire Protection Association (NFPA)

101 Life Safety Code

K. Steel Structures Painting Council (SSPC)

SSPC-PA 1 Paint Application Specification No. 1

SSPC Paint 12 Paint Specification No. 12 Cold Applied Asphalt Mastic (Extra Thick Film)

SSPC Paint 20 Paint Specification No. 20 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic")

SSPC-SP1 Surface Preparation Specification No. 1 "Solvent Cleaning" SSPC-SP2 Surface Preparation Specification No. 2 "Hand-Tool Cleaning"

SSPC-SP3 Surface Preparation Specification No. 3 "Power Tool Cleaning" SSPC-SP7 Surface Preparation Specification No. 7 "Brush-Off Blast Cleaning"
L. International Building Code (IBC)

M. Uniform Federal Accessibility Standards (UFAS) Fed. Std. 795
1.03 DEFINITIONS

A. Refer to ASTM E985 for railing-related terms that apply to this section.

B. Refer to the NAAMM publications listed in Article 1.02 "References" for definition of terms that apply to this section.

1.04 SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Section 01300, "Submittal Procedures".

A. Product Data: Submit product data for products used in metal fabrications, including paint products, grout and fasteners.

B. Shop Drawings: Submit detailed shop and erection drawings of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Welder certificates signed by Contractor certifying that welders comply with requirements specified in 1.05C.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated. Where conflicts occur, comply with the more stringent requirements.

1. ANSI 14.3

2. AWS D1.1 and D1.3

3. NFPA 101

B. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that shown on the drawings, with sufficient production capacity to produce required units without causing delay in the work.

C. Qualify welding processes and welding operators in accordance with AWS D1.1 and D1.3.

Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

D. All materials used shall be free of lead, and asbestos fibers.

E. Use of damaged items is prohibited.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.

B. Storage on Site: Store materials in a location and in a manner to avoid damage. Stacking shall be done in a way which will prevent bending.

Store metal components and materials in a clean, dry location. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that will permit circulation of air inside the cover.

C. Keep handling on-site to a minimum. Exercise care to avoid damage to finishes of material.

1.07 PROJECT CONDITIONS

Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

1.08 SEQUENCING AND SCHEDULING

Sequence and coordinate installation of wall handrails as follows:

A. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.

B. Mount handrails only on gypsum board assemblies reinforced with proper blocking and backing to receive anchors, and where the location of concealed anchor plates has been clearly marked for benefit of Installer.

PART 2 - PRODUCTS

2.01 FERROUS METALS

A. Metal Surfaces, General: Form metal fabrications exposed to view upon completion of the work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

B. Steel Plates, Shapes, and Bars: ASTM A36. C. Rolled Steel Floor Plates: ASTM A786.

D. Steel Bars for Gratings: ASTM A569 or ASTM A36. E. Wire Rod for Grating Cross Bars: ASTM A510.
F. Steel Tubing: Cold-formed, ASTM A500, Grade B, unless otherwise indicated.

G. Uncoated Structural Steel Sheet: Hot-rolled, ASTM A570, Grade 30 unless otherwise indicated.

H. Uncoated Steel Sheet (Commercial quality): Cold-rolled, ASTM A366. I. Galvanized Steel Sheet: Quality as follows:
1. Structural Quality: ASTM A446; Grade A, unless another grade required for design loading, and G90 coating designation unless otherwise indicated.

2. Commercial Quality: ASTM A526, G90 coating designation unless otherwise indicated.

J. Steel Pipe: ASTM A53, Type S, Grade B, standard weight (schedule 40), black finish, unless otherwise indicated.

K. Gray Iron Castings: ASTM A48, Class 30.

L. Malleable Iron Castings: ASTM A47, Grade 32510.

M. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

N. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A153.

O. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

2.02 STAINLESS STEEL

A. Bar Stock: ASTM A276, Type 302 or 304. B. Plate: ASTM A167, Type 302 or 304.
2.03 ALUMINUM

A. Extruded Bars and Shapes: ASTM B221, alloy 6061-T6 or 6063-T6 for bearing bars of gratings and shapes and 6061-T6 for grating cross bars.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B632, alloy 6061-T4 for treads and 6061-T6 for platforms.

2.04 GROUT

Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107 (formerly referenced as CE CRD C621).

Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to the following:

Euco N-S Grout - Euclid Chemical Co. Kemset - Chem-Masters Corp.
Crystex - L & M Construction Chemicals, Inc.
Sonogrout - Sonneborn Building Products Div., Rexnord Chemical Products, Inc. Supreme Grout - Cormix, Inc.
Sure-Grip High Performance Grout - Dayton Superior
Vibropruf #11 - Lambert Corp.

2.05 FASTENERS

A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required. Suspect/counterfeit bolts will not be accepted and will be replaced at Contractor's expense.

B. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A. C. Lag Bolts: Square head type, FS FF-B-561.
D. Machine Screws: FS FF-S-92.

E. Wood Screws: Flat head carbon steel, FS FF-S-111. F. Plain Washers: Round, carbon steel, FS FF-W-92.
G. Expansion Anchors: Expansion anchors complying with FS FF-S-325.

H. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required. I. Lock Washers: Helical spring type carbon steel, FS FF-W-84.
J. Special Fasteners: Split nuts, indicator washers and others, as indicated.

2.06 PAINT

A. Shop Primer for Ferrous Metal: Red oxide, lead- and cadmium-free, corrosion-inhibiting primer complying with performance requirements of FS TT-P-664.

B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94% zinc dust by weight, and complying with MIL-P-21035 or SSPC-Paint-20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint-12 except containing no asbestos fibers.

D. Zinc Chromate Primer: FS TT-P-645.

2.07 CONCRETE FILLA. Concrete Materials and Properties: Comply with requirements for Section 03300, "Cast- in-Place Concrete" for normal weight, ready-mix concrete with minimum 28-day compressive strength of 3000 psi (21 MPa), unless higher strength indicated.

B. Nonslip Aggregate Finish: Factory-graded, packaged material containing fused aluminum oxide grits or crushed emery as abrasive aggregate; rust-proof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

2.08 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

Temperature change (Range): 100 deg F (38 deg C).

D. Shear and punch metals cleanly and accurately. Remove burrs.

E. Ease exposed edges to a radius of approximately 1/32 inch (0.794 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Remove sharp or rough areas on exposed traffic surfaces.

G. Weld corners and seams continuously to comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matched those adjacent.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

K. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.09 ROUGH HARDWARE

Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required. Fabricate items to sizes, shapes, and dimensions required.

2.10 STEEL LADDERS

A. General: Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as indicated. Comply with requirements of ANSI A14.3 and CFR 29 1910.27; where conflicts occur, comply with the more stringent requirements.

B. Side Rails: Continuous steel flat bars, minimum size (cross section) 2-1/2" x 3/8" (63.5 mm x 9.5 mm), with eased edges, spaced 18 inches (0.46 m) apart.

For ladders subject to unusually corrosive atmospheric exposures, steel flat bars 2-1/2" x 1/2" (63.5 mm x 12.7 mm).

C. Bar Rungs: Round steel bars, minimum 3/4 inch (19.1 mm) diameter, spaced no greater than 12 inches (305 mm) o.c. and uniform throughout the length of the ladder.

Individual metal rungs embedded in concrete which serve as access to pits and other areas under floors, should have a minimum diameter of 1 inch (25 mm) or shall otherwise be treated to resist corrosion and rusting.

D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.

E. Support each ladder at top and bottom and at intermediate points spaced not more than 5'-0" (1.5 m) o.c. by means of welded brackets, unless otherwise indicated.

1. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches (178 mm).

2. Extend side rails 42 inches (1.1 m) above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.

2.11 LADDER SAFETY CAGES

A. General: Fabricate ladder safety cages to comply with requirements of ANSI A14.3 and CFR 29 1910.27; where conflicts occur, comply with the more stringent requirements. Assemble safety cages by welding.

B. Primary Hoops: Steel bars, 3" x 1/4" (76 mm x 6.4 mm), for top, bottom, and for cages longer than 20 feet (6.1 m), intermediate hoops spaced not more than 20'-0" (6.1 m) o.c.

C. Secondary Intermediate Hoops: Steel bars, 2" x 1/4" (51 mm x 6.4 mm) hoops spaced not more than 4'-0" (1.2 m) o.c. between primary hoops.

D. Vertical Bars: Steel bars, 1-1/2" x 1/4" (38.1 mm x 6.4 m), secured to each hoop, spaced at intervals not more than 40o (0.7 rad) o.c. around the circumference of the cage, maximum spacing of approximately 9-1/2 inches (241 mm) o.c.

E. Fasten assembled safety cage to ladder rails and adjacent construction as indicated.

2.12 LOOSE BEARING AND LEVELING PLATES

Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required.

2.13 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for opening and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels for equal bearing of one inch per foot of clear span but not less than 8 inches (203 mm) bearing at each side of openings, unless otherwise indicated.

2.14 MISCELLANEOUS METAL ITEMS

A. Miscellaneous Framing and Supports: Provide steel framing and supports for applications indicated which are not a part of structural steel framework, as required to complete work.

1. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

Except as otherwise indicated, space anchors 24 inches (61 cm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4" wide x 1/4" x 8" long (31.8 mm x 6.4 mm x 203 mm).

B. Miscellaneous Steel Trim: Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination for assembly and installation with other work.

2.15 SHELF AND LEDGER ANGLES

A. Fabricate shelf and ledger angles from steel angles of sizes indicated and for attachment to concrete framing. Provide slotted holes to receive 3/4 inch (19.1 mm) bolts, spaced not more than 6 inches (152 mm) from ends and not more than 24 inches (0.61 m) o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support shelf/ledger angles from back-up masonry and concrete. Align expansion joints in angles with indicated expansion joints in cavity wall exterior wythe.

C. Furnish wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.

2.16 METAL BAR GRATINGS

A. General: Produce metal bar gratings of description indicated per NAAMM marking system that comply with the following:

1. Metal Bar Grating Standard: "Standard Specifications for Metal Bar Grating and Metal Bar Grating Treads" published in ANSI/NAAMM MBG 531.

2. Heavy Duty Metal Bar Grating Standard: "Guide Specifications for Heavy Duty Metal Bar Grating" published in ANSI/NAAMM MBG 532.

B. If gratings are located in walking surfaces, gratings shall have spaces no greater than 1/2 inch (12.7 mm) wide in one direction.

If gratings have elongated openings, then they shall be placed so that the long dimension is perpendicular to the dominant direction of travel.

C. Fabricate steel gratings to comply with requirements as indicated on the drawings.
D. Traffic Surface for Steel and Aluminum Bar Gratings: Plain, unless otherwise indicated. E. Steel Finish: Shop prime paint applied in accordance with manufacturer's standard practice.

F. Aluminum Finish: Mill (as fabricated), unless otherwise indicated.

G. Fabricate removable grating sections with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated, or if not indicated, as recommended by manufacturer, for attachment to supports.

1. Heavy Duty Grating: Provide not less than 4 anchor blocks, 1/4 inch (6.4 mm) minimum thickness, for each section of grating composed of bearing bars over 3/16 inch (4.8 mm) in thickness, with each block shop-welded to 2 bearing bars.

2. Nonheavy Duty Grating: Provide not less than 4 saddle clips for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced not less than 15/16 inch (23.8 mm) o.c., with each clip designed and fabricated to fit over 2 bearing bars.

Furnish threaded bolts with nuts and washers for each clip required, unless otherwise indicated.

H. Attach toe plates to grating by welding, unless otherwise indicated.

Toe plate height: 4 inches (102 mm), unless a greater height indicated.

I. Fabricate cutouts in grating sections for penetrations indicated. Arrange layout of cutouts to permit grating removal without disturbing items penetrating gratings.

1. Edge band openings in grating that interrupt 4 or more bearing bars with bars of same size and material as bearing bars.

2. Do not notch bearing bars at supports to maintain elevation.

J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal bar gratings that may be incorporated in the Work include, but are not limited to, the following:

Alabama Metal Industries Corp. Barnet/Bates Corp.
IKG Industries
Klemp Corp.
Ohio Gratings, Inc.
Seidelhuber Metal Products, Inc.

2.17 FLOOR PLATE

A. Fabricate raised pattern floor plates from rolled steel floor plate of thickness and pattern indicated. If not indicated, pattern as selected from manufacturer's standard patterns. See ASTM A786 for pattern illustrations.

B. Abrasive Surface Floor Plate: Manufacturer's standard abrasive granules, rolled into surface of steel plate, where indicated.

C. Include steel angle stiffeners and fixed and removable sections as indicated.

Provide 2 steel bar drop handles for lifting plates, one at each end of each removable section.

2.18 TREAD PLATE

A. Fabricate raised pattern tread plates from aluminum-alloy rolled tread plate in pattern and thickness as indicated. See ASTM B632 for pattern illustrations.

B. Abrasive Surface Floor Plate: Manufacturer's standard abrasive granules, rolled into surface of aluminum plate, where indicated.

C. Include aluminum angle stiffeners and fixed and removable sections as indicated. Provide 2 aluminum bar drop handles for lifting plates, one at each end of each removable section.

2.19 STEEL PIPE GUARDRAILS AND HANDRAILS

A. General: Fabricate pipe guardrails and handrails to comply with requirements indicated for dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage.

B. Interconnect guardrails and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

At tee and cross intersections, cope ends of intersecting members to fit contour of pipe to which end is joined, weld all around and grind smooth.

C. Form changes in directions of railing members as follows:

1. By use of welded prefabricated steel elbow fittings.

2. By bending, of radius indicated.

3. By mitering at elbow bends.

D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.

E. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

F. Close exposed ends of pipe by welding 3/16 inch (4.8 mm) thick steel plate in place or by use of prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch (6.4 mm) or less.

G. Toe Boards: Where indicated, provide toe boards at railings around openings and at the edge of open-sided floors and platforms. Fabricate to dimensions and details indicated, or if not indicated, use 4 inches high x 1/4 inch (102 mm x 6.4 mm) steel bar welded to each railing post.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of guardrails

and handrails to other work. Furnish inserts and other anchorage devices for connecting guardrails and handrails to concrete or masonry work.

1. For railing posts set in concrete, fabricate sleeves from steel pipe not less than 6 inches (152 mm) long and with an inside diameter not less than 1/2 inch (12.7 mm) greater than the outside diameter of post, with steel plate closure welded to bottom of sleeve.

2. For removable railing posts, fabricate slip-fit sockets from steel pipe whose inside diameter is sized for a close fit with posts and to limit deflection of post without lateral load, measured at top, to not more than 1/12 of post height. Provide socket covers designed and fabricated to resist accidental dislodgement.

I. Fillers: Provide steel sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fills to produce adequate bearing to prevent bracket rotation and overstressing of substrate.

2.20 CAST NOSINGS AND TREADS

A. Fabricate units of material, sizes, and configurations indicated. If not indicated, provide cast-iron units with integral abrasive finish. Furnish in lengths as required to accurately fit each opening or conditions.

Cast units with an integral abrasive grit consisting of aluminum oxide, silicone carbide, or a combination of both.

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

AMSTEP Products, division of American Safety Technologies, Inc. American Safety Tread Co., Inc.
IKG Industries
Safe-T-Metal Co., Inc. Wooster Products Inc.

C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with the manufacturer.

D. Apply black asphaltic coating to concealed bottoms, sides, and edges of cast-iron units set into concrete.

2.21 STEEL FRAMED STAIRS

A. General: Construct stairs to conform to sizes and arrangements indicated with welded connections, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, columns, railings, newels, balusters, struts, clips, brackets, bearing plates, and other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.

Fabricate treads and platforms of exterior stairs to accommodate slopes to drain in finished traffic surfaces.

B. Stair Framing: Fabricate stringers of structural steel channels, or plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers, newels, and framing members to stringers and headers; fabricate and join so that bolts, if used, do not appear on finish surfaces.

C. Metal Pan Risers, Subtreads, and Subplatforms: Shape metal pans for risers and subtreads to conform to configuration shown. Provide thickness of structural steel sheet for metal pans as indicated.

1. Form metal pans of uncoated cold-rolled steel sheet, unless otherwise indicated.

2. Form metal pans of galvanized steel sheet, where indicated on the drawings.

3. Attach Risers and Subtreads to Stringers by the following methods:

a. Directly weld risers and subtreads to stringers; locate welds on side of metal pans to be concealed by concrete fill.

b. Attach by means of brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding or bolting.

4. Provide subplatforms of configuration and construction shown, with thickness of structural steel sheet as indicated. Attach subplatform to platform framing members with welds or as otherwise indicated.

Construct subplatforms with smooth soffits.

D. Steel Floor Plate Treads and Platforms: Provide raised pattern steel floor plate in pattern indicated or, if not indicated, as selected from manufacturer's standard patterns.

1. Form treads of 1/4 inch (6.4 mm) thick raised pattern steel floor plate with integral nosing and back edge stiffener. Weld steel supporting brackets to stringers and treads to brackets.

2. Fabricate platforms of raised pattern steel floor plate of thickness indicated.
Provide nosing matching that on treads at all landings. Secure to platform framing members with welds.

E. Floor Grating Treads and Platforms: Provide patterns, spacing, and bar sizes indicated; fabricate to comply with NAAMM MBG 531.

1. Finish to be shop prime paint, unless otherwise indicated.

2. Fabricate grating treads with steel plate nosing on one edge and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts or as otherwise indicated.

3. Fabricate grating platforms, with nosing matching that on grating treads, at all landings. Provide toe plates at open-sided edges of grating platform. Secure grating to platform frame with welds or as otherwise indicated.

F. Stair Guardrails and Handrails: Comply with applicable requirements specified elsewhere in this section for steel pipe guardrails and handrails, and as follows:

1. Fabricate newels of steel tubing and provide newel caps of gray-iron castings, as shown.

2. Railings may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.

3. Connect railing posts to stair framing by direct welding, unless otherwise indicated.

2.22 PIPE BOLLARDS

Fabricate pipe bollards from 4-inch (102 mm) standard black steel pipe, Schedule 40, unless otherwise indicated. Cap bollards with 1/4 inch (6.4 mm) minimum thickness steel base plate, or as otherwise indicated.

2.23 FINISHES

A. General: Comply with NAAMM AMP 500 "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

2.24 STEEL AND IRON FINISHES

A. General: Shop-paint uncoated surfaces of metal fabrications, except those to be embedded in concrete or masonry or to receive sprayed-on fireproofing, surfaces and edges to be welded, and galvanized surfaces, unless otherwise indicated. Comply with requirements of SSPC-PA 1 for shop painting.

B. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process in compliance with the following requirements:

1. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forced shapes, plates, bars, and strip 0.0299 inch (0.7595 mm) thick and heavier.

2. ASTM A153 for galvanizing iron and steel hardware.

C. Surface Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below.

1. Remove oil, grease and similar contaminants in accordance with SP-1, "Solvent Cleaning".

2. Remove loose rust, scale, spatter, slag and other deleterious materials in accordance with SSPC, utilizing the following methods as required:

SP-2 "Hand-Tool Cleaning" SP-3 "Power-Tool Cleaning"
SP-7 "Brush-Off Blast Cleaning"

D. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 3.0 mils (0.076 mm). Use painting methods that result in full coverage of joints, corners, edges, and exposed surfaces.

Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection.

2.25 ALUMINUM FINISH

Mill (as fabricated) finish, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

Installer shall examine the areas and conditions under which metal fabrication items are to be installed. Notify the SDR in writing of conditions detrimental to the proper and timely

completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.

C. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.03 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through- bolts, lag bolts, wood screws and other connectors as required.

B. Cutting, Fitting and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arch welding, appearance and quality of welds made, methods used in correcting welding work, and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surfaces matches those adjacent.

F. Grout: Follow manufacturer's recommendations for substrate preparation and application.

G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint or zinc chromate primer.

3.04 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.05 INSTALLATION OF METAL BAR GRATINGS

A. General: Install gratings to comply with requirements of NAAMM grating standard that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Secure removable units to supporting members with type and size of clips and fasteners indicated, or if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Secure non-removable units to supporting members by welding where both materials are the same; otherwise, fasten by bolting as indicated above.

D. Attach toe plates to gratings by welding, at locations indicated.

3.06 INSTALLATION OF STEEL PIPE GUARDRAILS AND HANDRAILS

A. Adjust railings prior to anchoring to ensure matching alignment at abutting joints.

Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:

1. Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's directions.

2. Anchor posts and rail ends to steel with welded connections, unless otherwise indicated.

3. Anchor posts and rail ends into concrete and masonry with steel round flanges welded to post and rail ends, and anchored into wall construction with expansion shields and bolts.

4. Install removable railing sections where indicated in slip-fit metal sockets cast into concrete. Accurately locate sockets to match post spacing.

B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2 inch (38.1 mm) clearance from inside face of handrail and finished wall surface. Locate brackets at spacing not less than 5'-0" (1.5 m) o.c., unless otherwise indicated. Secure wall brackets and wall return fittings to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

2. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.

3. For hollow masonry anchorage, fasten brackets directly on masonry wall using toggle bolts.

4. For steel framed gypsum board assemblies, fasten brackets to wood blocking using lag bolts or to metal blocking using self-tapping screws, of size and type required to support structural loads.

C. Expansion Joints: Provide expansion joints at locations indicated, or if not indicated, at intervals not to exceed 40 feet (12.2 m). Provide slip joint with internal sleeve extending 2 inches (51 mm) beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches (152 mm) of posts.

3.07 INSTALLATION OF CAST NOSINGS AND TREADS

Install cast nosings and treads with anchorage system indicated to comply with manufacturer's recommendations.

3.08 INSTALLATION OF PIPE BOLLARDS

A. General: Install bollards at locations shown on drawings. After installation, fill pipe with concrete and provide a smooth convex curve at the top of the pipe.

B. Backfill: The backfill in the annular space around bollards not embedded in poured footings shall be by the following methods:

1. Clean excess soil from hole. Do not leave loose soil at bottom of hole.

2. Backfill shall be of concrete with an ultimate strength of 3,000 pounds per square inch (210.92 kgs/sq cm) at 28 days. The hole shall not be less than four (4) inches (101.6 mm) larger than the diagonal dimension of a round, square or rectangular bollard.

3.09 ADJUSTING AND CLEANING

A. Touch-Up Painting of Steel Items: Immediately after erection, clean field welds, bolted connections, abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.

Apply by brush or spray to provide a minimum dry film thickness of 3.0 mils (0.076 mm).

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION 05500

SECTION 05520 - HANDRAILS AND RAILINGS

PART 1 GENERAL

1.1 SUMMARY
Section includes, but is not limited to those items located at ramps and hallways, as indicated in Drawings.

A. Related Sections:
1. Section 05500 - Metal Fabrications: Attachment plates, angles for metal stairs, including anchorage.

1.2 REFERENCES

A. ASTM E985, ASTM E488, ASTM C1048 and ISO/TC 59.

1.3 DESIGN REQUIREMENTS

A. Design handrail, guardrail, and attachments to resist forces as required by applicable code. Apply loads non-simultaneously to produce maximum stresses.
1. Guard Top Rail and Handrail Concentrated Load: 200 pounds (0.89 kN)
applied at any point in any direction.
2. Railings shall have high strength aluminum in order to comply with the above requirements.

B. Thermal Movements: Allow thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating, and installing handrails and railing systems to prevent bucking, opening of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 QUALITY ASSURANCE

A. Finish joints in accordance with NOMMA Guideline 1.

B. Single source responsibility: Materials shall be supplied and installed by a single firm.

C. Execution tolerance plus/minus 5/64” (2mm).

D. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

E. Mockups: Prior to installing railings, construct mockups for each form of railing system and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.

1.5 STORAGE

A. Store handrails and railing systems inside a well-ventilated area, away from uncured concrete and masonry and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication. All measurements for handrails and railings should be taken from construction site elements to what they are to be fastened. This information is to be recorded on final shop drawings.

B. Coordinate fabrication schedule with construction progress to avoid delay of work.

PART 2 PRODUCTS

2.1 GENERAL

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

B. Substitutions allowed according to Architect's approval via Substitution Request Forms.

2.2 COMPONENTS

A. Recycled Content of Steel Products: Post-consumer recycled content plus one- half of pre-consumer recycled content not less than 25 percent.

2.3 HANDRAILS AND RAILINGS

A. Available Manufacturers:

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

1. Ortram Aluminum System, Corp.
2. Garcinox Corporation
3. Santiago Metal, Inc.

2.4 RAILING SYSTEM COMPONENTS

Material: Guardrails and Handrails System:

A. Rails and other tubular components: size as indicated on Drawings; surface to be 320-grain/grit finish.

B. Posts: size as indicated on Drawings; finish and final design to be in accordance with selected manufacturer's design specification.

C. Surface to be bead blasted finish. Component fittings including handrail attachment and mounting component fittings to be in accordance with manufacturer's standard design specification.

D. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.

E. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise noted. Do not use metals that are corrosive or incompatible with materials joined.

F. Glass Railing: size as indicated on Drawings; vinyl protective top rail insert, connector sleeve, tempered float glass, neoprene vinyl trim, cladding rail base, vinyl setting block and cap screws.

2.5 METALS

A. General: Provide metal free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.

B. Brackets, Flanges, and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

2.6 ACCESSORIES

A. Universal Shop Primer: Fast-curing, lead and chromate free, universal modified alkyd primer complying with MPI #79, VOC limit not more than 200 g/L.

B. Zinc Rich Primer: Comply with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat. VOC limit not more than 340 g/L.

2.7 GROUT AND ANCHORING CEMENT

Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.8 FABRICATION

A. Fabricate railing system for compliance with structural requirements of applicable code.

B. Pre-assemble railings prior to shipping to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and for coordination with shop drawings.

C. Tubing cuts shall be square, without burrs and where exposed, rounded to produce smooth rigid and hairline joints.

D. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

E. Fabricate joints that will be exposed to weather in a watertight manner.

F. Provide weep holes or another means to drain entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field conditions are acceptable and are ready to receive work.

B. Verify concealed blocking and reinforcement is installed and correctly located to receive wall-mounted handrails, as needed.

3.2 PREPARATION

A. Clean and strip aluminum where site welding is required.

B. Supply items required to be embedded in masonry with setting templates, to appropriate sections.

3.3 INSTALLATION

A. Installation shall be by a qualified, authorized representative of the manufacturer.

B. Installation must be in accordance with standard or non-standard, yet applicable details as per manufacturer's instructions.

Install components plumb and in-line, accurately fitted, free from distortion or defects and securely fastened to the structure.
D. Provide anchors, plates, angles, etc. necessary for connecting railings to structure.

E. Any and all field welding shall be by a certified welder

F. Access must be made available for anchors that require through bolting either vertically or horizontally.

3.4 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative. B. Maximum Offset From Alignment: 1/4 inch (6 mm) for every 50-foot of railing.
3.5 RAILING CONNECTIONS (As Applicable)

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic filler, cement colored to match finish of handrails and railing systems.

B. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact, or use fittings designed for this purpose.

3.6 PROTECTION AFTER INSTALLATION

A. Provide protective covering on all hand and guardrails if construction is not yet finished in the adjacent area.

3.7 MAINTENANCE AND CLEARING

A. Railings shall be cleaned, including infill panels, by Contractor to the satisfaction of the Owner

B. Wipe with moistened cloth only. Do not use cleaning agents with abrasive or acid/alkaline contents.

3.8 CORRECTION OF DEFICIENCIES

A. All deficiencies in work and/or items not meeting specified requirements shall be corrected in order to comply with specifications requirements and at no additional cost to the Owner.

END OF SECTION 05520

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Custom fabricated ornamental railing systems. B. Stainless steel handrails, balusters and fittings. C. Aluminum handrails, balusters and fittings.
D. Brass handrails, balusters and fittings. E. Structural glass railing systems.
1.2 RELATED SECTIONS

A. Section 033000 - Cast-In-Place Concrete: Placement of anchors in concrete.

B. Section 040519.16 - Unit Masonry Assemblies: Placement of anchors in masonry.
C. Section 055100 - Metal Stairs: Handrails associated with standard metal stairs. D. Section 055200 - Handrails and Railings: Handrails other than decorative
handrails specified in this section.

E. Section 057100 - Monumental Stairs: Railing associated with monumental stairs.

F. Section 062000 - Finish Carpentry: Wood handrails. G. Section 057313 - Glazing: Glass baluster infill.
1.3 REFERENCES

A. ASTM A123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2001a.

B. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2001.

C. ASTM C1048 - Standard Specification for Heat Treated Flat Glass, Coated and Uncoated Glass.

D. AWS D 1.1 - Structural Welding Code - Steel; 2002.

E. NAAMM AMP 510 - Metal Stairs Manual; 1992, Fifth Edition.

F. SSPC Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic");
1982 (Ed. 2000).

1.4 SUBMITTALSA. Submit under provisions of Section 01300.

B. [Product Data] substantiating compliance with Contract Documents. Include manufacturer's installation instructions.

C. Shop Drawings: Submit Shop Drawings for stairs and railings.
1. Include plans, elevations, and details.
2. Show connection and accessory items and locations for anchor and bolt installation.
3. Include design loads, structural calculations, and material properties.
4. Provide Shop Drawings signed and sealed by structural engineer licensed in the state in which Project is located.

D. Railing Sample: 12 inch long Sample illustrating color, finish, sheen, and concealed connection detail.

E. Glass Sample: Submit 12 inch by 12 inch size glass illustrating color, thickness, and edge conditions.

F. Supply installation templates, required reinforcing, and recessed anchorage devices in timely fashion to installers of related work that will receive products of this section.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Work of this section shall be designed, fabricated, shipped and installed by a single source company that has specialized in ornamental handrails and railings with ten years minimum experience.

B. Installer Qualifications: Installation shall be performed by the fabricator or a company acceptable to the fabricator.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Store in a weather tight location and protect from corrosion, distortion, and other damage during delivery storage and handling.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Couturier Iron Craft, Inc., which is located at: P. O. Box 308 5050 West River Dr. ; Comstock Park, MI 49321-0308; Toll Free Tel: 800-670-6123; Tel: 616-784-6780; Fax: 616-784-5077

B. Substitutions: Permittel

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 MATERIALS

A. Stainless Steel Tubing: ÅSTM A554, Type 304.

B. Stainless Steel Bars, Shapes, and Moldings: ÅSTM A276, Type 304.

C. Brass Tubing: ÅSTM B135 (ÅSTM B135M), Alloy CDA 260 yellow brass.

D. Aluminum Tubing: ÅSTM B221 (B221M) extruded tubes, Alloy 6063-T52.

E. Aluminum Reinforcing: ÅSTM B221 (B221M) extruded shapes, Alloy 6061-T6.

F. Aluminum Bars, Shapes, and Moldings: ASTM B221 (B221M) extruded shapes, Alloy 6063-T52.

G. Glass: Tempered glass complying with ÅSTM C 1048.

2.3 TUBE RAILINGS

A. Consistency: Provide visible components of same alloy and components that are free of surface blemishes where exposed to view in finished installation.

B. Material: Stainless steel tubing.
1. Tubing Diameter: 1.9 inches (48 mm).
2. Thickness: 16 gage; 0.065 inches (1.7 mm).
3. Elbows and Tees: Flush design.
4. Dimensions and Configurations: As indicated on Drawings.
5. Assembly: Welded.
6. Decorative Flanges for Embedded Posts:
a. Circular, collard cover plate, no screw holes, for setting in concrete.
7. Wall Mounted Components: Components necessary to support railing with 1-1/2 inch (38 mm) clearance from wall, and as follows:
a. Under slung support brackets: Supports at maximum 60 inches (1524 mm).
b. Wall return without support: Terminates 1/4 inch (6 mm) from side wall.
c. Fasteners: Exposed.
d. Fasteners: Concealed.

8. Picket Rail Components: Pickets of 5/8 inch (15 mm) stainless steel, shape and lengths as indicated.
9. Finish: Stainless No. 4 satin.
10. Finish: Stainless No. 8 polished.

C. Material: Brass tubing.
1. Tubing Diameter:1.9 O.D. (48mm).
2. Elbows and Tees: Flush design.
3. Dimensions and Configurations: As indicated on Drawings.
4. Assembly: Welded.
5. Assembly: Splice locks with set screws.
6. Decorative Flanges for Embedded Posts:
a. Circular collared cover plate, no screw holes, for setting in concrete.
7. Wall Mounted Components: Components necessary to support railing with 1-1/2 inch (38 mm) clearance from wall, and as follows:
a. Under slung Support Brackets: Supports at maximum 60 inches (1524 mm).
b. Wall Return: Terminates 1/4 inch (6 mm) from side wall. c. Fasteners: Exposed.
d. Fasteners: Concealed.
8. Finish: Satin brass.
9. Finish: Bright brass.
10. Sealer: Clear sealer coating.

D. Material: Aluminum Schedule 40 pipe.
1. Diameter: 1-1/2 inch (38 mm).
2. Elbows and Tees: Flush design.
3. Dimensions and Configurations: As indicated on Drawings.
4. Assembly: Welded.
5. Assembly: Splice locks with set screws.
6. Decorative Flanges for Embedded Posts: Circular collared cover plate, no screw holes, for setting in concrete.
7. Wall Mounted Components: Components necessary to support railing with 1-1/2 inch (38 mm) clearance from wall, and as follows:
a. Under slung Support Brackets: Supports at maximum 60 inches (1524 mm).
b. Wall Return: Terminates 1/4 inch (6 mm) from side wall. c. Fasteners: Exposed.
d. Fasteners: Concealed.
8. Finish: Clear anodized.
9. Finish: Factory painted.

2.4 STRUCTURAL GLASS RAILING SYSTEM

A. Railings: Tempered glass structural balusters mounted in aluminum bottom rail, with metal top rail and accessories.
1. Design to resist minimum uniform lateral loading of 50 pounds per linear foot (8,8 kN/m).
2. Design to resist minimum concentrated lateral load of 200 pounds (91 kg) at any point 42 inches (1067 mm) above finished floor.
3. Mounting: Concealed, with top of bottom rail flush with finished floor.
4. Mounting: Side mounted to fascia, with top of bottom rail flush with finished floor.
5. Mounting: Exposed.
6. Mounting: As detailed on Drawings.

B. Glass: 1/2 inch (12 mm) tempered float glass.

C. Top Rail: Channel tubing with rabbet for glass, with matching welded miter corners, end caps, and internal splice connectors.
1. Material: Bright finish brass; 0.10 inch (2.54 mm).
a. Diameter: 1.9 inches (48 mm). b. Diameter: 2-1/2 inch (64 mm).
2. Material: Satin finish brass; 16 gage, 0.065 inch (1.65 mm). a. Diameter: 1.9 inches (48 mm).
b. Diameter: 2-1/2 inch (64 mm).
3. Material: Bright finish stainless steel; 16 gage, 0.065 inch (1.65 mm). a. Diameter: 1.9 inches (48 mm).
b. Diameter: 2-1/2 inch (64 mm).

4. Material: Satin finish stainless steel; 16 gage, 0.065 inch (1.65 mm). a. Diameter: 1.9 inches (48 mm).
b. Diameter: 2-1/2 inch (64 mm).
5. Material: Clear anodized aluminum.
a. Size: 1.9 inches (48 mm) diameter; 0.109 inch (2.78 mm) thickness. b. Size: 2-1/2 inches (64 mm) diameter; 0.125 inch (3.18 mm)
thickness.

D. Handrails: Metal tubing handrail fastened to glass balusters at heights indicated.
1. Material: Bright finish brass, 1.9 inches (48 mm) in diameter.
2. Material: Satin finish brass, 1.9 inches (48 mm) in diameter.
3. Material: Bright finish stainless steel, 1.9 inches (48 mm) in diameter.
4. Material: Satin finish stainless steel, 1.9 inches (48 mm) diameter.
5. End Caps: Match handrails.
6. End Caps: Decorative black plastic.
7. Brackets: Self-aligning type, matching handrails.
8. Brackets: Cast wall brackets, matching handrails.
9. Brackets: Tubular wall brackets, matching handrails.
10. Dimensions and Configurations: As indicated on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify that reinforcement and anchoring devices are the correct type, have been located correctly, and have been installed properly.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install ornamental railings plumb and level and in full accordance with manufacturer's instructions.

B. Locate railings as indicated on Drawings and at heights that are in accordance with applicable code.

C. Anchor to substrates in strict accordance with tested anchorage system, free from distortion or defects detrimental to appearance or performance.

3.3 CLEANING AND PROTECTION

A. Remove manufacturer's protective coverings from exposed surfaces after installation.

B. Clean surfaces using materials and methods as recommended by manufacturer.

C. Protect finishes from damage during construction period with temporary protective coverings acceptable to the manufacturer.

D. After installation of system is complete, advise General Contractor of methods necessary for protection until Substantial Completion.

END OF SECTION

SECTION 05 30 00 - METAL DECKING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION SUMMARY

A. Section includes:

1. Metal Floor Decking
2. Metal Roof Decking
3. Deck screed angles at deck perimeters and all deck openings for decks to receive concrete, unless otherwise indicated.

4. Metal shear connectors welded through the steel deck to supporting beams.

1.03 RELATED SECTIONS

A. Related Sections include:

1. Section 03 30 00 - Cast-In-Place Concrete
2. Section 05 12 00 - Structural Steel
3. Section 05 21 00 - Steel Joists
4. Section 07 25 00 - Spray-On Fireproofing
5. Section 09 90 00 – Painting

1.04 REFERENCES

A. AISC: American Iron and Steel Institute
B. SJI: Steel Joist Institute
C. SDI: Steel Deck Institute
D. AWS: American Welding Society
E. Factory Mutual "Approval Guide"
F. ASTM: American Society for Testing Materials

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.

B. Shop Drawings: Submit detailed drawings showing layout and types of deck panels, anchorage details, and conditions requiring deck screed angles, supplementary framing, cut openings, special jointing, finish or other accessories.

C. LEED Documentation: Provide certification documentation that recycled steel content of metal decking meets LEED requirements.

1.06 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated or specified.

1. AISI "Specification for the Design of Cold-Formed Steel
Structural Members."
2. AWS D1.3 "Structural Welding Code - Sheet Steel".
3. AWS D1.1 "Structural Welding Code - Steel".
4. SDI "Design Manual for Floor Decks and Roof Decks."
5. Factory Manual "Research Approval Guide Building Materials."

B. Qualifications of Field Welding: Qualify welding processes and
welding operators in accordance with AWS "Standard Qualification Procedure."

1. All welding to be performed by a certified welder experienced in light gage metal welding.

2. Welded decking in place is subject to inspection and testing. Expense of removing and replacing portions of decking for testing purposes will be
borne by Owner if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.

C. Fire-rated Assembly: Where indicated, provide steel deck units that comply with ASTM E 119.

1. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Epic Metals Corp; 412-351-3913.
B. Vulcraft Division of Nucor Corporation; 704-366-7000. C. United Steel Decking, Inc; 908-277-1617.

2.02 MATERIALS

A. Roof Deck: ASTM A 653/A 653 M, Structural Steel grade 33 (230), G90 zinc coating; conforming to ASTM A525, G-90, cleaned.

1. Fabricate panels without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary Steel Roof
Deck," in SDI Publication No. 29.

B. Architecturally exposed acoustic roof deck: EPIC Metals Corporation "Epicore
ER3.5A" Deck.

C. Composite Floor Deck: ASTM A 653/A 653 M, Structural Steel grade 33 (230), G60 (Z180) zinc coating; conforming to ASTM A525, G-90 cleaned.

1. Fabricate panels with integrally embossed or raised pattern ribs an interlocking side laps, to comply with "SDI
Specifications and Commentary for Composite Steel Floor Deck," in
SDI Publication No. 29.

C. Sheet Metal Accessories: ASTM A 526, commercial quality, galvanized.

D. Shear Connectors: Headed stud type, ASTM A 108, Grades 1010 thru 1020,
cold-finished carbon steel, AWS D1.1-85, Type B with dimensions complying with AISC specifications, unless otherwise shown on drawings. Weld to structure by automatic welding process. Do not stick weld.

E. Deformed Bar Anchor: Deformed reinforcing bar anchors welded to structural steel via automatic welding process such as D2L by Nelson Division or T.R.W. or equal by Cox Industries. Do not stick weld.

F. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with ASTM A 780. Low VOC content meeting LEED requirements.

G. Steel to contain high-recycled-content steel; minimum of 90% recycled material
(75% post-consumer steel).

2.03 ACCESSORIES

A. Floor Screed Angles: Fabricate metal closure angles at floor perimeters and all openings, unless otherwise shown on drawings.

1. Height shall be same as top of concrete slab.
2. 18 gage (0.047inch)(1.20mm) sheet steel, minimum. Refer to Steel Deck Institute Design Manual. Do not use if handrail or brick veneer relief angle is to be attached to screed angle. Use 3/8" bent plate screed at such locations.

B. Rib Closure Strips: Galvanized sheet metal closures.

2.04 FABRICATION

A. General: Form deck units in lengths to span 3 or more supports, with flush, telescoped or nested 2 inch (50mm) laps at ends and interlocking or nested side laps, unless otherwise indicated. Stagger end joints.

B. Side laps shall be joined when spans exceed 24 inches (600mm) at24 inches for floor deck and 12 inches at roof deck.

C. Floor Deck; to receive concrete.

1. Type: Composite
2. Depth: See structural drawings.
3. Gage: See structural drawings.
4. Finish: Galvanized steel, G-60.
5. Span: Double span minimum.

D. Roof Deck

1. Type: Type "D" 1-1/2 wide rib roof deck and Type “F” - 3" roof deck. See structural drawings for locations of each type.
2. Depth: 1-1/2 inches and 3 inches, see structural drawings.
3. Gage: See structural drawings for required gages.
4. Finish: Galvanized steel, G-90.
5. Span: Triple span minimum.

E. Architecturally Exposed Acoustic Roof Deck:

1. Type: Type “E” Epic metals "Epicore ER3.5A"

2. Depth: 3-1/2"
3. Gage: See structural drawings.

4. Finish: Manufacturer’s standard finish; Architect to select from full range of color.
5. Span: Single span.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install deck units and accessories in accordance with SDI Publication No. 29, manufacturer's recommendations and final shop drawings, and as specified herein.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

C. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.

D. Place deck units flat and square, and fasten to supporting frame without warp or deflection.

E. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

F. Do not use deck units for storage or working platforms until permanently secured.
G. Use runways or planking for transporting concrete across deck to protect the deck. H. Fastening Deck Units: Fasten roof deck units to steel supporting members by not less than 3/4 inch diameter puddle welds or elongated welds of equal perimeter, spaced not more than 12 inches o.c. with a minimum of 2 welds per unit at each support. Fasten floor deck units to supports with 5/8" diameter puddle welds or elongated welds of equal perimeter at 12 inch c/c spacing, with a minimum of two welds per deck unit at each support. Provide 3/4" diameter puddle welds at 6" o.c. spacing at perimeter of roof deck, including perimeter of roof deck openings,
edges, valleys and etc. Tack weld or use self-tapping No. 8 or larger machine screws.

1. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work. Use welding washers where recommended by Steel Deck Institute or deck manufacturer.

2. Fasten side laps of adjacent deck units between supports, at intervals not exceeding 24 inches o.c. for floor deck and 12 inches o.c. for roof deck, using self-tapping No. 10 or larger machine screws.

3. Uplift Loading: Install and anchor roof decks to resist gross uplift loading of 30 lbs. per sq.ft.(219.7kg/sq.m) at eave overhang and 20 lbs. per sq.ft.(146.4kg/sq.m) for other roof areas.

I. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.

J. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown. See "Deck Damage and Penetrations" by Richard B. Heagler, P.E., published by the Steel Deck Institute for requirements of strengthening around openings in roof and floor deck. Comply with requirements therein unless noted otherwise.

K. Shear Connectors: Weld shear connectors to supports through decking units in accordance with AWS "Structural Welding Code" and manufacturer's instructions. Do not weld shear connectors through two layers (lapped ends) of decking units. Weld only on clean, dry deck surfaces. Weld to structure by automatic welding process. Do not stick weld.

L. Floor Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor deck panels, unless noted otherwise.

M. Touch-Up Painting: Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions and to ASTM A780. Low VOC content meeting LEED requirements.

N. Waste Management: Recycle offcuts and scraps.

3.02 TESTING AND INSPECTION

A. The Owner will employ and pay all costs for the services of an approved testing laboratory, whose duties it shall be to inspect all deck attachments, for conformance with this specification.

B. Perform visual inspection of all welds for deck attachment and shear connectors attachment.

1. Inspect 10 percent of welded connections for shear connectors by means of moderate hammer blows as per AWS D1.1.

2. Bend tests will be performed if visual inspections reveal less than a full 360 degree flash or welding repairs to any shear connector stud.

C. The testing laboratory shall submit, on their own letterheads, reports of their inspections to the Architect. Submit test reports in triplicate.

D. Perform additional tests as may be necessary to reconfirm any non-compliance of the original work, and as may be necessary to show compliance of corrected work.

END OF SECTION

Division 7 – Thermal & Moisture Protection

07500 - Modified Bituminous Membrane Roofing

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modified bituminous roofing membrane, conventional application. B. Vapor retarders.
C. Deck sheathing.

D. Base flashings.

E. Roofing cant strips and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 - Rough Carpentry: Wood nailers and curbs. B. Section 07 - Sheet Metal Flashing and Trim
C. Section 15 - Plumbing Piping Specialties: Roof drains.

1.03 REFERENCE STANDARDS

A. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2005.

B. ASTM D 312 - Standard Specification for Asphalt Used in Roofing; 2000 (Reapproved 2006).
C. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007.
D. ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements; 2000a.

E. FM DS 1-28 - Wind Design; Factory Mutual Research Corporation; 2007.

F. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

G. ASTM E 1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces

H. ASTM E 903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres

I. ASTM E 1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low- Sloped Surfaces in the Field

J. ASTM C 1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer

K. ASTM E 408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection- Meter Techniques

L. ASTM C 1371 - Standard Test Method for Determination of Emittance of Materials Near Room
Temperature Using Portable Emissometers

1.05 SUBMITTALS

A. See Section 01300 - Submittal Procedures. C. Product Data: Provide manufacturer's catalog data for membrane and bitumen materials, base flashing materials, insulation, vapor retarder, surfacing, and .

D. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation and mechanical fastener layout.

E. Samples: Submit two samples 12 x 12inches (30 x 30 mm) in size illustrating granule surfaced sheet, colored coated sheet and insulation if applicable

F. Manufacturer's qualification data. G. Installer's qualification data.
H. Manufacturer's Installation Instructions: Indicate special procedures.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Jonathan Woodner Company's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.
1. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 10 years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture; ballast materials may be stored outdoors.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane when environmental conditions are outside the ranges recommended by manufacturer.

B. Do not apply roofing membrane during unsuitable weather.

C. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C).

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.09 WARRANTY

A. See Closeout Submittals Section of the Project Manual, for additional warranty requirements. B. Correct defective Work within a two year period after Date of Substantial Completion.

C. Provide 15 year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Membrane Materials:
1. Johns Manville: www.jm.com
2. Siplast: www.siplast.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

4. The energy star labeled roof products website (http://www.energystar.gov/ia/products/prod_lists/roof_prods_prod_list.pdf) lists Energy Star labeled roofing products (both coatings and roofing membranes) and the Lawrence Berkeley National Laboratory's Cool Roofing Material Database (http://eande.lbl.gov/coolroof/) lists the emissivity values of various roof products, and the Cool Roof Rating Council web site (www.coolroofs.org) lists the solar reflectivity and emissivity of specific roof membrane and coating products.

2.02 Examples of Energy Star Labeled Products

TYPE/CRITERIA	MANUFACTURER	PRODUCT INFO.	COMMENTS
Bituminous Roofing-Energy Star compliant, At least 0.9 emissivity	Consolidated Fiber Glass Products Robert K. Perry 661-323-6026	Conglas, Metal Shield Aluminum, SBS Modified Bitumen	Emissivivitv= Awaiting e-mail verification
	Danosa Roofing Products Felix Romero 787-785-4545 www.danosa.com	Danosa, Glasdan AL-80, Single Ply (SBS Modified Ashphalt)	Emissivitv= Awaiting e-mail verification
	Ecoloy Roof Systems 800-553-3833 www.ecolgyroofsyste	Ecology Roof Systems, ERS-Rain Coat, Modified Bitumen	Emissivitvlbl=0.9? Awaiting e-mail verification
	Firestone Building Products Co. Jim Jannasch 800-428-4442 www.firestonebpco.	Firestone, Firestone Metal flash AL, Single Ply (SBS Modified Asphalt)	Emissivity: 0.44
	Johns Manville Corp. www.jm.com/roofing	DynaClad, Modified Bitumen	Emissivitv= Awaiting e-mail verification
	Siplast, Inc. www.siplast.com	Veral Aluminum Modified Bitumen	Emissivity:0.05.

2.03 ROOFING - CONVENTIONAL APPLICATION A. Modified Bituminous Roofing:.

B. Roofing Assembly Requirements:
1. External Fire Exposure Classification: ASTM E 108 Class A, UL or Warnock Hersey listed.
2. Wind Resistance Classification: Factory Mutual I-60, in accordance with FM DS 1-28.

2.04 MEMBRANE AND SHEET MATERIALS

A. Membrane: Polymer modified asphalt, reinforced with non-woven fabric; granule surfaced; with the following characteristics:
1. Minimum Quality: ASTM D 6162 Type I; styrene-butadiene-styrene (SBS) modified, glass fiber and polyester reinforced.

B. Flexible Flashing Material: Same material as membrane.

2.05 BITUMINOUS MATERIALS

A. Bitumen: Asphalt, ASTM D 312 Type IV; for adhering insulation, use Type III. B. Primer: ASTM D 41, asphalt type.
C. Roof Cement: ASTM D 4586, Type II.

2.06 DECK SHEATHING

A. See section 06 1000

2.07 ACCESSORIES

A. Cant and Edge Strips: Asphalt-impregnated wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.

B. Roofing Nails: Galvanized, hot dipped type, size and configuration as required to suit application.

C. Strip Reglet Devices: Galvanized steel, maximum possible lengths per location, with attachment flanges.

D. Sealants: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work. B. Verify deck is supported and secure.
C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 WOOD DECK PREPARATION

A. Verify flatness and tightness of joints of wood decking. Fill knot holes with latex filler. B. Seal joints of plywood with tape.
C. Confirm dry deck by moisture meter with 12 percent moisture maximum.

D. Conventional Application: Apply mopped two-ply vapor retarder; nail along ply laps at 12 inches (300 mm) on center.
3.03 VAPOR RETARDER INSTALLATION - CONVENTIONAL APPLICATION A. Mopped Two-ply Vapor Retarder:
1. Apply primer at a rate of 1 gal/square (4.5 L/10 sq m) and allow to dry.
2. Mop surface with hot bitumen and embed two plies of vapor retarder felt; lap plies 19 inches (480 mm), full mop each ply.
3. Apply bitumen at 20 lb/square (98 kg/100 sq m).
4. Glaze top surface of the vapor retarder with bitumen if insulation is not placed immediately.

B. Extend vapor retarder under cant strips and blocking.

3.04 MEMBRANE APPLICATION

A. Apply membrane in accordance with manufacturer's instructions.

B. Apply membrane; lap and seal edges and ends permanently waterproof.

C. Apply smooth, free from air pockets, wrinkles, fish-mouths, or tears. Ensure full bond of membrane to substrate.

D. At end of day's operation, install waterproof cut-off. Remove cut-off before resuming roofing.

E. At intersections with vertical surfaces:
1. Extend membrane over cant strips and up a minimum of 8 inches (200 mm) onto vertical surfaces.
2. Apply flexible flashing over membrane.

F. Around roof penetrations, mop in and seal flanges and flashings with flexible flashing. G. Coordinate installation of roof drains and sumps and related flashings.
3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field quality control and inspection.

B. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.

3.06 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07600 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: This section includes furnishing and installing flashing and sheet metal as indicated on Contract documents and by provisions of this section.

B. Section Does Not Include:

1. Flashings which are integral with membrane roofing or waterproofing systems (base flashings).

2. Flashings which are integral with prefabricated roof accessories and equipment.

3. Wood blocking, nailers, edge strips, and battens. C. Related Sections:
1. Section 04200, “Concrete Masonry Unit”

2. Section 07900, “Joint Sealants”

3. Section 15810, “Ductwork”

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

A526 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality

A527 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality

A755 Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products

A792 Specification for Steel Sheet, Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

B32 Specification for Solder Metal

B. Factory Mutual Systems (FM)

Loss Prevention Data Sheet 1-49 Perimeter Flashing

C. Federal Specification (FS)

TT-C-494 Coating Compound, Bituminous, Solvent Type, Acid Resistant

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Architectural Sheet Metal Manual

1.03 SUBMITTALS

A. General: Submit the following in accordance with conditions of Contract and Section 01300, " Submittal Procedures."

B. Product Data: Submit manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

C. Samples for Initial Selection Purposes: Submit manufacturer's color charts and texture variations for specified sheet materials to be exposed as finished surfaces.

D. Provide written certification that all materials used are asbestos-free and lead paint-free.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed flashing, sheet metal, and trim work similar in material, design, and extent to that indicated for project that have resulted in construction with a record of successful in-service performance.

B. Quality Standard: Fabricate and install sheet metal work in accordance with Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) "Architectural Sheet Metal Manual," unless specifically indicated otherwise.

C. Wind Resistance: Fabricate and install flashings at edges of roof in accordance with FM Loss Prevention Data Sheet 1-49 for specified wind zone. Ensure that substrate construction is also in compliance.

D. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss. Temperature Change Range: 120ºF (67º

C), ambient; 180ºF (100º C) material surfaces. Water Filtration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Products made by the following manufacturers will be among those considered acceptable, however, it is the Contractor's responsibility to provide only products compatible with adjacent materials in the assembly.

ATAS Aluminum Corporation
Copper Sales, Inc.

Fry Reglet Corporation Keystone Flashing Company MM Systems Corporation
Petersen Aluminum Corporation
Integris Metals

2.02 MATERIALS

A. General: Unless otherwise indicated on Contract documents, provide Aluminum-Zinc Alloy-Coated Steel Sheet , as standard material with a fluoropolymer "Kynar 500" or "Hylar 5000" factory finish.

B. Galvanized Steel Sheet: ASTM A526, G90, commercial quality, or ASTM A527, G90, lock- forming quality, hot-dip galvanized steel sheet with 0.20 percent copper.

1. Finish: Mill phosphatized (paint-grip).
2. Color: Selected from manufacturer's standard color selection at time of submittals. C. Aluminum-Zinc Alloy-Coated Steel Sheet : ASTM A792, Class AZ-50 coating, grade 40, or to suit project conditions, with 55 percent aluminum, not less than 0.0336 inch (0.85 mm) thick, unless otherwise indicated.

1. Finish

a. Mill finish.

b. Coil-Coated Fluoropolymer Factory Finish "Kynar 500" or "Hylar 5000."

2. Color: Selected from manufacturer's standard color selection at time of submittals.

3. Provide strippable plastic protective film on prepainted surfaces.

D. Prepainted, Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial quality steel sheet conforming to ASTM A755, G90 coating designation, coil-coated with high performance flouropolymer coating.

1. Finish: Coil-coated factory finish “Kynar 500” or “Hylar 5000.”

2. Color: Selected from manufacturer’s standard color selection at time of submittals.

3. Provide strippable plastic protective film on prepainted surfaces.

2.03 REGLETS

A. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.

B. Surface Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

C. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.

D. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
E. Masonry Type: Provide with offset top flange for embedment in masonry mortar joints. F. Counterflashing Wind-Restraint Clips: Provide hold down clips with 1/2 inch (12.7 mm) kickout to be installed before counterflashing to prevent wind uplift on the counterflashing lower edge. Fabricate the clips of the following materials:

Galvanized Steel: 22 gage; 0.0336 inch (0.8534 mm) thick.

2.04 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Solder: For use with steel, furnish lead-free solder complying with ASTM B32, with rosin flux.

B. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

C. Mastic Sealants: Polyisobutylene; Nonhardening, nonskinning, nondrying, nonmigrating sealant.

D. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed; Noncorrosive; Size and thickness required for performance.

E. Installation Accessories: Provide joint tape, adhesives, sealers, and fasteners as recommended by flashing manufacturer for indicated applications.

F. Bituminous Coating: Heavy bodied, sulfur-free, asphalt-based paint; FS TT-C-494.

2.05 FABRICATION, GENERAL

A. Sheet metal fabrication standard: Fabricate sheet metal flashing and trim to comply with recommendation of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal and other characteristics of the item indicated.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

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

D. Seams: Fabricate nonmoving seams in sheet metal flat-lock seams.

E. Sealed Joints: Form nonexpansion, but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

F. Expansion Provisions: Space movement joints at maximum of 10 feet (3 m) with no joints allowed within twenty four (24) inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flange, not less than one (1) inch (25 mm) deep filled with mastic sealant concealed within joints.

G. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by SMACNA or sheet metal manufacturer.

Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

J. Form a one-half inch (12.7 mm) hem on underside of exposed edges.

2.06 SHEET METAL FABRICATIONS

A. General: As a minimum, fabricate flashings using materials in the thickness listed for each flashing application.

B. Exposed Flashings-Low Slope Roofs or Waterproofing: Formed copings, gravel stops and scuppers:

1. Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

2. Aluminum-Zinc Alloy-Coated Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).
3. Prepainted Coil-Coated Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm). C. Semiconcealed Flashings-Low Slope Roofs or Waterproofing: Counter flashing, reglets, equipment support flashing, roof area joint and roof expansion joint covers and pipe/conduit penetration flashing:

1. Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

2. Aluminum-Zinc Alloy-Coated Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

3. Prepainted Coil-Coated Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm). D. Miscellaneous Flashings
1. Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

2. Aluminum-Zinc Alloy-Coated Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

3. Prepainted Coil-Coated Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm). E. Gutters and Downspouts
1. Fabricate from same material and finish used for adjacent exposed flashings.

2. Form sheet metal to profile dimensions indicated, free from distortions and defects detrimental to water-tight system.

3. Provide expansion joints in gutters at spacing not to exceed 30 feet (9 m). Drain each section to allow water to drain that is otherwise trapped by expansion joint ridges.

4. Provide removable debris screens for gutters, fabricated from 1/4 inch (6.35 mm) mesh wire cloth of same material used for gutters or approved compatible material. Provide formed sheet metal frame on 4 sides of each screen unit. Length of screen units not to exceed 10 feet (3 m).

5. Provide wire basket type strainers at downspouts, fabricated from wire and sheet metal of same material used for downspouts or approved compatible material.

6. Provide sheet metal baffles 6 inches (152 mm) high with legs 18 inches (457 mm) long at gutter corners below roof valleys.

7. Provide formed metal splash pans fabricated from same type of sheet metal used for downspouts. Locate where downspout discharges onto lower roof.

8. Gutter supports: Brackets spaced at 30 inches (762 mm) on center.

9. Downspout supports: 20 gage, (0.0396 inch) (1.006 mm) straps at each joint and at center of section.

10. Back-paint concealed metal surfaces with bituminous coating to a minimum of 15 mils (0.38 mm) dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

B. Isolate dissimilar metals by means of a heavy bituminous coating, approved paint coating, adhered polyethylene sheet, or other means approved by the Resident Engineer.

3.03 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; Conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of one and one-half (1-1/2) inches (38.1 mm), except where pretinned surface would show in finished work. Do not solder prepainted, coil-coated, galvanized steel sheets.

D. Sealed Joints: Form nonexpansion, but moveable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joints with sealant and form metal to completely conceal sealant.

1. Use joint adhesive for nonmoving joints specified not to be soldered.

2. Moving Joints: When ambient temperature is moderate (40 - 70 degrees F) (4 - 21 degrees C) at time of installation, set joined members for 50 percent movement either way. Adjust setting position of joined members proportionally for temperatures above 70 degrees F (21 degrees C). Do not install sealant at temperatures below 40 degrees F (4 degrees C). Refer to section on sealants, elsewhere in Division 7, for handling and installation requirements for joint sealers.

E. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of two (2) inches (51 mm) and bed with sealant.

F. Install continuous gutter screens on gutters with noncorrosive fasteners, arranged as hinged units to swing open for cleaning gutters.

G. Roof Edge Flashings: Secure metal flashings at roof edges to comply with FM Loss

Prevention Data Sheet 1-49 for Zone 2 wind exposure.

H. Surface-Mounted Reglets: Attach reglets securely to substrate, at locations indicated. Install elastomeric sealant at top edge.

3.04 CLEANING AND PROTECTION

A. Remove protective film from prefinished sheet metal immediately after installation.
B. Repair or replace work which is damaged or defective, as directed by SDR.
Refinish marred and abraded areas of prefinished sheet using finish manufacturer's recommended methods and materials. Replace units which cannot satisfactorily be refinished in place.

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

D. Provide final protection and maintain conditions that ensure sheet metal flashing and trim work during construction is without damage or deterioration other than by natural weathering.
END OF SECTION 07600

SECTION 07900 - JOINT SEALANTS

PART 1 GENERAL
1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including general and Supplementary Conditions and Division I Specification, apply to this Section

1.2 SUMMARY:

A. This Section includes, but is not limited to, joint sealants for the following locations:

1. Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:

a. Control and expansion joints in cast-in-place concrete.

b. Control and expansion joints in unit masonry. Joints between different materials listed above.

c. Perimeter joints between materials listed above and frames of doors and windows.

d. Control and expansion joints in ceiling and overhead surfaces. e. Other joints as indicated on drawings.

2. Exterior joints horizontal traffic surfaces as indicated below:

a. Control, expansion, and isolation joints in cast-in-place concrete slabs. b. Tile control and expansion joints.
c. Joints between different materials listed above. d. Other joints as indicated.

3. Interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:

a. Control and expansion joints on exposed interior surfaces of exterior walls. b. Perimeter joints of exterior openings where indicated.
c. Joints between tops of non-load-bearing unit masonry walls and underside of cast-in-place concrete slabs and beams.
d. Tile control and expansion joints.

e. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.

f. Perimeter joints between interior wall surfaces and frames on interior doors, windows, and elevator entrances.

g. Perimeter joints of toilet fixtures. h. Other joints as indicated.

4. Interior joints in horizontal traffic surfaces as indicated below:

a. Control and expansion joints in cast-in-place concrete slabs. b. Control and expansion joints in tile flooring.
c. Other joints as indicated.

1.3 SYSTEM PERFORMANCE REQUIREMENTS:

A. Provide elastomeric joint sealants that have been produce and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

B. Provide joint sealants for interior applications that have been produce and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.4 SUBMITTALS (As Applicable):

A. General: Submit the following in accordance with Conditions of Contract and Division I Specification Sections.

B. Product data from manufacturers for each joint sealant product required.

1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

C. Samples for initial selection purpose in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

D. Samples for verification purpose of each type and color of joint sealant required. Install joint sealant samples in ½-inch (13-mm) wide joints formed between two 6-inch (150-mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

E. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

F. Qualification data complying with requirements specified in “Quality Assurance” article. Include list of completed projects with project names addresses, names of Architects and Owners, plus other information specified.

G. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer’s interpretation of test results relative to sealant performance and recommendations for primers and substrates preparation needed to obtain adhesion.

H. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

I. Preconstruction field test reports indicating which products and joint preparation methods demonstrate acceptable adhesion to joint substrates.

1.5 QUALITY ASSURANCE:

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with record of successful in-service performance.

B. Testing Laboratory Qualifications: To qualify for acceptance, and independent testing laboratory must demonstrate to Architect’s satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM 699, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying progress of the Work.

C. Single Source Responsibility for joint Sealant Materials: Obtain joint sealant materials from single manufacturer for each different product required.

D. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers samples of materials that will contact or affect joint sealants for compatibility and adhesion testing as indicated below:

1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

a. Perform test under normal environmental conditions that will exist during actual installation.

2. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.

3. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.

4. Investigate materials failing compatibility or adhesion test and obtain joint sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.

5. Testing will not be required when joint sealant manufacturer is able to submit joint preparation data required above that are acceptable to Architect and are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

E. Product Testing: Provide comprehensive test data for each type off joint sealant based on test conducted by a qualified independent testing laboratory on current product formulations within a 24-month period preceding date of Contractor's submittal of test results to Architect.

1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C 920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C 719), low- temperature flexibility, modulus of elasticity at 100 percent strain, effects of heat aging, and effects of accelerated weathering.

2. Include test results performed on joint sealants after they have cured for 1 year.

F. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:

1. Locate test joints where indicated or, if not indicated, as directed by Architect.

2. Conduct field test for each application indicated below:

a. Each type of elastomeric sealant and joint substrates indicated.

b. Each type of non-elastomeric sealant and joint substrates indicated.

3. Notify Architect one week in advance of the dates and times when mock-ups will be erected.

4. Arrange for test to take place with join sealant manufacturer's technical representative present.

5. Test Method: Test joint sealants by hand pull method described below:

a. Install joint sealants in 60 inches (1500 mm) joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allows sealants to cure fully before testing.

b. Make knife cuts horizontally from one side of joint to the other followed by 2 vertical cuts approximately 2 inches (50 mm) long at side of joint and meeting horizontal cut at top of 2-inch (50-mm) cuts. Place a mark 1 inch (25 mm) from top of 2-inch (50-mm) piece.

c. Use fingers to grasp 2-inch (50-mm) piece of sealant just above 1-inch (25- mm) mark; pull firmly down at a 90-degree angle or more while holding a ruler alongside of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less that equaling specified maximum movement capability in extension; hold this position for 10 seconds.

6. Report whether or not sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrates.

7. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

G. Field-Constructed Mock-Ups: Prior to installation of joint sealants, apply elastomeric sealants as follows to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualifies of materials and execution:

1. Joints in field-constructed mock-ups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants specified in this Section.

H. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of the Division I Section covering this activity.

1.6 DELIVERY, STORAGE, AND HANDLING:

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

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

1.7 PROJECT CONDITIONS:

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

1. When ambient and substrates temperatures conditions are outside the limits permitted by joint sealant manufacturer.

2. When joint substrates are wet.

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

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

1.8 SEQUENCING AND SCHEDULING:

A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL:

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

B. Colors: Provide color of exposed joint sealants to comply with the following:

1. Provide selections made by Architect from manufacturer's full range of standard colors

for products of type indicated.

C. Sealants used inside the weatherproofing system, shall have a VOC content of not more than
250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Glazing sealants formulated with aromatic solvents (organic solvent with benzene ring in its molecular structure), fibrous talc or asbestos, formalhyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, or their components not allowed.

E. Available manufacturers subject to compliance with requirements. Manufacturers offering products that may be incorporated into the Work include but are not limited to the manufacturers listed herewith.

F. Substitutions allowed according to Architect's approval via Substitution Request Forms provided
as attachments to Section 01600: Product Requirements.

2.2 ELASTOMERIC JOINT SEALANTS (As Applicable):

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric
sealants that comply with ASTM C 920

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

B. Products: Subject to compliance with requirements.

2.3 SOLVENT-RELEASE-CURING JOINT SEALANTS (As Applicable):

A. Acrylic Sealant: Manufacturer's standard one-part, no sag, solvent-release-curing acrylic terpolymer sealant complying with AAMA 808.3 or FS TT-S-00230 or both, with capability when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the following percentage change in joint width existing at time of application and remain adhere to joint substrates indicated for Project without failing cohesively:

1. 12-1/2 percent movement in both extension and compression for total of 25 percent.

B. Butyl Sealant: Manufacturer's standard one-part, no sag, solvent-release-curing, polymerized butyl sealant complying with ASTM C 1085 and formulated with minimum of 75 percent solids to be no staining, paintable, and have a tack-free time of 24 hours or less.

C. Pigmented narrow Joint Sealant: Manufacturer's standard, solvent-release-curing, pigmented synthetic rubber sealant complying with AAMA 803.3 and formulated for sealing joints 3/16 inch (5 mm) or smaller in width.

D. Available Products: Subject to compliance with requirements, solvent-release-curing joint sealants that may be incorporated in the Work include, but are not limited to, the following:

1. Acrylic Sealant:

a. "60+Unicrylic," Pecora Corp.

b. "PTI 738," Protective Treatments, Inc. c. "PTI 767," Protective Treatments, Inc. d. "Mono," Tremco, Inc.

2. Butyl Sealant:

a. "BC-158," Pecora Corp.

b. "PTI 757," Protective Treatments, Inc.

c. 'Sonneborn Multi-Purpose Sealant," Sonneborn Building Products Div., ChemRex, Inc.

d. "Tremco Butyl Stealant," Tremco, Inc.

3. Pigmented Narrow Joint Sealant:

a. "PTI 200," Protective Treatments, Inc.

2.4 LATEX JOINT SEALANTS (As Applicable):

A. General: Provide manufacturer's standard one-part, nonsag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.

B. Acrylic-Emulsion Sealant: Provide product complying with ASTM C 834 and, except for weight loss measured per ASTM C 792, with ASTM C 920 that accommodates joint movement of not more than 25 percent in both extension and compression for a total of 50 percent.

C. Silicone Emulsion Sealant: Provide product to compliance with requirements, latex joint sealants that may be incorporated in the Work include, but are not limited to, the following:

1. Acrylic-Emulsion Sealant:

a. “AC-20.” Pecora Corp.

b. “Sonolac,” Sonneborn Building Products Div., ChemRex, Inc.

c. “Tremco Acrylic Latex 834,” Tremco, Inc.

2. Silicone-Emulsion Sealant:

a. “Trade Mate Paintable Glazing Sealant,” Dow Corning Corp.

2.6 TAPE SEALANTS (As Applicable):

A. Tape Sealant: Manufacturer’s standard, solvent-free, butyl-based tape sealant with a solids content of 100 percent formulated to be no staining, paintable, and non-migratingin contact with nonporous surfaces with or without reinforcement thread to prevent stretch and packaged on rolls with a release paper on one side.

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

1. “Extru-Seal Tape,” Pecora Corp.

2. “Shim-Seal Tape,” Pecora Corp.

3. “PTI 606,” Protective Treatments, Inc.

4. “Tremco 440 Tape,” Tremco, Inc.

5. “MBT-35,” Tremco, Inc.

2.7 PERFORMED FOAM SEALANTS (As Applicable):

A. Performed Foam Sealants: Manufacturer's standard performed, pre-compressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water repellent agent; factory-produced in pre- compressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following requirements:

1. Properties: Permanently elastic, mildew-resistant, non-migratory, no staining, and compatible with joint substrates and other joint sealants.

2. Impregnating Agent: Manufacturer's standard.

3. Density: Manufacturer's standard.

4. Backing: pressure-sensitive adhesive factory applied to one side with protective wrapping.

5. Available Products: Subject to compliance with requirements, performed foam sealants that may be incorporated in the Work include, but are not limited to, the following:

a. "Emseal," Emseal Corp.

b. "Emseal Greyflex," Emseal Corp.

c. "Wil-Seal 150," Wil-Seal Construction Foams Div., Illbruck. d. "Wil-Seal 250," Wil-Seal Construction Foams Div., Illbruck.

2.8 JOINT SEALANT BACKING (A Applicable):

A. General: Provide sealant backings of material and type that are no staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Performed, compressible, resilient, no staining, non-waxing, non-extruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Open-cell polyurethane foam.

2. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, no outgassing in unruptured state.

3. Proprietary, reticulated, closed-cell polymeric foam, no outgassing, with a density of 2.5 pcf (40kg/cu. M) and tensile strength of 35 psi (240 kPa) per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.

4. Any material indicated above.

C. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D
1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -
26 deg F (-32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

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

E. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS (As Applicable):

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

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

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

PART 3 EXECUTION

3.1 EXAMINATION:

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

B. Follow (if applicable) the IAQ Plan During Construction as specified, to mitigate emissions from activities.

3.2 PREPARATION:

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

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

2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joints substrates surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrates capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

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

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

3.3 INSTALLATION JOINT SEALANTS:

A. General: Comply with joint sealant manufacturer's printed installation instruction applicable to
products and applications indicated, except where more stringent requirements apply.

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

C. Acoustical Sealant Application Standard: Comply with recommendation of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

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

a. Do not leave gaps between ends of joints fillers. b. Do not stretch, twist, puncture, or tear joint fillers.
c. Remove absorbent joint fillers that have become wet prior to sealant
application and replace with dry material.

2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

F. Tooling of No-sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5a in ASTM C 1193, unless otherwise indicated.

2. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated. a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

G. Installation of Performed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

3.4 CLEANING:

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

3.5 PROTECTION:

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

END OF SECTION 07900

Division 8 – Doors & Windows

SECTION 08100 - METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

Furnish all labor, materials, equipment and services necessary to provide all hollow metal doors and frames, complete in place, as shown and specified.

A. Section Includes:
1. Standard steel doors and frames.
2. Preparation for finish hardware.
3. Assemblies for fire rated openings.

B. Related Work Specified in other Sections:
1. Wood doors for installation in steel frames: Elsewhere in Division 8.
2. Finish painting.
3. Door hardware: Elsewhere in Division 8..
4. Glass and glazing: Elsewhere in Division 8.

1.02 REFERENCES

A. ASTM A 153-82(87) – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 1982 (Reapproved 1987).

B. ASTM A 366/A366M-96 – Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality; 1996.

C. ASTM A 526/A 526M-90 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip process, Commercial Quality; 1990.

D. ASTM A 568/A 568M-95 – Standard Specification for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold Rolled, General Requirement for; 1995.

E. ASTM A 569/A 569M-91a – Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality; 1991.

F. ASTM A 525-93 – Standard Specification for General Requirements for Steel Sheet, Zinc- Coated (Galvanized) by the Hot-Dip Process; 1993.

G. ASTM E 152-81a – Standard Methods of Fire Tests of Door Assemblies; 1981.

H. DHI A115 Series – Specifications for Steel Door and Frame Preparation for Hardware; 1980-94.

I. NFPA 80 – Standard for Fire Doors and Windows; National Fire Protection Association; 1992 (with Errata dated October 6, 1992).

J. SDI 100-1991 – Recommended Specifications: Standard Steel Doors and Frames; Steel Door Institute; 1991.

K. SDI 105-92 – Recommended Erection Instructions for Steel Frames; Steel Door Institute; 1992.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's printed product information indicating compliance with specified requirements.

B. Shop Drawings: Submit drawings for fabrication and installation of steel doors and frames, including the following information:
1. Details of construction, joints, and connections.
2. Details of each frame type, including anchorage.
3. Elevations of each opening type.
4. Conditions at openings, including coordination with glass and glazing requirements.
5. Location and installation requirements of door hardware and reinforcements.
6. Schedule of openings coordinated with numbering system used in contract documents.

1.04 QUALITY ASSURANCE

A. Quality Standard: Comply with SDI 100.

B. Labeled Assemblies: At all locations where fire-rated door and frame assemblies are required, provide assemblies which comply with NFPA 80 and have been tested and labeled in accordance with ASTM E 152 by agency acceptable to the City of San Jose Fire Department.

C. Coordination: Transmit copy of final shop drawings to wood door manufacturer to allow prefitting of wood doors to steel frames.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in cartons or crates suitable for storage at the site.

B. Replace items damaged in delivery, unless damage is minor and can be repaired to match intact items, as determined by architect.

C. Store products under cover, raised above ground level, and stacked to prevent warping and to promote air circulation.
1. Prevent moisture from accumulating and remove saturated packaging before products can be damaged.
construction, profile of molding, connections to other work, fastening, anchors and reinforcing for hardware. All profiles shall match details.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hollow Metal Frames: Frames shall be by Forderer Cornice Works, Ceco Corporation, Republic Builders Products Corp., Steelcraft or approved equal. Frames shall have combination buck, jambs and trim, with all miters clean-cut and reinforced. Exterior and interior frames shall be 16 gauge cold-rolled steel with welded corners. Both flus hframe and drywall frames may be used. Prime finish interior frames. Provide U.L. labels or certificates where required.

B. Hollow Metal Doors: Doors shall be "Regent" by Ceco Corp., "DM Series" by Republic Builders Products Corp., "L-series" by Steelcraft, or approved equal. Doors shall be full flush face with completely smooth and unbroken surface on face, with visible seams permitted on edges. Doors shall be reinforced for all hardware. Exterior doors shall be
18 gauge and interior doors shall be 20 gauge prime painted with one coat baked-on rust-inhibiting primer, ASTM B-117, after doors have been cleaned and phosphatized. Provide U.L. labels or certificates where required.

2.02 FABRICATION

A. Metal Frames
1. Reinforcing: Concealed metal reinforcement shall be provided for hardware as required. The gauges of metal for reinforcement shall be in accordance with the manufacturer's recommendations for the type of hardware and the thickness and width of doors, provided that the gauges used are not lighter than those required by CS 242.
2. Workmanship and Design: The finished work shall be strong and rigid, neat in appearance and free from defects. Molded members shall be fabricated straight and true with corner joints well-formed, in true alignment and fastenings concealed where practicable.
3. Forming Corner Joints: Joints for welded-type frames shall be mitered or butted and continuously arc-welded for full depth and width of frame and

trim. All contact edges shall be closed tight and all welds on exposed surfaces dressed smooth and flush.

4. Provisions for Hardware: Frames shall be prepared at the factory for the installation of hardware. Welding of hinges to frames will not be permitted. Frames shall be mortised, reinforced, drilled and tapped to templates to receive all mortised hardware; frames to receive surface applied hardware shall be provided with reinforcing plates only. Provide cover boxes in back of all hardware cutouts. Door frames shall be punched to receive rubber or vinyl door silencers; provide for three silencers on lock side of single doors and four silencers in heads of double-door frames. Lock strikes shall be set out and adjusted to provide clearance for silencers.

5. Wall Anchors: Provide metal anchors of shapes and size required for the adjoining type of wall construction. Fabricate jamb anchors of steel, not lighter than the gauge used for frame. Locate one anchor on jambs near the top and two anchors 4 inches apart at the bottom of each frame and at intermediate points not over 24 inches apart. For frames set in stud partitions, weld or otherwise securely fasten anchors to back of frames at jambs; make provision for securing anchors to studs with No. 12 self-taping sheet metal screws for metal studs No. 12 round-head wood screws or nails for wood studs.

6. Floor Anchors: Provide floor clips of not less than 36-gauge steel and fasten to bottom of each jamb member for anchoring frame to floor construction. Clips shall be fixed and drilled for 3/8-inch diameter anchor bolts.

7. Fastenings: Conceal all fastenings. Countersink exposed screws using Phillips flat-head screws.

B. Doors

1. Construction: Top and bottom closures shall be 16-gauge steel, welded to face panels at approximately 2 inch centers around their entire perimeters. Interior of doors shall be reinforced by honeycomb core, securely fastened, completely filling inside of door.

2. Cutouts and Reinforcement: Provide cutouts and reinforcement for closers, locksets, and other recessed hardware. Reinforce frame and drill to template for attachment of surface applied hardware. Apply surface mounted astragal on door stiles where called for on drawings. Provide openings on doors to receive louvers and prepare for field installation.

PART 3 - EXECUTION

3.01 DOOR FRAMES

Door frames shall be erected plumb and in a straight and even plane with the adjacent surfaces and according to details on the drawings and approved shop drawings. Set frames in position, plumb, align and brace securely until permanent anchors are set. Anchor bottom of frames to floors with expansion bolts or with power fasteners. Build wall anchors into walls or

secure to adjoining construction as indicated or specified. Where frames require detailing struts or other structural overhead bracing, they shall be anchored securely to ceilings or structural frame above, as indicated or specified.

3.02 DOORS

Shall be installed under "Wood Doors" Section.

3.03 ADJUST AND CLEAN

A. Touch-Up: At locations where primer has been abraded or minor rusting has occurred, sand smooth and spray apply compatible primer.

B. Final Operating Adjustments: Check hardware at all openings for proper operation of doors, making final corrections as required to assure that work of this section is complete and undamaged.

END OF SECTION 08100

SECTION 08210 - WOOD DOORS

PART I - GENERAL

1.1 DESCRIPTION

A. Scope: Work under this Section shall include all materials and installation necessary to provide Wood Doors as shown and detailed on the Drawings and shown herein.

1.2 QUALITY ASSURANCE

A. References:

1. National Fire Protection Association (NFPA): NFPA 80 – Fire Doors and Windows; and NFPA 252 – Standard Method of Fire Tests for Door Assemblies.

2. Underwriters Laboratories (UL): UL 10B – Fire Tests of Door Assemblies.

3. Warnock-Hersey (WH): Certification Listings for fire doors.

B. Labels: Provide proper Underwriters' Laboratories, Inc. label for wood doors in fire-rated openings.

C. Testing: One (1) or more doors, of each type, may be selected at random from those delivered for testing. Those tested or cut apart will be used to determine compliance with specified requirements; noncompliance is basis for rejection of all of that kind and type of door delivered to the site. Acceptable doors used for testing will be replaced at University's expense.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specification, data, and installation instructions for review.

B. Certificates: Submit WIC Certified Compliance Certificate for Installation.

1.4 PRODUCT HANDLING

A. Do not use packing materials that will stain or discolor door surface.

B. Storage: Per WIC Technical Bulletin No. 420-R for flush doors and No. 416-R for fire rated doors. Store materials under cover, in heated rooms and protected from damage, including exposure to excess humidity.

1.5 MAINTENANCE

A. Guarantee: Provide in required form for a period of two (2) years from date of final acceptance by University.

PART II - PRODUCTS

2.1 MATERIALS

A. Wood Doors:

1. General: Conform to WIC Custom Grade Standards.

2. Manufacture:

a. Architectural Doors manufactured by Haley Bros., Inc., Architectural Door Division of the Weyerhaeuser Co., or equal.

3. Flush Type:

a. Exterior: 1-¾" thick. b. Interior: 1-¾" thick. c. Construction:
1) Hollow Core: Expanded corrugated honeycomb.

2) Solid Core:

a) Unrated and 20 Minute: Staved lumber [Particleboard]. b) Fire Rated: Mineral core; 45 [and 60] [and 90] minute.
3) Edge-bands: NWMA hardwood.

d. Facing:

1) Hardwood: Birch; plain sliced [Red oak; rift][Red oak; plain sliced][White oak; rift][White oak; plain sliced][Mahogany; Lauan][Mahogany; Honduras plain sliced][Mahogany; African quarter sliced][Walnut; plain sliced].

2) Paint Grade: Hardboard.

3) Plastic Laminate: Manufacturer's standard; color selected by the University's Representative.

e. Adhesive: PS 51 Type I and II. f. Accessories:
1) Anemostat Door Products Division of the Dynamics Corporation of America, Air Louvers, Inc., or equal.

2) Louvers:

a) General: Model No. AFDL.

b) Fire Rated: Model No. FLDL-UL.

3) Vision Light Frames: Model No. BFL-75; glass and glazing per Division 8, Section 08810 – Glass and Glazing, as shown.

4) Fasteners: Manufacturer's standard; tamperproof.

g. Finish: Manufacturer's standard finish as selected by University's Representative per Division 9, Section 09900 – Painting.

4. Transom Panels: Same construction as flush type doors.

5. Flush Full or Half Glazed Doors: Same construction as flush type doors; stile and rail glued block core with edge bands all sides.

6. Flush Dutch Doors: Each leaf of same construction as flush type doors. Provide solid wood shelf on lower leaf for application of plastic laminate top, as shown. Ease exposed edges and round corners.

7. Style and Rail Type:

a. Construction: 1-¾" thick Douglas fir [birch][red oak][white oak][mahogany][walnut]; solid lumber construction, as shown.

b. Adhesive: PS 51 Type I and II.

c. Finish: Manufacturer's standard finish as selected by University's Representative per Division 9, Section 09900 – Painting.

PART III - EXECUTION

3.1 PREPARATION

A. Examination: Examine conditions of work in place before beginning work; report defects. Verify that doorframes are the type required for door and are properly installed. Install fire rated doors only in corresponding fire rated frames.

3.2 INSTALLATION

A. General: Install in strict conformance with NFPA Pamphlet No. 80 "Installation of Fire Doors", other referenced standards, the manufacturer's written directions, as shown, and as herein specified. Make manufacturer's instructions available to the inspecting authorities.

B. Tolerances:

1. General: Maximum distortion measured with straight edge or taught string, corner to corner, over an imaginary 36” x 84” surface area.

2. Diagonal (Warp), Vertical (Bow) and Width (Cup): ⅛”.

C. Hardware: Per Division 8, Section 08710 – Finish Hardware. Fit doors to specified clearances; do not trim job fitted doors more than ¼” from any edge. D. Glazing: Per Division 8, Section 08810 – Glass and Glazing.
E. Finishing:

1. General: Per Division 9, Section 09900 – Painting.

. Priming: Prime or seal tops and bottoms of doors immediately upon delivery, unless factory sealed.

3. Preparation for Finishing: Use 150 grit sandpaper to remove handling marks or effects of exposure to moisture; steam out deep scratches, to satisfaction of University's Representative, and clean finish sand exposed surfaces before application of sealer or finish.

4. All electrically operated locks and strikes and locking hardware shall operate on 24 volts DC. All hardware shall use the manufactures recommended power supply. Power supplies shall be equipped with battery backup large enough to provide for 24 hours of operation with the door to remain locked. All electric strikes and electric locks shall be manufactured by Von Duprin, Schlage or Folger Adams. No substitutions allowed unless approved by University.

5. All doors that are in a fire rated wall must use electric locks that ensure positive latching at all times. When panic hardware has electric latch retraction and it is unlocked or in

the day mode it is not latched this hardware is not permitted. The Fire Marshal has stated that the use of an electric strike in the unlocked position is not positively latched.

3.3 ADJUSTMENT

A. General: Prior to acceptance, adjust moveable parts to assure smooth operation.

3.4 CLEANING

A. General: Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions.

END OF SECTION 08210

SECTION 08700 - FINISH HARDWARE

PART 1 - GENERAL

A. DESCRIPTION

1. The extent of finish hardware is shown on the drawings. Finish hardware is hereby defined to include all items known commercially as builder's hardware, as required for swing doors, except special types of hardware specified in the same section as the door and door frame.

2. Finish Hardware: Hinges Closers
Panic Devices

Wall Stops

Master keyed cylinders for hollow metal doors

Thresholds

Weatherstripping

3. Installation:

Hardware for hollow metal doors, except as noted

B. QUALITY ASSURANCE

1. Manufacturer: To the greatest extent possible, obtain each kind of hardware (latch and lock sets, hinges, closers, etc.) from only one manufacturer, even though several may be specified as acceptable manufacturers.

2. Supplier: Furnish hardware supplied only by a recognized builder's hardware supplier who has been furnishing hardware in the same area as the project for a period of not less than two years and who has in his employment an experienced hardware consultant who is available at all reasonable times during the course of the work, for project hardware consultation to the Owner, Engineer and Contractor.

3. Assign the installation of hardware to experienced tradesmen in compliance with trade union jurisdictions; either at the door and frame fabrication plant or at the project site. Coordinate with the requirements of Section 08100.

4. Scheduled Designations: Except as otherwise indicated, the use of one manufacturer's numeric designation system in schedules does not imply that another manufacturer's products

will not be acceptable, unless they are not equal in design, size, weight, finish, function or other quality or significance. However, do not make substitutions after Engineer's acceptance of the offered hardware schedule. 5. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door UL label indicating "Fire Door to be Equipped with Fire Exit Hardware", and provide
UL label on exit device indicating "Fire Exit Hardware".

C. SUBMITTALS

1. Submit copies of manufacturer's data for each item of finish hardware in accordance with Section 13300 Submittal Procedures. Include whatever information may be necessary to show compliance with requirements and include instructions for installation and for maintenance of operating parts and exposed finishes. Wherever needed, furnish templates to fabricators of other work which is to receive finish hardware.

2. Hardware Schedule, Finish Hardware

a. Finish hardware schedules and project data shall be submitted for acceptance. Hardware schedules shall list each door by opening number along with hardware used for that opening. Hardware schedule shall have a summary list showing all hardware items and quantities. Review and acceptance by the Engineer or Owner does not relieve the Contractor of his exclusive responsibility to fulfill the requirements as shown and specified.

b. Hardware Schedule: Based on finish hardware requirements as indicated (including drawings, schedules and specifications), organize schedule into "hardware sets," indicating complete designation of every item required for each door or opening. Furnish schedule with samples and manufacturer's data sheets.

D. PRODUCT HANDLING

1. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control the handling and installation of hardware items which are not immediately replaceable so that the completion of the work will not be delayed by hardware losses, both before and after installation.

E. JOB CONDITIONS

1. Coordination: Coordinate hardware with other work. Tag each item or package separately with identification related to the final hardware schedule and include basic installation instructions on the package. Furnish hardware items of proper design for use on doors and frames of the thicknesses, profile, swing security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information in the contract documents.

2. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check the shop drawings of such work to confirm that adequate provisions will be made for the proper installation of hardware.

PART 2 - PRODUCTS

A. MATERIALS AND FABRICATION

1. Produce hardware units of the basic metal indicated, using the manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for the applicable hardware units by FS FF - H - 106, FS FF - H - 111, FS FF - H - 116, and FS FF - H - 121. Do not substitute "optional" materials for those indicated, except as otherwise permitted by other sections of these specifications.

2. Form the base metal into the required shapes and sizes by the method indicated (cast, wrought, forged, rolled, pressed, etc.) or, if not indicated, by the manufacturer's standard production method for the class or quality of hardware units required.

3. Fasteners: Manufacture hardware to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

4. Furnish screws for installation with each hardware item. Provide Phillips flathead screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, except as otherwise indicated.

5. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard-manufactured units of the type specified are available with concealed fasteners. Do not use through bolts for installation where the bolt head or the nut on the opposite face is exposed under any condition, except where it is not possible to adequately reinforce the work and use machine screws or concealed fasteners of another standard type, to satisfactorily avoid the use of through bolts.

6. Provide fasteners which are compatible with both the unit fastened and the substrate and which will not cause corrosion or deterioration of hardware, base material or fastener.

7. Hand of door: The drawings show the swing or hand of each door leaf, (left, right, reverse level, etc.). Furnish each item of hardware for proper installation and operation of the door swing as shown.

B. FINISHES

1. General

a. Match the finish of every hardware unit at each door or opening, to the greatest extent possible and except as otherwise indicated. Reduce differences in colors and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match all items to the manufacturer's standard finish for the latch and lock set (or pushpull units if no latch-lock sets) for color and texture.

b. The Engineer will be the sole judge of whether hardware units match the accepted samples and match each other satisfactorily.

c. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by FS FF-H-106, FS FF-H-116, and FS FF-H-121.

d. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "ND" is used with standard finish designations to indicate "no lacquer".

e. The following designations are used to indicate the standard commercial finishes required for finish hardware (general description, base metal under finish, limitations and other requirements);

1) US26D: Dull chromium plated; for nickel coated metals; on plain surfaces.

2) US32D: Satin stainless steel; for stainless steel; on smooth and polished surfaces. f. Finishes shall be as follows:
1) Hinges - USP on steel

2) Locks - US26D plated on brass

3) Exit devices US26D plated on brass

4) Closers - sprayed aluminum enamel

5) Wall Stops - US32D floor brass C US226D on brass

6) Thresholds and weatherstrip - aluminum

C. DETAILED PRODUCT REQUIREMENTS

1. Requirements for locks and latchsets (BHMA Series 4000, Grade 1):

a. Locks and latch sets shall be supplied as BEST removable, interchangeable 7-pin core that is keyed to the County's existing master keyed system.

b. Locks and latchsets shall conform to ANSI 156.2, Series 4000, Grade 1 and be UL listed. Locks and latchsets with knobs shall meet ANSI 156.2 door preparation. Locks and latch sets with levers shall meet modified ANSI 156.2 door preparation. Locksets and core shall be of the same manufacturer to maintain complete lockset warranty.

c. Locksets shall be extra heavy duty cylindrical type with 2¾-inch backset, or as specified, with a 9/16-inch throw latch bolt.

d. Knobs must be of brass or bronze material and a minimum 0.100-inch thick at the thinnest point of the knob wall. The lockset shall be available with a tactile or knurled knob or lever for identification of hazardous areas.

e. Locksets shall have solid shank with no openings for access to keyed knob keeper. Keyed knob or lever shall be removable only after core is removed, by authorized control key, to allow access to knob keeper.

f. Keyed knob shall be protected from forced entry by means of a "break away" mechanism.

g. Knob locksets shall be constructed to be capable of changing hand before and after installation by rotation of face of knob.

h. Permanent core face must have the same finish as the lockset.

2. Requirements for exit devices (ANSI Grade 1):

a. Exit devices shall be supplied with a BEST rim cylinder and removable 7-pin core keyed to the existing master keyed system, function and type as specified in hardware sets.

3. Requirements for padlocks:

a. Padlocks shall have a 3/8-inch diameter steel shackle 1½ inches high, with a removable 7-pin core keyed to the existing School master keyed system.

b. Padlock case shall be of corrosion-resistant construction, machined from solid extruded brass.

c. Padlock shackle shall be hardened, multiple plated steel for corrosion resistance, and shall lock at heel and toe, conforming to the requirements of ASTM F883-84, Grade 4.

D. ACCEPTABLE MANUFACTURERS

1. Manufacturers: Hardware items specified are as follows with acceptable substitutes where allowed:

a. Butts: (BHMA types A8111, A8112 and A8133)

McKinney Mfg. Company TB2714-T4A3386-T4B3786

Stanley FBB 179-BB199-BB168

Hager 1279-BB1199-BB1168 Or equal

b. Locks and Latchsets: (BHMA Series 4000, Grade 1)

At exterior door: Best Lock #35H7FW16J x 630 x LH Mortise set; substitutions allowed.

At interior door: Best Lock #35HON16J x 630 x RH Mortise set; substitutions allowed. c. Exit Devices: (BHMA types 2 and 6)
Van Duprin 88 series trim to match locksets, function and type as specified in hardware sets.

Allowable Substitutes: BEST 2R Series, trim and functions per hardware sets. d. Door Closers: (BHMA type C02062)

LCN 40-40 non-handed door closer equipped with hold-open device, mounted as required by opening conditions.

Allowable Substitutes: Dorma 7600

e. Wall and Floor Door Stops: (BHMA types L32401 and L32142, and type C05512)

Shall be as manufactured by the H.B. Ives Company. Wall stops are preferred. Use 405-1/2 series as required by wall conditions and knob function.

Where wall stop cannot be used, use H.B. Ives floor stop 436 or 438 as conditions require.

Provided substitutes are the same design finish, material and are fastened identically to those specified, allowable substitutes as manufactured by:

Russwin

Sargent Or equal

f. Thresholds and weatherstripping:

Shall be as manufactured by National Guard Products. Provided substituted items are identical in composition, function and appearance, allowable substitutes are as
manufactured by:

Zero

Pemko

Rese Or equal g. Padlocks:
Shall be BEST Series 41B; substitutions allowed.

2. Templates: It shall be the responsibility of the hardware supplier to furnish templates of all items of hardware as soon as practical after receipt of approved hardware schedule and hollow metal shop drawings.

3. Marking, Packing, Delivery, and Storage: Hardware shall be delivered to the job site in manufacturer's original packages, marked to correspond with the approved hardware schedule.

4. Keying: All locks shall be master keyed and sub-mastered and construction master keyed as directed by Engineer and/or Owner, utilizing BEST components. Supply six (6) master keys and ten (10) construction master keys.

PART 3 - EXECUTION

A. HARDWARE MOUNTING HEIGHTS

1. Hardware locations:

a. Hinges - shall be installed at door and frame manufacturer standard location. b. Locksets - centerline of lock shall be 40-5/16" from finished floor.
c. Exit Devices - shall be located as per manufacturer's templates. d. Door Closers - shall be located as per manufacturer's templates.
e. Wall Stops - shall be located so center of knob or pull strikes center of stop.

B. INSTALLATION

Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finish, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

C. ADJUSTMENT AND CLEANING

Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Lubricate moving parts with the type of lubrication recommended by the manufacturer (graphite-type or as otherwise recommended). Replace units that cannot be adjusted and lubricated to operate freely and smoothly as intended for the application.

END OF SECTION 08700

Division 9 – Finishes

SECTION 09220 - PORTLAND CEMENT PLASTER

PART 1 GENERAL

1.1 SUMMARY

A. Section includes Portland cement plaster system.

1.2 SYSTEM DESCRIPTION

A. Fabricate vertical elements to limit finish surface to 1: 180 deflection under lateral point load of 100 lbs (445 N).

B. Fabricate horizontal elements to limit finish surface to 1: 240 deflection under superimposed dead load and wind uplift loads.

1.3 SUBMITTALS

A. Product Data: Submit data on plaster materials, characteristics and limitations of products specified.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C926 and PCA Portland Cement Plaster Manual.

1.5 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 GENERAL

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

B. Substitutions allowed according to Architect's approval via Substitution Request Forms provided as attachments to Section 01600: Product Requirements.

2.2 PORTLAND CEMENT PLASTER

A. Manufacturers:
1. W.R. Bonsal Co.
2. The Quikrete Companies.
3. United States Gypsum Co.
4. Substitution allowed according to Architect's approval via Substitution Request Forms provided as attachments to Section 01600: Product Requirements.

2.3 COMPONENTS

1. Cement: ASTM C150, Type I Portland cement, ASTM C91 for below grade, Type M, S, or N masonry cement.
2. Lime: ASTM C206, Type S.
3. Aggregate: In accordance with ASTM C897, PCA Plaster (Stucco) Manual.
4. Water: Clean, fresh, potable and free of mineral or organic matter affecting plaster.
5. Bonding Agent: ASTM C932; type recommended for bonding plaster to concrete and concrete masonry surfaces.
6. Admixtures: Air entrainment.

B. Plaster Finish Materials:

1. Cement: As specified for plaster base coat, gray color.
2. Lime: As specified for plaster base coat.
3. Color Pigment: ASTM C979 mineral oxide type, color as selected, when indicated on drawings.
4. Water: Clean, fresh, potable, and free of matter affecting plaster.

2.4 MIXES

A. Base Coats: Mix and proportion cement plaster base coat [in accordance with ASTM C926, as indicated on Drawings.

B. Finish Coat: Mix and proportion cement plaster finish coat [in accordance with

ASTM C926, as indicated on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Masonry: Verify joints are cut flush and surface is ready to receive work of this section. Verify no bituminous or water repellent coatings exist on masonry surface.
B. Concrete: Verify surfaces are flat, honeycomb are filled flush, and surfaces are ready to receive work of this section. Verify no bituminous, water repellent, or form release agents exist on concrete surface detrimental to plaster bond.

C. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.

D. Mechanical and Electrical: Verify services within walls have been tested and approved.

3.2 PREPARATION

A. Dampen masonry surfaces to reduce excessive suction.

B. Clean concrete surfaces of foreign matter. Clean surfaces using acid solutions, solvents, or detergents. Wash surfaces with clean water.

C. Roughen smooth concrete surfaces and apply bonding agent.

3.3 EXISTING WORK

A. Extend existing Portland cement plaster installations using materials and methods as specified.

B. Repair existing remaining damaged Portland cement plaster to be remodeled.

3.4 INSTALLATION

A. Installation of Lathing Materials:
1. Apply one layer over substrate; lap edges 2 inches (50 mm) minimum.
Fasten in place.
2. Install metal lath in accordance with ASTM C1063.

B. Installation of Accessories:
1. Install accessories in accordance with ASTM C1063.
2. Place corner bead at external wall corners; fasten at outer edges of lath only.
3. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
4. Place casing beads at terminations of plaster finish. Butt and align ends.
Secure rigidly in place.
5. Install door frames plumb and level in opening. Secure rigidly in place. C. Control Joints:
1. Establish control joints with specified joint device.
2. Coordinate joint placement with other related work

D. Plastering:
1. Apply plaster in accordance with PCA Portland Cement Plaster Manual.

2. Apply base coat to nominal thickness of 0.375 inch, brown coat to
nominal thickness of 0.375 inch and finish coat to nominal thickness of
0.125 inch over metal lath surfaces.
3. Moist cure base and brown caats. Apply brown coat immediately following initial set of scratch coat.
4. After curing, dampen previous coat prior to applying finish coat.
5. Apply finish coat to indicated color and texture in accordance with PCA Portland Cement Plaster (Stucco) Manual.]
6. Avoid excessive working of surface. Delay troweling as long as possible to avoid drawing excess fines to surface.
7. Moist cure finish coat for minimum period of 48 hours.

3.5 ERECTION TOLERANCES

A. Maximum Variation from Flat Surface: 1/8inch in 10 feet.

3.6 ADJUSTING

A. Remove damaged or defective plaster by cutting and replace with specified materials to match adjacent plaster.

END OF SECTION 09220

SECTION 09300 - TILE

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of Work: Tile work is indicated on Contract drawings and schedules.

Tile includes ceramic surfacing units made from clay or other ceramic materials. B. Types: Tile work in this section includes the following:
1. Interior glazed ceramic tile for interior walls where scheduled.

2. Unglazed porcelain interior floor tile where scheduled.

3. Ceramic tile trim for floors and base.

C. Related Sections: Refer to the following sections for related work:

1. Section 03300, “Cast-in-Place Concrete” for concrete surfaces.

2. Section 07900 “Joint Sealants” for sealing of expansion, contraction, control and isolation joints in tile surfaces.

1.02 REFERENCES

A. American National Standards Institute (ANSI)

A108.5 Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar

A118.1 Dry-Set Portland Cement Mortar A118.4 Latex-Portland Cement Mortar A137.1 Ceramic Tile
B. American Society for Testing and Materials (ASTM)

C171 Specification for Sheet Materials for Curing Concrete

C373 Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired White Ware Products

C482 Test Method for Bond Strength of Ceramic Tile to Portland Cement

C648 Test Method for Breaking Strength of Ceramic Tile

C650 Test Method for Resistance of Ceramic Tile to Chemical Substances

C1026 Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling

C. National Tile Promotion Federation

D. Ceramic Tile Institute

E. Tile Council of America (TCA)

W212 Handbook for Ceramic Tile Installation W213 Handbook for Ceramic Tile Installation W214 Handbook for Ceramic Tile Installation

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical information and installation instructions for materials required.

B. Asbestos Free and Lead Free Paint Certification: Submit manufacturer's written certification that all materials are free of asbestos and lead paint.

C. Samples for Initial Selection Purposes: Submit manufacturer's color charts consisting of actual tiles or sections of tile showing full range of colors, textures, and patterns available for each type of tile indicated. Include samples of grout and accessories involving color selection.

D. Certified Test Reports: Submit certified test reports from a qualified independent testing laboratory evidencing compliance of tile and tile setting products with requirements specified, based on comprehensive testing of current products. Include in reports testing laboratory's interpretation of test results relative to specific requirements.

E. Shop Drawings: Submit shop drawings indicating tile patterns if applicable and locations and widths of control and expansion joints in tile surfaces.

1.04 QUALITY ASSURANCE

A. Source of Materials: Provide materials obtained from one source for each type and color of tile, grout, and setting materials.

B. Guarantee: All floor tile to be guaranteed by manufacturer for 15 years against undue glaze wear caused by pedestrian foot traffic.

C. Qualifications of Installers: Ceramic tile is to be installed in a workmanlike manner by an installer with not less than three (3) years experience in similarly sized commercial work.

1.05 DELIVERY, STORAGE, AND HANDLING

Deliver and store packaged materials in manufacturer's original unopened containers with seals unbroken and labels intact until time of use. Store materials off ground and under cover to prevent damage or contamination to materials by water, freezing, foreign matter or other causes. Promptly remove from site any materials which show evidence of damage, and immediately make all replacements necessary.

1.06 PROJECT CONDITIONS

A. Environmental: Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Maintain temperatures at 50□ Fahrenheit (10□ Celsius) or more in tiled areas during installation and for seven (7) days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

C. Tile installer must examine substrate and environmental conditions under which ceramic tile is to be installed.

1.07 MAINTENANCE AND EXTRA MATERIALS

Extra material will not be required upon project completion if the tile provided and installed on the project is from the manufacturer's standard product line. Extra material will be required if the tile provided and installed is of a unique or special run. Upon project completion, deliver required extra tile , trim units, composition, color, pattern, and size of each type installed to Resident Engineer. Materials should be packaged with protective covering and identified with labels. Furnish not less than 5% maintenance stock of total product installed for each type, color, pattern, and size of tile products installed.

PART 2 - PRODUCTS

2.01 STANDARDS

A. General: All tile products, grouts, trims, mortars, cleaners, thinset, etc. shall be checked for compatibility with substrate and adjacent materials by Contractor prior to purchasing material.

B. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 “American National Standard Specifications for Ceramic Tile” for types and grades of tile indicated. Furnish tile complying with “Premium Grade” requirements unless otherwise indicated.

C. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced for setting and grouting.

D. Color, Textures and Patterns: As indicated on drawings and schedules; for products listed and requiring selection of colors, surface textures or other appearance characteristics, as selected at time of submittals.

E. Accessories: Provide tile trim and accessories which match color and finish of adjoining flat tile if not as selected at time of submittals.

F. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.

2.02 MANUFACTURERS

Approved manufacturers include, but are not limited to, the following: Dal-Tile Corporation American Olean Tile Company, Inc. Monarch Tile Manufacturing, Inc. Winburn Tile Manufacturing Company Summitville Tiles, Inc.

2.03 TILE PRODUCTS

A. Glazed Wall Tile: Where indicated on Contract documents, provide Premium Grade tile in compliance with ANSI A137.1 and suitable for use on countertops, bathroom walls, and general commercial use and complying with the following requirements:

1. Composition: Glazed wall tile

a. Porcelain Tile: Provide porcelain tile only when noted elsewhere in the Contract documents.

b. Ceramic Mosaic Tile: Provide ceramic mosaic tile only when noted elsewhere in the Contract documents.

2. Nominal Face Dimensions: If not indicated on drawings or schedules, provide manufacturer’s standard size.

3. Nominal Thickness: 5/16 inch (7.94 mm) except ceramic mosaic tile shall be 1/4 inch (6.35 mm).

4. Grout Dimension: 1/8 inch (3.18 mm).

5. Wearing Surface: Smooth.

6. Back Mounting: Manufacturer's standard back-mounted sheets are allowed provided they do not interfere with any patterns indicated on Contract Documents. Contractor shall notify SDR if manufacturer's mounting prohibits installation of any patterns indicated on Contract documents at time of submittal.

7. Trim Units: Required.

B. Floor Tile: Where indicated on Contract documents, provide Premium Grade tile suitable for use on bathrooms, entries, and general use floor areas and complying with the following requirements:

1. Composition: Unglazed porcelain.

2. Nominal Face Dimensions: If not indicated on drawings or schedules, provide manufacturer's standard size with square edges.

3. Nominal Thickness: 5/16 inch (7.94 mm).

4. Group Dimensions: 1/4 inch (6.35 mm).

5. Wearing Surface: Slip-resistant grid or sand blasted finish.

6. Water Absorption: Less than 1/2 percent per ASTM C373.

7. Frost Resistance: Yes, per ASTM C1026.

8. Chemical Resistance: Tile unaffected per ASTM C650.

9. Break Strength: 250 pounds minimum per ASTM C648.

10. Bond Strength: 50 psi minimum per ASTM C482.

11. Trim Units: Required.

C. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:

1. Size: Size shall be as coordinated with sizes and coursing of adjoining flat tile.

2. Shapes: Shapes shall be as follows:

a. Base: Coved.

b. External Corners: Surface bullnose.

c. Internal Corners: Field-butted square corners, except use internal cove and cap angle pieces designed to member with stretcher shapes.

2.04 SETTING MATERIALS

A. Latex-Portland Cement Mortar: Provide product complying with ANSI A118.4 and the following requirement for composition:

Prepackaged dry mortar mix incorporating dry polymer additive in the form of a re-emulsifiable powder to which only water is added at job site.

B. Thin-Set Portland Cement Mortar: Where thin-set Portland cement mortar applications are required, use the following unless otherwise indicated:

Dry-set Portland cement mortar, factory sanded and meeting the requirements of ANSI A118.1-1988 and Tile Council of America Formula 759.

2.05 GROUTING MATERIALS

A. Latex-Portland-Cement Grout: Proprietary pre-blended compound of Portland cement, selected and graded aggregates, color pigments and chemical additives gauged with latex additive to comply with manufacturer's directions.

Use latex additive in grout which is compatible with latex additive in latex-Portland cement mortar.

B. Dry-Set Grout: Proprietary compound composed of Portland cement and additives formulated for type of tile installed.

C. Grout Color: As selected at time of submittals.

2.06 MISCELLANEOUS MATERIALS

A. Metal Edge Strips: Zinc alloy or stainless steel, 1/8 inch (3.175 mm) at top edge with integral provision for anchorage to substrate, unless otherwise indicated.

B. Tile Cleaner: Product specifically acceptable to manufacturer of tile and group manufacturer for application indicated and as recommended by Ceramic Tile Institute,

12061 West Jefferson Blvd. Culver City, CA 90230.
C. Cleavage Membrane: 4 mil (0.102 mm) polyethylene film per ASTM C171 Type 1.1.2. D. Reinforcing: 2 inch x 2 inch (51 mm x 51 mm) x 16/16 gauge welded wire mesh or equivalent.

PART 3 - EXECUTION

3.01 INSPECTION

A. Preparation: Examine surfaces to receive tile work and conditions under which tile will be installed. Do not proceed with tile work until unsatisfactory conditions are corrected by Contractor and comply with requirements indicated in referenced tile installation standards, manufacturer's installation instructions, and meets SDR's approval.

3.02 INSTALLATION

A. ANSI Tile Installation Standard: Comply with applicable parts of ANSI A108 series of tile installation standards included under "American National Standard Institutes Specifications for the Installation of Ceramic Tile".

B. Tile Council of America Installation Guidelines: Follow (TCA "Handbook for Ceramic Tile Installation"); comply with TCA installation methods and the following:

1. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, obstructions, edges and corners without disrupting pattern or joint alignments.

2. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish or built- in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures and other penetrations so that plates, collars, or covers overlap tile.

3. Jointing Patterns: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise shown.

4. Expansion Joints: Locate expansion joints and other sealant filled joints, including control, contraction isolation joints, where indicated, or if not indicated, at spacings and locations recommended in TCA "Handbook for Ceramic Tile Installation", and approved by SDR.

Prepare joints and apply sealants to comply with requirements of referenced standards and sealant manufacturer.

5. Grout tile to comply with referenced installation standards, using grout materials indicated.

Mix and install proprietary components to comply with grout manufacturer's directions.

3.03 FLOOR TILE INSTALLATION METHODS

A. General: Install tile to comply with requirements indicated below for setting bed methods, TCA installation methods related to types of subfloor construction, and grout types:

1. Thin-Set Portland Cement Mortar: ANSI A108.5.

2. Concrete Subfloor, Interior: TCA F111 cleavage membrane (bond breaker).

3. Concrete Subfloor, Interior: TCA F113 (bonded).

4. Bond Coat: Portland cement paste on plastic bed or the following thin-set mortar on cured bed, ANSI A108.5, at Contractor's option: Latex-Portland cement mortar.

B. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood or other flooring which finishes flush with top of tile.

3.04 WALL TILE INSTALLATION METHODS

Install types of tile designated for wall application to comply with requirements indicated below for setting bed methods, TCA installation methods related to subsurface wall conditions, and grout types:

Thin-Set Portland Cement Mortar: ANSI A108.5.

A. Masonry Interior: TCA W212 (with leveling coat). B. Masonry, Interior: TCA W213.
C. Metal Studs, Interior: TCA W244.

3.05 CLEANING AND PROTECTION

A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning. Flush surfaces with clean water before and after cleaning.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded or otherwise defective tile work.

C. Protection: When recommended by tile manufacturer, apply a coat of neutral protective cleaner to completed tile walls and floors.

1. Grout Sealer: Provide and apply manufacturer's standard [Silicone or Teflon] product for sealing grout joints that does not change color or alter appearance of the grout.

2. Protect installed tile work with Kraft paper and cardboard or other heavy covering during construction period to prevent staining, damage and wear. Prohibit foot and wheel traffic from using tiled floors for at least seven (7) days after grouting is completed.

D. Before construction complete, remove protective coverings and rinse tile with neutral cleaner compatible for use with tile and approved by tile and grout manufacturers.

END OF SECTION 09300

SECTION 09510 - ACOUSTICAL CEILING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Mineral Fiber acoustical ceiling system and suspension grid. B. Related Sections:
1. Divisions 13, 15, and 16 Sections for light fixtures, sprinklers, and air-distribution components.

1.2 REFERENCES

A. ASTM International:

1. ASTM C635 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

3. ASTM E1264 Standard Classification for Acoustical Ceiling Products. B. Ceilings and Interior Systems Construction Association (CISCA):
1. CISCA Code of Practices.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Provide acoustical ceiling assembly designed and tested to provide surface burning characteristics
(ASTM E84) as follows:

a. Flamespread: 0.

b. Smoke Developed: 0.

2. Provide acoustical ceiling system which has been manufactured, fabricated and installed to provide Noise Reduction Coefficient (NRC) rating as follows:

a. 0.45.

1.4 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1
Submittal Procedures Section 01300.

B. Product Data: Submit manufacturer's product data and installation instructions.

C. Samples: Submit selection and verification samples: 6 inch × 6 inch (152 × 152 mm) sample for each ceiling unit required, showing full range of exposed texture to be expected in completed work.

D. Quality Assurance/Control Submittals: Submit the following:

1. Certificates: Submit manufacturer's certificate that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity.

1.6 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirement Section.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1. Provide labels indicating brand name, style, size and thickness.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1. Prevent soiling, physical damage or wetting.

2. Store cartons open at each end to stabilize moisture content and temperature.

1.7 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

1. Do not install ceiling panels until building is closed in and HVAC system is operational.

2. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.

3. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:

a. Relative Humidity: 65 - 75%.

b. Uniform Temperature: 55 - 70 degrees F (13 - 21 degrees C).

1.8 MAINTENANCE

A. Extra Materials: Provide 10% additional material for use by owner in building maintenance and repair.

B. Provide new unopened cartons of extra materials, packaged with protective covering for storage and identified with appropriate labels.

PART 2 - PRODUCTS

2.1 ACOUSTICAL CEILING PANELS

A. Manufacturer: Subject to compliance with requirements, provide products by Armstrong Inc. or pre-approved equal. Basis of Design:
Item Acoustical Tile Type Optima Lay -in Width 24"
Length 24" Thickness 5/8" Color White
Edge Type Square Lay-In
Ceiling Attenuation Class (CAC) 40
Light Reflectance (LR) 0.85
Material Mineral Fiber Coverage 96 Sq Ft Temp. Range (F) 32-120
Recycled Content 40% Standards ASTM E1264

2.2 CEILING SUSPENSION SYSTEMS - GENERAL

A. Attachment Devices for Suspension System:

1. Anchors and intermediate support members: Provide sizes capable of sustaining five (5) times the load-carrying capabilities shown in ASTM C 635, Table 1, "Direct Hung" column.

2. Hanger wire: Zinc-coated (galvanized) carbon steel wire, ASTM A 641, soft temper, with Class 1 coating, minimum 12 gage (0.106 inch diameter).

B. Manufacturer: Subject to compliance with requirements, provide products by Armstrong or pre-approved equal.

C. Exposed Steel Suspension Grid: Formed, hot-dip galvanized steel for concealed portion of grid; painted, formed aluminum for exposed portion.

1. Profile: Exposed tee.

2. Structural classification (ASTM C 635): Intermediate-Duty System.

3. Color and texture: White baked polyester paint.

2.3 ACCESSORIES

A. Provide accessories as follows:

1. Acousti-Tough Keep Clips:

a. Material: Steel.

b. Manufacturer Designation: ARC-100 for 1 inch panels.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. General: Do not begin installation until materials sufficient to complete an entire room are received and prepared for installation.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders.

C. Symmetrically locate grid layout in each space. Coordinate work with other trades so that lighting fixtures, grilles and other ceiling fixtures work with grid layout.

D. Do not use universal splices or other splices that would obstruct passage of recessed lighting fixtures through grid openings or limit fixture relocation upon flanges of ceiling grids.

E. Support suspension system from structure above, not from ductwork, metal deck, equipment or piping. Follow seismic resistant hanging layouts as shown on drawings.

F. Space hangers not more than 6 inches (152 mm) from ends and not more than 4 feet (1219 mm) on centers on runners.

G. Install wall moldings at the perimeter of each acoustical ceiling area and at locations where edge of units would otherwise be exposed.

1. Secure moldings to supporting construction by fastening with screw anchors into the substrate, through holes drilled in vertical leg. Space holes not more than 3 inches (76 mm) from each end and not more than 16 inches (406 mm) on center along each molding.

2. Level moldings with ceiling suspension system, to a level tolerance of 1/8 inch (3.2 mm) in 12 feet (3658 mm).3. Miter corners of moldings accurately to provide hairline joints, securely connected to prevent dislocation. Cope exposed flanges of intersecting suspension system members, so that flange faces will be flush.

4. Furnish additional tees for supporting grilles, diffusers and light fixtures. Refer to reflected ceiling, HVAC and electrical plans for locations.

5. Provide reveal edge at walls, other abutting vertical surfaces. H. Field paint cut edges to match surface color and sheen.
I. Arrange acoustical units and orient directionally patterned units, if any, in manner shown on reflected ceiling plans.

3.2 EXAMINATION

A. Site Verification of Conditions:

1. Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities and dampness that would affect quality and execution of work.

2. Do not proceed with installation of ceiling system until unacceptable conditions are corrected.

3.3 CLEANING

A. Clean exposed surfaces of acoustical ceilings, trim, edge moldings and suspension members to comply with manufacturer’s instructions for cleaning.

B. Touch up any minor finish damage.

C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.4 PROTECTION

A. Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION 095

SECTION 09900 - PAINTING

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Scope: Work under this Section shall include all materials and installation necessary to provide Painting including: exposed exterior items and surfaces, exposed interior items and surfaces, surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections as shown and detailed on the Drawings and specified herein.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and ironwork, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finishedcomponents:

a. Architectural woodwork and casework b. Acoustical wall panels
c. Metal toilet enclosures d. Metal lockers
e. Unit kitchens

f. Elevator entrance doors and frames g. Elevator equipment
h. Finished mechanical and electrical equipment

i. Light fixtures

j. Distribution cabinets

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spacesb. Furred areas

c. Ceiling plenums d. Utility tunnels
e. Pipe spaces f. Duct shafts
g. Elevator shafts

3. Finished metal surfaces include the following:

a. Anodized aluminum b. Stainless steel
c. Chromium plate d. Copper
e. Bronze and brass

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators b. Linkages
c. Sensing devices

d. Motor and fan shafts

5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 2 Section "Hot-Mix Asphalt Paving" for traffic-markingpaint.

2. Division 2 Section "Portland Cement Concrete Paving" for traffic-marking paint.

3. Division 5 Section "Structural Steel" for shop priming structural steel.

4. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.

5. Division 6 Section "Exterior Architectural Woodwork" for shop priming exterior architectural woodwork.

6. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.

7. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.

8. Division 8 Section "Wood Windows" for shop priming unclad wood windows.

9. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board.

10.
Division 9 Section "Special Coatings" for industrial paints and maintenance and special coatings.

11. Division 9 Section "Multicolored Interior Coatings" for spray-applied multicolored coatings.

12. Division 9 Section "Exterior Wood Stains" for exterior wood stains.

13. Division 9 Section "Wall Coverings" for substrate sealer under wall coverings.

14. Divisions 15 and 16: Painting of mechanical and electrical work is specified in Divisions 15 and 16, respectively.

15. Alternates: Refer to Division 1 Section "Alternates" for description of Work in this Section affected by alternates.

1.2 DEFINITIONS
A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 10 when measured at an 85º meter.

2. Eggshell refers to low-sheen finish with a gloss range between 10 to 15 when measured at a 60º meter.

3. Satin refers to low-sheen finish with a gloss range between 30 to 35 when measured at a 60º meter.

4. Semi-gloss refers to medium-sheen finish with a gloss range between 50 to 55 when measured at a 60º meter.

5. Full gloss refers to high-sheen finish with a gloss range more than 75 when measured at a 60º meter.

1.3 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Samples for each color selection verification; of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

2. Provide a list of materials and applications for each coat of each sample.
Identify the manufacturer base paint information intended for each paint color. Label each sample with same identification number, manufacturer color name/number as listed in the finish schedule.

3. Submit Samples: 8-½” x 11" brush-outs for the Architect's review for each color and texture specified.

C. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats unless specified otherwise.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Duplicate finish of approved prepared samples.

1. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.

a. Wall Surfaces: Provide samples on at least 100 sq. ft. of wall surface.

b. Small Areas and Items: The Architect will designate an item or area as required.

2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.

a. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be determined by University's Representative.

D. Contractor shall notify the University’s Representative prior to the application of each coat of primer and paint to verifycolor and coating system.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material

2. Product description (generic classification or binder type)

3. Manufacturer's stock number and date of manufacture

4. Contents by volume, for pigment and vehicle constituents

5. Thinning instructions

6. Application instructions

7. Color name and number

8. VOC content

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45ºF. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50º and 90ºF.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45º and 95ºF.

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or at temperatures less than 5ºF above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART II - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.

B. Products: Provide one of the products identified in the paint schedule for the base paint. Actual paint colors may be specified from other manufacturer. Add formulated colorants as required to base paint to achieve color specified.

C. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:

1. Kelly Moore Paints (KM)

2. Sherwin-Williams Co. (S-W)

3. Or equal.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions under "Substitutions" in Section 01610 Product Requirements.

PART III - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting. Art and signage will be removed by the University. Notify the University’s representative well in advance of the intended removal date.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved. Notify University's representative to reinstall items the University removed.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.

b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

c. Clean concrete floors to be painted with a 5% solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum beforepainting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer.

After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

b. Prime, stain, or seal wood to be painted immediately on delivery.
Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.

c. When transparent finish is required, backprime with spar varnish.

d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.

e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.

b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.

10. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer on metal surfaces that have been shop primed and touchup painted.

3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, thefollowing:

1. Piping, pipe hangers, and supports.

2. Heat exchangers.

3. Tanks.

4. Ductwork.

5. Insulation.

6. Motors and mechanical equipment.

7. Accessory items.

G. Electrical items to be painted include, but are not limited to, the following:

1. Conduit and fittings.

2. Switchgear.

3. Panelboards.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surfaceimperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. The University reserves the right engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.

1. The University may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 INTERIOR PAINT SCHEDULEA. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Flat Acrylic Finish: 2 finish coats over a primer.

a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore Paints (KM) 971 Acry-Plex PVA Primer

2) Sherwin-Williams Co. (S-W) Preprite ProMar 200 Latex Wall
Primer, B28W200

3) Or equal.

b. First and Second Coats: Flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore, (KM) 550 Premium Flat

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Flat, B30W200 series

3) ICI Paints 1210 Ultra-Hide Acrylic Flat

2. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore, (KM) 971 PVA Primer

2) Sherwin-Williams Co. (S-W) Preprite ProMar 200 Latex Wall
Primer, B28W200

3) ICI Paints 1030 Ultra-Hide PUA

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

1) Kelly Moore (KM) 1510 Premium Eggshell Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Egshel, B20W200 series

3. Semi-gloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 971 PVA Primer

2) Sherwin-Williams Co. (S-W) Preprite ProMar 200 Latex Wall
Primer, B28W200

3) Or equal.

b. First and Second Coats: Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

1) Kelly Moore (KM) 1650 Premium Semi-Gloss

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Semi-Gloss, B31W200 series

3) Or equal.

4. Semi-gloss, Alkyd-Enamel Finish: 2 finish coats over a primer.

a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 971 PVA Primer

2) Sherwin-Williams Co. (S-W) Preprite ProMar Interior Latex Wall
Primer, B28W200

3) Or equal.

b. First and Second Coats: Odorless, semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss, A40 series

3) Or equal.

5. Full-Gloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 971 PVA Primer

2) Sherwin-Williams Co. (S-W) Preprite ProMar 200 Latex Wall
Primer, B28W200

3) Or equal.

b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.064 mm).

1) Kelly Moore (KM) 1680 Dura-Poxy Gloss Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Interior Latex Gloss, B21W200 series

3) Or equal.

6. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a primer.

a. Primer: Alkyd- or latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 971 PVA Primer

2) Sherwin-Williams Co. (S-W) Preprite ProMar 200 Latex Wall
Primer, B28W200

3) Or equal.

b. First and Second Coats: Odorless, full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore (KM) 1980 Professional Gloss Enamel

2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54Z-400 series

3) Or equal.

B. Woodwork and Hardboard: Provide the following paint finish systems over new, interior wood surfaces:

1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Alkyd- or acrylic-latex-based, interior wood primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.

1) Kelly Moore (KM) 975 Acry-Plex Enamel Undercoat

2) Sherwin-Williams Co. (S-W) Preprite Wall & Wood Primer, B49WZ2

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

1) Kelly Moore (KM) 1510 Premium Eggshell Enamel

2) Sherwin-Williams Co. (S-W) ProMar Latex Egshel, B20W200 series

3) Or equal.

2. Semi-gloss, Acrylic-Enamel Finish: 2 finish coats over a wood undercoater.

a. Undercoat: Alkyd or acrylic-latex-based, interior wood undercoater, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 975 Acry-Plex Enamel Undercoat

2) Sherwin-Williams Co. (S-W) Preprite Wall & Wood Primer, B49WZ2

3) Or equal.

b. First and Second Coats: Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

1) Kelly Moore 1650 Premium Semi-Gloss

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Semi-Gloss, B31W200 series

3) Or equal.

3. Semi-gloss, Alkyd-Enamel Finish: 2 finish coats over a primer.

a. Primer: Alkyd or latex-based, interior enamel undercoater applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 975 Acry-Plex Enamel Undercoat

2) Sherwin-Williams Co. (S-W) Preprite Wall & Wood Primer, B49WZ2

3) Or equal.

b. First and Second Coats: Odorless, semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss, A40 series

3) Or equal.

4. Full-Gloss, Acrylic-Enamel Finish: 2 finish coats over a wood undercoater.

a. Undercoat: Alkyd- or acrylic-latex-based, interior wood undercoater, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.1 mils.

1) Kelly Moore (KM) 975 Acry-Plex Enamel Undercoat

2) Sherwin-Williams Co. (S-W) Preprite Wall & Wood Primer, B49WZ2

3) Or equal.

b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore (KM) 1980 Professional Gloss Enamel

2) Sherwin-Williams Co. (S-W) ProClassic Waterborne Gloss
Enamel, B21 series

3) Or equal.

5. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a wood undercoater.

a. Undercoat: Alkyd, interior enamel undercoater applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 975 Acry-Plex Enamel Undercoat

2) Sherwin-Williams Co. (S-W) Preprite Wall & Wood Primer, B49WZ2

3) Or equal.

b. 11.First and Second Coats: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils (0.061 mm).

1) Kelly Moore (KM) 1980 Professional Gloss Enamel

2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54Z-400 series

3) Or equal.

C. Stained Woodwork: Provide the following stained finishes over new, interior woodwork:

1. Alkyd-Based, Satin-Varnish Finish: 2 finish coats of an alkyd-based, clear-satin varnish over a sealer coat and an alkyd-based, interior wood stain. Wipe wood filler before applying stain.

a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.

1) Kelly Moore (KM) none available

2) Sherwin-Williams Co. (S-W) None Available

3) Or equal.

b. Stain Coat: Alkyd-based, interior wood stain applied at spreading rate recommended by the manufacturer.

1) Old Masters Alkyd Wiping Stain

2) Sherwin-Williams Co. (S-W) Wood Classics Interior Oil Stain, A48 series

3) Or equal.

c. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.

1) Old Masters Sanding Sealer

2) Sherwin-Williams Co. (S-W) Wood Classics Fast Dry Sanding
Sealer, B26V43

3) Or equal.

d. First and Second Finish Coats: Alkyd-based or polyurethane varnish, as recommended by the manufacturer, applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Polyurethane

2) Sherwin-Williams Co. (S-W) Wood Classics Fast Dry Oil Varnish, A66-300 series

3) Or equal.

2. Waterborne, Satin-Varnish Finish: 2 finish coats of a waterborne, clear-satin varnish over a sealer coat and a waterborne, interior wood stain. Wipe wood filler before applying stain.

a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.

1) Old Masters Wood Grain Filler

2) Sherwin-Williams Co. (S-W) None Available

3) Or equal.

b. Stain Coat: Waterborne, interior wood stain applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Wood Stain

2) Sherwin-Williams Co. (S-W) None Available

3) Or equal.

c. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Sanding Sealer

2) Sherwin-Williams Co. (S-W) Wood Classics
Waterborne Polyurethane Varnish, A68 series

3) Or equal.

d. First and Second Finish Coats: Waterborne, varnish finish applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Polyurethane

2) Sherwin-Williams Co. (S-W) Wood Classics
Waterborne Polyurethane Varnish, A68 series

3) Or equal.

3. Water-Based, Full-Gloss, Varnish Finish: 2 finish coats of a waterborne, clear, full-gloss varnish over a sealer coat and a interior wood stain. Wipe filler before applying stain.

a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Filler

2) Sherwin-Williams Co. (S-W) None Available

3) Or equal.

b. Stain Coat: Interior wood stain applied at spreading rate recommended by the manufacturer.

1) Old Masters Alkyd Wiping Stain

2) Sherwin-Williams Co. (S-W) Wood Classics Interior Oil Stain, A48 series

3) Or equal.

c. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Sanding Sealer

2) Sherwin-Williams Co. (S-W) Wood Classics Waterborne Polyurethane Varnish A68 series

3) Or equal.

d. First and Second Finish Coats: Waterborne finish applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Polyurethane

2) Sherwin-Williams Co. (S-W) Wood Classics
Waterborne Polyurethane Varnish, A68 series

3) Or equal.

4. Alkyd-Based Stain, Wax-Polished Finish: 3 finish coats of paste wax over a sealer coat and an alkyd-based, interior wood stain.

a. Stain Coat: Alkyd-based, interior wood stain applied at spreading rate recommended by the manufacturer.

1) Old Masters Alkyd Wiping Stain

2) Sherwin-Williams Co. (S-W) Wood Classics Interior Oil Stain, A48 series

3) Or equal.

b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Sanding Sealer

2) Sherwin-Williams Co. (S-W) Wood Classics Fast Dry Sanding
Sealer, B26V43

3) Or equal.

c. Second, Third, and Fourth Coats: Paste wax as recommended by the manufacturer.

D. Natural-Finish Woodwork: Provide the following natural finishes over new, interior woodwork:

1. Alkyd-Based, Satin-Varnish Finish: 2 finish coats of an alkyd-based, clear-satin varnish over a sanding sealer. Provide wood filler on open-grain wood before applying first varnish coat.

a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.

1) Old Masters Wood Grain Filler

2) Sherwin-Williams Co. (S-W) Natural Wood Filler,D70T1

3) Or equal.b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Sanding Sealer

2) Sherwin-Williams Co. (S-W) Wood Classics Fast Dry Sanding
Sealer, B26V43

3) Or equal.

c. First and Second Finish Coats: Alkyd-based or polyurethane varnish, as recommended by the manufacturer, applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Polyurethane

2) Sherwin-Williams Co. (S-W) Wood Classics Fast Dry Oil Varnish, A66-300 series

3) Or equal.

2. Waterborne, Satin-Varnish Finish: 2 finish coats of a waterborne, clear- satin varnish over a sanding sealer. Wipe wood filler before applying stain.

a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.

1) Old Masters Wood Grain Filler

2) Sherwin-Williams Co. (S-W) None Available

3) Or equal.

b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Sanding Sealer

2) Sherwin-Williams Co. (S-W) Wood Classics
Waterborne Polyurethane Varnish, A68 series

3) Or equal.

c. First and Second Finish Coats: Waterborne, varnish finish applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Polyurethane

2) Sherwin-Williams Co. (S-W) Wood Classics
Waterborne Polyurethane Varnish, A68 series

3) Or equal.

3. Water-Based, Full-Gloss, Varnish Finish: 2 finish coats of a waterborne, clear, full-gloss varnish over a sealer coat. Wipe filler before applying stain.

a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.

1) Old Masters Wood Grain Filler

2) Sherwin-Williams Co. (S-W) None Available

3) Or equal.

b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Sanding Sealer

2) Sherwin-Williams Co. (S-W) Wood Classics
Waterborne Polyurethane Varnish, A68 series

3) Or equal.

c. First and Second Finish Coats: Waterborne finish applied at spreading rate recommended by the manufacturer.

1) Old Masters Water Based Polyurethane

2) Sherwin-Williams Co. (S-W) Wood Classics
Waterborne Polyurethane Varnish, A68 series

3) Or equal.

4. Wax-Polished Finish: 3 finish coats of paste wax over a sanding-sealer firstcoat. a. Sealer Coat: Clear sanding sealer applied at spreading
rate recommended by the manufacturer.

1) Old Masters Water Based Sanding Sealer

2) Sherwin-Williams Co. (S-W) Wood Classics Fast Dry Sanding
Sealer, B26V43

3) Or equal.

b. Second, Third, and Fourth Coats: Paste wax as recommended by the manufacturer.

E. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Flat Acrylic Finish: 2 finish coats over a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Rust Oleum CV740

2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series

3) Or equal.

b. First and Second Coats: Flat, acrylic-latex, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore (KM) 550 Premium Flat

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Flat, B30W200 series

3) Or equal.

2. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Rust Oleum CV740

2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series

3) Or equal.

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

1) Kelly Moore (KM) 1510 Premium Eggshell Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Egshel, B20W200 series

3) Or equal.

3. Semi-gloss, Acrylic-Enamel Finish: One finish coat over an enamel undercoater and a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Rust Oleum CV740

2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series

3) Or equal.

b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, acrylic- latex, interior enamel, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.

1) Kelly Moore (KM) 1650 Premium Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Semi-Gloss, B31W200 series

3) Or equal.

c. Finish Coat: Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.

1) Kelly Moore (KM) 1650 Premium Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Semi-Gloss, B31W200 series

3) Or equal.

4. Semi-gloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoater and a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate

recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Rust Oleum CV740

2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series

3) Or equal.

b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss, A40 series

3) Or equal.

c. Finish Coat: Odorless, semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss, A40 series

3) Or equal.

5. Full-Gloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Rust Oleum CV740

2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series

3) Or equal.

b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore (KM) 1680 Dura-Proxy Gloss Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Gloss, B21W200 series

3) Or equal.

6. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over an enamel undercoater and a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Rust Oleum CV740

2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series

3) Or equal.

b. Undercoat: Alkyd, interior enamel undercoat or full-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1980 Professional Gloss Enamel

2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54Z-400 series

3) Or equal.

c. Finish Coat: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1980 Professional Gloss Enamel

2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54Z-400 series

3) Or equal.

F. Zinc-Coated Metal: Provide the following finish systems over zinc-coatedmetal:

1. Flat Acrylic Finish: 2 finish coats over a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish

2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30

3) Or equal.

b. First and Second Coats: Flat, acrylic-latex, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore (KM) 550 Premium Flat

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Flat, B30W200 series

3) Or equal.

2. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than
1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish

2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30

3) Or equal.

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

1) Kelly Moore (KM) 1510 Premium Eggshell Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Egshel, B20W200 series

3) Or equal.

3. Semi-gloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish

2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30

3) Or equal.

b. First and Second Coats: Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

1) Kelly Moore (KM) 1650 Premium Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Semi-Gloss, B31W200 series

3) Or equal.

4. Semi-gloss, Alkyd-Enamel Finish: One finish coat over an undercoat and a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish

2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30

3) Or equal.

b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss, A40 series

3) Or equal.

c. Finish Coat: Odorless, semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss A40 series

3) Or equal.

5. Full-Gloss, Acrylic-Enamel Finish: 2 coats over a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish

2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30 series

3) Or equal.

b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore (KM) 1680 Dura-Proxy Gloss Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Gloss, B21W200 series

3) Or equal.

6. Full-Gloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoater and a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish

2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30

3) Or equal.

b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54-Z400 series

3) Or equal.

c. Finish Coat: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1980 Professional Gloss Enamel

2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54-Z400 series

3) Or equal.

G. Cotton or Canvas Covering over Insulation: Provide the following finish system on cotton or canvas insulation covering:

1. Flat Acrylic Finish: 2 finish coats. Add fungicidal agent to render fabric mildewproof.

a. First and Second Coats: Flat, latex-based, interior paint applied at spreading rate recommended by the manufacturer.

1) Kelly Moore (KM) 550 Premium Flat

2) Sherwin-Williams Co. (S-W) DTM Acrylic Primer Finish, B66W1

3) Or equal.

END OF SECTION 09900

Division 10 – Specialties

SECTION 10 21 00 - TOILET PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Toilet Partitions:
1. Textured Powder Shield Dur-A-Tex Toilet Partitions.
2. Powder Shield Toilet Partitions.
3. Stainless Steel Partitions.
4. Polly (HDPE) Partitions.
5. Plastic Laminate Toilet Partitions.
6. Phenolic Core Toilet Partitions.
7. Solid Phenolic, Color Thru, Toilet Partitions.
8. Solitude - Phenolic Core.

B. Urinal Screens:
1. Wall Hung.
2. Post Supported.
3. Pilaster Supported, "FT".
4. "T" Screen Flange Mounted.
5. "V" Screen Wedge Type.

C. Shower and Privacy Screens:
1. Pilaster Supported.
2. Post Supported.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry. B. Section 05 50 00 - Metal Fabrications.
C. Section 10 28 00 - Toilet, Bath and Laundry Accessories.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
1. ANSI/ICC A117.1 - Accessible and Usable Buildings and Facilities.

B. ASTM International:
1. ASTM A591 - Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight (Mass) Applications.
2. ASTM A653 - Steel Sheet, zinc-coated (galvanized) or zinc iron alloy-coated, galvanealed by hot dip process.

3. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's product data for materials, fabrication, and installation including catalog cuts of anchors, hardware, fastenings, and accessories, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings:
1. Provide shop drawings for fabrication and installation of compartment assemblies that are not fully described by architectural drawings.
2. Provide template layouts and installation instructions for anchorage devices built into other work.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company regularly engaged in manufacture of products specified in this section, and whose products have been in satisfactory use under similar service conditions for not less than 5 years.

B. Performance Requirements:
1. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with the ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials:
2. Smoke Developed Index: Not to exceed 450.
3. Flame Spread Index: Not to exceed 25.

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. Rebuild mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 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. Manufacturers storage and handling instruction shall be reviewed and maintained.

B. Field Measurements: Take field measurements prior to component fabrication to ensure proper fitting of work.

1.8 WARRANTY

A. Warranty: Manufacturer's standard form to repair or replace toilet compartment components against defects in material and workmanship, at no cost to owner for the specified warranty period. Provide warranty to owner after completion of installation.
1. Warranty Period Panels, Doors, and Pilasters in Powder Shield (Baked Enamel) and all standard hardware: Four Years.
2. Warranty Period Panels, Doors, and Pilasters in Stainless Steel and all standard hardware: Six Years.
3. Warranty Period Panels, Doors, and Pilasters in Plastic Laminate and all standard hardware: One Year.
4. Warranty Period Panels, Doors, and Pilasters in Dur-A-Tex: Five Years.
5. Warranty Period Panels, Doors, and Pilasters in Solid Phenolic Material: Fifteen Years.
6. Warranty Period Panels, Doors, and Pilasters in Solid Phenolic Color-thru Material: Fifteen Years.
7. Warranty Period Panels, Doors, and Pilasters in Polly SPR, Solid Plastic or HDPE: Fifteen Years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Metpar Corp.

C. Requests for substitutions will be considered in accordance with provisions of Section 01

60 00.

2.2 COMPARTMENTS AND SCREENS - GENERAL

A. General: Doors, panels, screens, and pilasters assembled into complete compartment system, with cutouts and drilled holes to receive hardware as indicated; processed and fabricated in a craftsman like manner; complying with ANSI/ICC A117.1, Americans with Disabilities Act (ADA).

2.3 TEXTURED POWDER SHIELD DUR-A-TEX TOILET PARTITIONS

A. Textured Powder Shield Dur-A-Tex Toilet Partitions: Floor mounted overhead braced "Corinthian" FP-500:
1. Compartment Depth and Width: As indicated on Drawings.
2. Door Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Overhead Bracing: Continuous extruded aluminum, anti-grip profile with clear anodized finish, with returns and anchors.
5. Pilaster Mountings: Leveling bolts threaded to bottom pilaster support bracket:
a. Floor mounting consists of two angles attaching to floor by No. 12 x 2-1/2 inch (63.5 mm) screws and shields.
b. Mountings concealed with a 4 inch (102 mm) high type 304 stainless steel plinth.

B. Textured Powder Shield Dur-A-Tex Toilet Partitions: Floor mounted "Luxor" FT-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Door Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilasters Mountings:
a. Mounting Channels: 12-gauge steel electrically welded to the pilaster face sheets.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. 4 inch (102 mm) high type 304 stainless steel plinth.

C. Textured Powder Shield Dur-A-Tex Toilet Partitions: Ceiling Hung "Forum" CH-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Door Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilasters Mountings:
a. Mounting Channels: 12-gauge steel electrically welded to the pilaster face sheets.

b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. 4 inch (102 mm) high type 304 stainless steel plinth.

D. Textured Powder Shield Dur-A-Tex Toilet Partitions: Floor-to-Ceiling F/C-FP/FP:
1. Compartment Depth and Width: As indicated on Drawings.
2. Door Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings: Leveling bolts threaded to bottom pilaster support bracket:
a. Floor mounting consists of two angles attaching to floor by No. 12 x 2-1/2 inch (63.5 mm) screws and shields.
b. Mountings concealed with a 4 inch (102 mm) high type 304 stainless steel plinth.

E. General:
1. Doors, Panels, and Pilasters: Bonderized, galvannealed steel.
a. Two face sheets of textured steel embossed with a 5SM pattern cemented under pressure to a honeycomb core.
b. Partition Edges: Roll formed 20-gauge interlocking molding.
c. Corners: Finished with preformed, painted Type 304 stainless steel reinforcements.
d. Doors, Panels, and Screens: 1 inch (25 mm) thick with 22 gauge face sheets. e. Pilasters: 1-1/4 inch (32 mm) thick with 22 gauge face sheets.
f. Finish: Two-step process of epoxy hybrid powder and graffiti-resistant clear coat applied electrostatically.
g. Color: Platinum 715.
h. Color: Grey Dawn 700. i. Color: Nickel Silver 304. j. Color: Almond 300.
k. Color: Sahara Beige 450. l. Color: Desert Tan 500.
m. Color: French Grey 710.
n. Color: Gunmetal Grey 750. o. Color: Black 021.
p. Color: Cool Sand 400. q. Color: Deep Coral 640. r. Color: Terra Cotta 680. s. Color: Burgundy 675.
t. Color: Red 650.
u. Color: Navy Blue 870.
v. Color: Hunter Green 950.
w. Color: To be selected by Architect from Manufacturer's full range.
x. Color: To be selected by Architect from Manufacturer's standard range.
2. Door Hardware: Includes hinges, strike and keeper, door pull, coat hook and bumper, spring loaded no-rise cam, and concealed ADA approved slide latch with external "in-use" indicator.
a. Finish: Die-cast chrome plated steel. b. Finish: Stainless steel.
c. Finish: Stainless steel continuous multicam hinge.
3. Fastener Finish: Die-cast chrome plated steel.
4. Fastener Finish: Stainless steel.
5. Connecting Brackets:

a. Wall Fittings: Minimum of two at each connection.
b. Stirrup and "U" Shaped Brackets: Die-cast chrome plated steel finish. c. Stirrup and "U" Shaped Brackets: Stainless steel finish.
d. Continuous Brackets: Aluminum finish.
e. Continuous Brackets: Stainless Steel finish.
6. Privacy strip: Continuous anodized aluminum extrusion.
7. Height:
a. Standard Height: 58 inches (1473 mm), 12 inches (310 mm) above the finished floor.
b. Dorian Height: 64 inches (1626 mm), 6 inches (152 mm) above the finished floor.
c. Dorian Max Height: 72 inches (1829), 6 inches (152 mm) above the finished floor.

2.4 POWDER SHIELD PARTITIONS

A. Powder Shield Toilet Partitions: Floor Mounted Overhead Braced "Corinthian" FP-500:
1. Compartment Depth and Width: As indicated on Drawings.
2. Door Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster:
a. Width: As required to fit space; maximum 24 inches (610 mm). b. Face Sheet: 20 gauge.
4. Overhead Bracing: Continuous extruded aluminum, anti-grip profile with clear anodized finish, with returns and anchors.
5. Pilaster Mountings: Leveling bolts threaded to bottom pilaster support bracket:
a. Floor mounting consists of two angles attaching to floor by No. 12 x 2-1/2 inch (63.5 mm) screws and shields.
b. Mountings concealed with a 4 inch (102 mm) high type 304 stainless steel plinth.

B. Powder Shield Toilet Partitions: Floor mounted "Luxor" FT-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Door Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster:
a. Width: As required to fit space; maximum 24 inches (610 mm). b. Face Sheet: 18 gauge.
4. Pilaster Mountings:
a. Mounting Channels: 12-gauge steel electrically welded to the pilaster face sheets.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. 4 inch (102 mm) high type 304 stainless steel plinth.

C. Powder Shield Toilet Partitions: Ceiling Hung "Forum" CH-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Door Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster:

a. Width: As required to fit space; maximum 24 inches (610 mm). b. Face Sheet: 18 gauge.
4. Pilaster Mountings:
a. Mounting Channels: 12-gauge steel electrically welded to the pilaster face sheets.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. 4 inch (102 mm) high type 304 stainless steel plinth.

D. Powder Shield Toilet Partitions: Floor-to-Ceiling F/C-FP/FP:
1. Compartment Depth and Width: As indicated on Drawings.
2. Door Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster:
a. Width: As required to fit space; maximum 24 inches (610 mm). b. Face Sheet: 20 gauge.
4. Pilaster Mountings: Leveling bolts threaded to bottom pilaster support bracket:
a. Floor mounting consists of two angles attaching to floor by No. 12 x 2-1/2 inch (63.5 mm) screws and shields.
b. Mountings concealed with a 4 inch (102 mm) high type 304 stainless steel plinth.

E. General:
1. Doors, Panels, and Pilasters: Bonderized, galvanized steel.
a. Two face sheets of bonderized, galvanized steel formed and cemented under pressure to a honeycomb core.
b. Partition Edges: Roll formed 20-gauge interlocking molding.
c. Corners: Finished with preformed, painted Type 304 stainless steel reinforcements.
d. Doors, Panels, and Screens: 1 inch (25 mm) thick with 20 gauge face sheets. e. Pilasters: 1-1/4 inch (32 mm) thick.
f. Finish: Multiple coats of epoxy hybrid powder applied electrostatically. g. Color: Platinum 715.
h. Color: Grey Dawn 700. i. Color: Nickel Silver 304. j. Color: Almond 300.
k. Color: Sahara Beige 450. l. Color: Desert Tan 500.
m. Color: White 149.
n. Color: French Grey 710.
o. Color: Gunmetal Grey 750. p. Color: Black 021.
q. Color: Silver Lava 997. r. Color: Cool Sand 400.
s. Color: Deep Coral 640. t. Color: Terra Cotta 680. u. Color: Burgundy 675.
v. Color: Red 650.
w. Color: Navy Blue 870.
x. Color: Hunter Green 950. y. Custom Color: .
z. Color: To be selected by Architect from Manufacturer's full range.
aa. Color: To be selected by Architect from Manufacturer's standard range.

2. Door Hardware: Includes hinges, strike and keeper, door pull, coat hook and bumper, spring loaded no-rise cam, and concealed ADA approved slide latch with external "in-use" indicator.
a. Finish: Die-cast chrome plated steel. b. Finish: Stainless steel.
c. Finish: Stainless steel continuous multicam hinge.
3. Fastener Finish: Chrome plated steel.
4. Fastener Finish: Stainless steel.
5. Connecting Brackets: Minimum of two at each connection.
a. Stirrup and "U" Shaped Brackets: Die-cast chrome plated steel finish. b. Stirrup and "U" Shaped Brackets: Stainless steel finish.
c. Continuous Brackets: Aluminum finish.
d. Continuous Brackets: Stainless Steel finish.
6. Privacy Strips: Continuous anodized aluminum extrusion.
7. Height:
a. Standard Height: 58 inches (1473 mm), 12 inches (310 mm) above the finished floor.
b. Dorian Height: 64 inches (1626 mm), 6 inches (152 mm) above the finished floor.
c. Dorian Max Height: 72 inches (1829 mm), 6 inches (152 mm) above the finished floor.

2.5 STAINLESS STEEL PARTITIONS

A. Stainless Steel Toilet Partitions: Floor Mounted Overhead Braced "Corinthian" FP-500:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors:
a. Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes. b. Face Sheet: 22 gauge.
3. Pilaster:
a. Width: As required to fit space; maximum 24 inches (610 mm). b. Face Sheet: 20 gauge.
4. Panel Face Sheets: 20 gauge.
5. Overhead Bracing: Continuous extruded aluminum, antigrip profile with clear anodized finish, with returns and anchors.
6. Pilaster Mountings: Leveling bolts threaded to bottom pilaster support bracket:
a. Floor mounting consists of two angles attaching to floor by No. 12 x 2-1/2 inch (63.5 mm) screws and shields.
b. Mountings concealed with a 4 inch (102 mm) high type 304 stainless steel plinth.

B. Stainless Steel Toilet Partitions: Floor mounted "Luxor" FT-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors:
a. Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes. b. Face Sheet: 22 gauge.
3. Pilaster:
a. Width: As required to fit space; maximum 24 inches (610 mm). b. Face Sheet: 18 gauge.
4. Panel Face Sheets: 20 gauge.

5. Pilaster Mountings:
a. Mounting Channels: 12-gauge steel electrically welded to the pilaster face sheets.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. 4 inch (102 mm) high type 304 stainless steel plinth.

C. Stainless Steel Toilet Partitions: Ceiling Hung "Forum" CH-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors:
a. Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes. b. Face Sheet: 22 gauge.
3. Pilaster:
a. Width: As required to fit space; maximum 24 inches (610 mm). b. Face Sheet: 18 gauge.
4. Panel Face Sheets: 20 gauge.
5. Pilaster Mountings:
a. Mounting Channels: 12-gauge steel electrically welded to the pilaster face sheets.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. 4 inch (102 mm) high type 304 stainless steel plinth.

D. Stainless Steel Toilet Partitions: Floor-to-Ceiling F/C-FP/FP:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors:
a. Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes. b. Face Sheet: 22 gauge.
3. Pilaster:
a. Width: As required to fit space; maximum 24 inches (610 mm). b. Face Sheet: 20 gauge.
4. Panel Face Sheets: 20 gauge.
5. Pilaster Mountings: Leveling bolts threaded to bottom pilaster support bracket:
a. Floor mounting consists of two angles attaching to floor by No. 12 x 2-1/2 inch (63.5 mm) screws and shields.
b. Mountings concealed with a 4 inch (102 mm) high type 304 stainless steel plinth.

E. General:
1. Doors, Panels, and Pilasters: Stainless steel.
a. Two face sheets of stainless steel formed and cemented under pressure to core.
1) Core: Honeycomb.
2) Core: 7-ply Exterior-grade Plywood.
b. Partition Edges: Roll formed 20-gauge stainless steel interlocking molding. c. Corners: Finished with preformed stainless steel reinforcements.
d. Doors, Panels, and Screens: 1 inch (25 mm) thick. e. Pilasters: 1-1/4 inch (32 mm) thick.
f. Finish: No. 4 finish.
g. Finish: 2B Leather-grain.

h. Finish: 5SM Diamond Pattern.
2. Door Hardware: Includes hinges, strike and keeper, door pull, coat hook and bumper, spring loaded no-rise cam, and concealed ADA approved slide latch with external "in-use" indicator.
a. Finish: Die-cast chrome plated steel. b. Finish: Stainless steel.
c. Finish: Stainless steel continuous multicam hinge.
3. Fastener Finish: Chrome plated steel.

4. Fastener Finish: Stainless steel.
5. Connecting Brackets: Stirrup and "U" shaped brackets.
a. Wall Fittings: Minimum of two at each connection.
b. Stirrup and "U" Shaped Brackets: Die-cast chrome plated steel finish. c. Stirrup and "U" Shaped Brackets: Stainless steel finish.
d. Continuous Brackets: Aluminum finish.
e. Continuous Brackets: Stainless Steel finish.
6. Privacy Strips: Continuous anodized aluminum extrusion.
7. Height:
a. Standard Height: 58 inches (1473 mm), 12 inches (310 mm) above the finished floor.
b. Dorian Height: 64 inches (1626 mm), 6 inches (152 mm) above the finished floor.
c. Dorian Max Height: 72 inches (1829 mm), 6 inches (152 mm) above the finished floor.

2.6 HDPE TOILET PARTITIONS

A. Polly SPR (HDPE) Toilet Partitions: Floor Mounted Overhead Braced "Corinthian" FP-500:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Overhead Bracing: Continuous extruded aluminum, antigrip profile with clear anodized finish, with integral curtain track profile.
5. Pilaster Mountings:
a. 14 gauge stainless steel angle forks mounted to floor with No. 12 x 1-1/2 inch (38 mm) stainless steel screws and plastic anchors.
b. Leveling Bolt: 1/4 inch (6 mm) x 3 inch (76 mm) hex head.
c. Concealed with a 3 inch (76 mm) 20 gauge stainless steel floor shoe.

B. Polly SPR (HDPE) Toilet Partitions: Floor mounted "Luxor" FT-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. Anchor Bar: 3/8 inch (9.5 mm) steel anchor bar mechanism.

b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. Concealed with a 3 inch (76 mm) 20 gauge stainless steel floor shoe.

C. Polly SPR (HDPE) Toilet Partitions: Ceiling Hung "Forum" CH-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. Anchor Bar: 3/8 inch (9.5 mm) steel anchor bar mechanism.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. Concealed with a 3 inch (76 mm) 20 gauge stainless steel floor shoe.

D. Polly SPR (HDPE) Toilet Partitions: Floor-to-Ceiling F/C-FP/FP:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. 14 gauge stainless steel angle forks mounted to floor with No. 12 x 1-1/2 inch (38 mm) stainless steel screws and plastic anchors.
b. Leveling Bolt: 1/4 inch (6 mm) x 3 inch (76 mm) hex head.
c. Concealed with a 3 inch (76 mm) 20 gauge stainless steel floor shoe.

E. General:
1. Material: Solid Polymer Resin - Heavy Duty Polyethylene.
2. Doors and Panels:
a. Thickness: 1 inch (25 mm).
1) Edge Radius: 1/4 inch (6 mm).
2) Corner Radius: 1/2 inch (13 mm).
b. Integrated aluminum heat sink at bottom.
3. Pilasters:
a. Thickness: 1 inch (25 mm).
1) Edge Radius: 1/4 inch (6 mm).
2) Corner Radius: 1/2 inch (13 mm).
4. Color: Cream SP-180.
5. Color: Almond #P-300.
6. Color: Coffee SP-240.
7. Color: Khaki SP-520.
8. Color: White Granite SP-138.
9. Color: Stone Granite SP-638.

10. Color: Platinum SP-630.
11. Color: Grey Granite SP-658.
12. Color: Pale Green SP-510.
13. Color: Evergreen SP-580.
14. Color: Violet Blue SP-780.
15. Color: Claret SP-460.
16. Color: Grey Dawn #P-700.
17. Color: Slate Grey SP-680.
18. Color: Galactica SP-928.
19. Color: Black SP-910.
20. Color: To be selected by Architect from Manufacturer's full range.
21. Door Hardware: Includes integral hinges with nylon cams, strike and keeper, slide latch, door pulls, and coat hooks as required.
a. Hinge: Aluminum wrap-around style.
b. Hinge: Stainless steel continuous multicam. c. Finish: Aluminum, bright polished finish.
d. Finish: Stainless steel.
22. Connecting Brackets: Full height.
a. Finish: Clear anodized aluminum. b. Finish: Stainless steel.
23. Privacy Edge: Rabbeted edge on strike side of door and pilaster and continuous hinge on hinge side.
24. Height:
a. Standard Height: 55 inches (1397 mm), 13-1/2 inches (343 mm) above the finished floor.
b. Dorian Height: 64 inches (1626 mm), 6 inches (152 mm) above the finished floor.
c. Dorian Max Height: 72 inches (1829 mm), 6 inches (152 mm) above the finished floor.

2.7 PLASTIC LAMINATE TOILET PARTITIONS

A. Plastic Laminate Toilet Partitions: Floor Mounted Overhead Braced "Corinthian" FP-500:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Overhead Bracing: Continuous extruded aluminum, antigrip profile with clear anodized finish.
5. Pilaster Mountings:
a. 16 gauge, hot-dipped galvanized channel fastened to bottom of pilaster. b. Concealed with a 3 inch (76 mm) high plinth.

B. Plastic Laminate Toilet Partitions: Floor mounted "Luxor" FT-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.

3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. Anchor Bar: 3/8 inch (9.5 mm) steel anchor bar mechanism.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. Concealed with a 3 inch (76 mm) high plinth.

C. Plastic Laminate Toilet Partitions: Ceiling Hung "Forum" CH-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. Anchor Bar: 3/8 inch (9.5 mm) steel anchor bar mechanism.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. Concealed with a 3 inch (76 mm) high plinth.

D. Plastic Laminate Toilet Partitions: Floor-to-Ceiling F/C-FP/FP:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. 16 gauge, hot-dipped galvanized channel fastened to bottom of pilaster. b. Concealed with a 3 inch (76 mm) high plinth.

E. General:
1. Material: High-pressure decorative laminate over particle board, NEMA approved.
2. Doors and Panels:
a. Thickness: 1 inch (25 mm).
b. Edge laminates applied before face laminates.
3. Pilasters:
a. Thickness: 1-1/4 inch (32 mm).
b. Edge laminates applied before face laminates.
4. Color: 920 Almond.
5. Color: 899 Desert Beige.
6. Color: 927 Folkstone.
7. Color: 961 Fog.
8. Color: 7708 Flax Gauze.
9. Color: 7022 Natural Canvas.
10. Color: 507 Folkstone Grafix.
11. Color: 515 Graphite Grafix.

12. Color: 3687 Autumn Indian Slate.
13. Color: 7018 Navy Grafix.
14. Color: 5882 Citadel Warp.
15. Color: 837 Graphite.
16. Color: 7197 Dover White.
17. Color: 9285 White Twill.
18. Color: 5488 Smokey Brown Pear.
19. Color: 507 Stone Grafix.
20. Color: 3505 Storm Solidz.
21. Color: 928 Mouse.
22. Color: 8844 Wheat Strand.
23. Color: 7735 Portico Marble.
24. Color: 8844 Aged Ash.
25. Color: 7265 Elemental Stone.
26. Color: 5883 Pecan Woodline.
27. Color: 6307 Burnt Strand.
28. Color: 851 Spectrum Blue.
29. Color: 7008 Acajou Mahogany.
30. Color: 758 Blossom Cherrywood.
31. Color: 5884 Chestnut Woodline.
32. Color: 8918 Blackened Steel.
33. Color: 1595 Black.
34. Color: 4942 Crisp Linen.
35. Color: Classic Linen.
36. Color: D92 Dove Grey.
37. Color: 4944 Casual Linen.
38. Color: D96 Shadow.
39. Color: 4878 Pewter Mesh.
40. Color: D91 Slate Grey.
41. Color: 4168 Grey Pampas.
42. Color: 4841 Desert Zephyer.
43. Color: 4843 Misted Zephyer.
44. Color: 4746 Woodlamia Brush.
45. Color: 4886 Pearl Soapstone.
46. Color: 4813 Nickel EV.
47. Color: 4874 Evening Tigris.
48. Color: 4651 Navy Legacy.
49. Color: 4779 Pewter Brush.
50. Color: 4879 Steel Mesh.
51. Color: 4885 Green Soapstone.
52. Color: 4882 Oiled Soapstone.
53. Color: 10776 Kensington Maple.
54. Color: 7986 Pasadena Oak.

55. Color: 7937 River Cherry.
56. Color: 7991 Neo Walnut.
57. Color: 7995 Sterling Ash.
58. Color: 7984 Mangalore Mango.
59. Custom Color: .
60. Color: To be selected by Architect from Manufacturer's full range.
61. Door Hardware: Includes 2 hinges with wrap around flanges, latch, stop and keeper, and coat hook.
a. Finish: Polished chrome plated steel. b. Finish: Stainless steel.
62. Connecting Brackets: 1-ear or 2-ear, minimum 2 per connection. a. Material: Chrome-plated Zamac.
b. Material: Stainless steel.
c. Material: Continuous manufactures standard Stainless Steel. d. Material: Continuous manufactures standard Aluminum.
63. Pilaster Core: Particle board, 45 pound density.
64. Pilaster Core: 11 gauge steel core in full height and width of pilasters.
65. Height:
a. Standard Height: 58 inches (1473 mm), 12 inches (310 mm) above the finished floor.
b. Dorian Height: 64 inches (1626 mm), 6 inches (152 mm) above the finished floor.
c. Dorian Max Height: 72 inches (1829 mm), 6 inches (152 mm) above the finished floor.

2.8 PHENOLIC CORE TOILET PARTITIONS

A. Phenolic Core Toilet Partitions: Floor Mounted Overhead Braced "Corinthian" FP-500:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Overhead Bracing: Continuous extruded aluminum, anti-grip profile with clear anodized finish.
5. Pilaster Mountings:
a. Type 304 stainless steel floor mounting clips.
b. Concealed with a 3 inch (76 mm) high plinth.

B. Phenolic Core Toilet Partitions: Floor mounted "Luxor" FT-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. Anchor Bar: 3/8 inch (9.5 mm) steel anchor bar mechanism.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.

c. Concealed with a 5 inch (127 mm) high plinth.

C. Phenolic Core Toilet Partitions: Ceiling Hung "Forum" CH-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. Anchor Bar: 3/8 inch (9.5 mm) steel anchor bar mechanism.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. Concealed with a 5 inch (127 mm) high plinth.

D. Phenolic Core Toilet Partitions: Floor-to-Ceiling F/C-FP/FP:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. Type 304 stainless steel floor mounting clips.
b. Concealed with a 3 inch (76 mm) high plinth.

E. General:
1. Material: Solid phenolic with melamine surface both sides produced with resin impregnated materials compressed at pressures exceeding 1000 psi at 256 degrees Fahrenheit, resulting in a solid, dense, water resistant product.
a. Fire Rating (ASTM E84, NFPA 255, and UL 723): Class A. b. Fire Rating (ASTM E84, NFPA 255, and UL 723): Class B.
2. Doors, Panels, and Pilasters:
a. Door Thickness: 3/4 inch (19 mm). b. Panel Thickness: 1/2 inch (13 mm). c. Pilaster Thickness: 3/4 inch (19 mm). d. Edge Color: Black.
e. Edge Color: Same as face color. f. All edges beveled and polished.
3. Color: 920 Almond.
4. Color: 927 Folkstone.
5. Color: 961 Fog.
6. Color: 912 Storm.
7. Color: 909 Black.
8. Color: 3687 Autumn Indian Slate.
9. Color: 7022 Natural Canvas.
10. Color: 692 Folkstone Celesta.
11. Color: 7018 Navy Grafix.
12. Color: 515 Graphite Grafix.
13. Color: 949 White.

14. Color: 6696 Carrara Bianco.
15. Color: 7708 Flax Gauze.
16. Color: 8831 Elemental Stone.
17. Color: 8830 Elemental Concrete.
18. Color: 899 Desert Beige.
19. Color: 7813 Cardboard Solidz.
20. Color: 7812 MDF Solidz.
21. Color: 7213 Earth Wash.
22. Color: 3518 Flint Crystall.
23. Color: 845 Spectrum Red.
24. Color: 7966 New Burgundy.
25. Color: 967 Hunter Green.
26. Color: 914 Marine Blue.
27. Color: 837 Graphite.
28. Color: 8907 Fox Teakwood.
29. Color: 9312 Planked Urban Oak.
30. Custom Color: .
31. Color: To be selected by Architect from Manufacturer's full range.
32. Door Hardware: Includes hinges, latch, stop and keeper, and coat hook. a. Finish: Stainless steel.
33. Connecting Brackets: 1-ear or 2-ear, 13 gauge stainless steel, minimum 2 per connection stirrup type.
a. Continuous Brackets manufacturers standard Aluminum.
b. Continuous Brackets manufacturers standard Stainless Steel.
34. Privacy Edge: Rabbeted edge on strike side of door and pilaster and continuous hinge on hinge side.
35. Height:
a. Standard Height: 58 inches (1473 mm), 12 inches (310 mm) above the finished floor.
b. Dorian Height: 64 inches (1626 mm), 6 inches (152 mm) above the finished floor.
c. Dorian Max Height: 72 inches (1829 mm), 6 inches (152 mm) above the finished floor.

2.9 SOLID PHENOLIC, COLOR THRU, TOILET PARTITIONS

A. Solid Phenolic Toilet Partitions: Floor Mounted Overhead Braced "Corinthian" FP-500:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Overhead Bracing: Continuous extruded aluminum, antigrip profile with clear anodized finish.
5. Pilaster Mountings:
a. Type 304 stainless steel floor mounting clips.
b. Concealed with a 3 inch (76 mm) high plinth.

B. Solid Phenolic Toilet Partitions: Floor mounted "Luxor" FT-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. Anchor Bar: 3/8 inch (9.5 mm) steel anchor bar mechanism.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. Concealed with a 5 inch (127 mm) high plinth.

C. Solid Phenolic Toilet Partitions: Ceiling Hung "Forum" CH-700:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. Anchor Bar: 3/8 inch (9.5 mm) steel anchor bar mechanism.
b. Fastening: 3/8 inch (9.5 mm) diameter studs, lock washers, nuts, and lead expansion shields.
c. Concealed with a 5 inch (127 mm) high plinth.

D. Solid Phenolic Toilet Partitions: Floor-to-Ceiling F/C-FP/FP:
1. Compartment Depth and Width: As indicated on Drawings.
2. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
3. Pilaster Width: As required to fit space; maximum 24 inches (610 mm).
4. Pilaster Mountings:
a. Type 304 stainless steel floor mounting clips.
b. Concealed with a 3 inch (76 mm) high plinth.

E. General:
1. Material: Solid phenolic with melamine surface both sides produces with resin impregnated materials compressed at pressures exceeding 1000 psi at 256 degrees Fahrenheit, resulting in a solid, dense, water resistant product. a. Fire Rating (ASTM E84, NFPA 255, and UL 723): Class A.
2. Doors, Panels, and Pilasters:
a. Door Thickness: 3/4 inch (19 mm). b. Panel Thickness: 1/2 inch (13 mm). c. Pilaster Thickness: 3/4 inch (19 mm). d. Edges: No visible lines, solid color.
e. All edges beveled and polished.
3. Color: D92 Dove Grey.
4. Color: 8203 Silver Oak Ply.

5. Color: 8212 Phantom Ecru.
6. Color: 4991 Pressed Linen.
7. Color: 4886 Pearl Soapstone.
8. Color: D30 Natural Almond.
9. Color: 8202 Light Oak Ply.
10. Color: 7999 Field Elm.
11. Color: 4990 Flax Linen.
12. Color: 4981 Calcatta Oro.
13. Color: D50 Khaki Brown.
14. Color: 7970 High Line.
15. Color: 7967 Park Elm.
16. Color: 4860 Silver Alchemy.
17. Color: 4887 Tan Soapstone.
18. Custom Color: .
19. Color: To be selected by Architect from Manufacturer's full range.
20. Door Hardware: Includes hinges, latch, stop and keeper, and coat hook. a. Finish: Stainless steel.
21. Connecting Brackets: 1-ear or 2-ear, 13 gauge stainless steel, minimum 2 per connection stirrup type.
a. Continuous Brackets manufacturers standard Aluminum.
b. Continuous Brackets manufacturers standard Stainless Steel.
22. Privacy Edge: Rabbeted edge on strike side of door and pilaster and continuous hinge on hinge side.
23. Height:
a. Standard Height: 58 inches (1473 mm), 12 inches (310 mm) above the finished floor.
b. Dorian Height: 64 inches (1626 mm), 6 inches (152 mm) above the finished floor.
c. Dorian Max Height: 72 inches (1829 mm), 6 inches (152 mm) above the finished floor.

2.10 SOLITUDE - PHENOLIC CORE

A. Phenolic Core Toilet Partitions: Floor Mounted Overhead Braced "Solitude":
1. Description: Euro Design Privacy System.
2. Compartment Depth and Width: As indicated on Drawings.
3. Doors Width: 22 inch (559 mm) minimum; at ADA accessible compartments 32 inch (813 mm) clear minimum or as required by local codes.
4. Pilaster Width: As required to fit space.
5. Door, Panel, and Partition Height: 78 inches (1981 mm). a. Door and pilaster thickness: 3/4 inch (19 mm).
b. Dividing panel thickness: 1/2 inch (13 mm).
6. Door, Panel, and Partition Clearance above Finished Floor: 4 inches (102 mm).
7. Door, Panel, and Partition Clearance above Finished Floor: 9 inches (229 mm).
8. Door Edges: Overlapping vertical edges for maximum privacy.9. Overhead Bracing: Tubular 7/8 inch (22 mm) brushed stainless steel.

10. Panel to Pilaster Connections: Full length 77 inch (1956 mm) U-brackets brushed stainless steel.
11. Other Brackets: 1 x 2-1/4 x 77 inch (25 x 57 x 1956 mm) stainless steel angles.
12. Door hardware: Brushed stainless steel. a. Paired surface mounted hinges.
b. Include occupancy indicator latch.
13. Fire Rating (ASTM E84, NFPA 255, and UL 723): Class A.
14. Fire Rating (ASTM E84, NFPA 255, and UL 723): Class B.
15. Edge Color: Black core.
a. Color: 920 Almond. b. Color: 927 Folkstone. c. Color: 961 Fog.
d. Color: 912 Storm. e. Color: 909 Black.
f. Color: 3687 Autumn Indian Slate. g. Color: 7022 Natural Canvas.
h. Color: 692 Folkstone Celesta. i. Color: 7018 Navy Grafix.
j. Color: 515 Graphite Grafix. k. Color: 949 White.
l. Color: 6696 Carrara Bianco. m. Color: 7708 Flax Gauze.
n. Color: 8831 Elemental Stone.
o. Color: 8830 Elemental Concrete. p. Color: 899 Desert Beige.
q. Color: 7813 Cardboard Solidz. r. Color: 7812 MDF Solidz.
s. Color: 7213 Earth Wash. t. Color: 3518 Flint Crystall.
u. Color: 845 Spectrum Red.
v. Color: 7966 New Burgundy. w. Color: 967 Hunter Green.
x. Color: 914 Marine Blue. y. Color: 837 Graphite.
z. Color: 8907 Fox Teakwood.
aa. Color: 9312 Planked Urban Oak. bb. Custom Color: .
cc. Color: To be selected by Architect from Manufacturer's full range.
16. Edge Color: Color core.
a. Color: D30 Natural Almond. b. Color: D50 Khaki Brown.
c. Color: D92 Dove Grey.
d. Color: 4981 Calacatta Oro. e. Color: 4887 Tan Soapstone.
f. Color: 4886 Pearl Soapstone. g. Color: 4990 Flax Linen.
h. Color: 7970 High Line.
i. Color: 4991 Pressed Linen. j. Color: 7967 Park Elm.
k. Color: 8202 Light Oak Ply. l. Color: 8203 Silver Oak Ply. m. Color: 8212 Phantom Ecru. n. Color: 4860 Silver Alchemy. o. Color: 7999 Field Elm.

p. Custom Color: .
q. Color: To be selected by Architect from Manufacturer's full range.

2.11 URINAL SCREENS

A. Type "WH" Wall Hung:
1. Material: Stainless Steel.
2. Material: Powder Shield.
3. Material: Plastic Laminate.

4. Material: Solid Phenolic.
5. Material: Polly (HDPE).
6. Height: 42 inches (1067 mm).
7. Height: 48 inches (1219 mm).
8. Depth: 12 inches (305 mm).
9. Depth: 18 inches (457 mm).
10. Depth: 24 inches (610 mm).
11. Brackets: Three brackets chrome.
12. Brackets: Three brackets Stainless Steel.
13. Brackets: Full height, aluminum.
14. Brackets: Full height, stainless steel.
15. Color and Finish: To match toilet partitions.
16. Color and Finish: .

B. Type "T" Wall Hung:
1. Material: Stainless Steel.
2. Material: Powder Shield.
3. Height: 42 inches (1067 mm).
4. Depth: 18 inches (457 mm).
5. Depth: 24 inches (610 mm).
6. Mounting: Concealed wall plate.
7. Color and Finish: To match toilet partitions.
8. Color and Finish: .

C. Type "PF" Wall and Floor Mounted:
1. Material: Stainless Steel.
2. Material: Powder Shield.
3. Material: Plastic Laminate.
4. Material: Solid Phenolic.
5. Material: Polly (HDPE).
6. Height: 58 inches (1473 mm).
7. Height: 55 inches (1397 mm).
8. Depth: 12 inches (305 mm).
9. Depth: 24 inches (610 mm).
10. Depth: 30 inches (762 mm).
11. Brackets: Chrome Stirrup 2 per connection.
12. Brackets: Stainless Steel Stirrup 2 per connection.
13. Brackets: Continuous Aluminum.
14. Brackets: Continuous Stainless Steel.
15. Floor Mounting: Chrome floor mounted shoe.
16. Color and Finish: To match toilet partitions.
17. Color and Finish: .

D. Type "FT" Wall and Floor Mounted:
1. Material: Stainless Steel.
2. Material: Powder Shield.
3. Material: Plastic Laminate.4. Material: Solid Phenolic.
5. Material: Polly (HDPE).
6. Height: 58 inches (1473 mm).
7. Height: 55 inches (1397 mm).
8. Depth: 18 inches (457 mm).
9. Depth: 30 inches (762 mm).
10. Depth: 36 inches (914 mm).
11. Floor Mounting: Stainless Steel shoe to conceal mountings.
12. Brackets: Chrome Stirrup type 2 per connection.
13. Brackets: Stainless Steel Stirrup type 2 per connection.
14. Brackets: Continuous Aluminum.
15. Brackets: Continuous Stainless Steel.
16. Color and Finish: To match toilet partitions.
17. Color and Finish: .

E. Type "V" Wall Hung:
1. Material: Stainless Steel.
2. Material: Powder Shield.
3. Height: 30 inches (762 mm).
4. Depth: 18 inches (457 mm).
5. Depth: 24 inches (610 mm).
6. Mounting: Concealed wall plate.
7. Color and Finish: To match toilet partitions.
8. Color and Finish: .

2.12 SHOWER AND PRIVACY SCREENS

A. Shower and Dressing Enclosures:
1. Material: Stainless Steel.
a. Shower Size: 32 inch (813 mm) square. b. Shower Size: 36 inch (914 mm) square. c. Shower Size: 40 inch (1016 mm) square.
d. Shower Size, Handicap: 36 x 48 (914 x 1219 mm) inches. e. Shower Size, Handicap: 39 inch (991 mm) square.
f. Shower Size, Handicap: 36 inch (914 mm) square.
2. Material: Powder Shield.
a. Shower Size: 32 inch (813 mm) square. b. Shower Size: 36 inch (914 mm) square. c. Shower Size: 40 inch (1016 mm) square.
d. Shower Size, Handicap: 36 x 48 (914 x 1219 mm) inches. e. Shower Size, Handicap: 39 inch (991 mm) square.
f. Shower Size, Handicap: 36 inch (914 mm) square.

3. Material: Dur-a-tex.
a. Shower Size: 32 inch (813 mm) square. b. Shower Size: 36 inch (914 mm) square. c. Shower Size: 40 inch (1016 mm) square.
d. Shower Size, Handicap: 36 x 48 (914 x 1219 mm) inches. e. Shower Size, Handicap: 39 inch (991 mm) square.
f. Shower Size, Handicap: 36 inch (914 mm) square.
4. Material: Solid Phenolic.
a. Shower Size: 32 inch (813 mm) square. b. Shower Size: 36 inch (914 mm) square. c. Shower Size: 40 inch (1016 mm) square.
d. Shower Size, Handicap: 36 x 48 (914 x 1219 mm) inches.
5. Material: Polly (HDPE).
a. Shower Size: 32 inch (813 mm) square.

b. Shower Size: 36 inch (914 mm) square. c. Shower Size: 40 inch (1016 mm) square.
6. Receptors: Precast terrazzo with integral cast drain and removable stainless steel strainer.
7. Accessories: Includes heavy-duty, translucent vinyl curtain, integral curtain track, hooks, and soap dish.
8. Mounting: Pilaster supported.
9. Mounting: Post supported.
10. Color and Finish: To match toilet partitions.
11. Color and Finish: . PART 3 EXECUTION
3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. General: Install in accordance with manufacturer's instructions.
1. Install compartment units rigid, straight, plumb and level.
2. Provide clearance of not more than 1/2 inch (13 mm) between stiles and panels and not more than 1 inch (25 mm) between panels and walls.

3. Secure panels to walls with not less than two brackets attached near top and bottom of panel.
4. Locate wall brackets so holes for wall anchorages occur in masonry or tile joints.
5. Secure panels to stiles with not less than two brackets located to align with brackets at wall.
6. Secure panels in position with manufacturer's recommended anchoring devices.
7. Level, plumb, and tighten installation with devices furnished.

B. Overhead Braced Compartments:
1. Secure stile to floor.
2. Secure overhead brace to each stile with fasteners required.
3. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor Mounted Compartments:
1. Set stile units with anchorages having not less than 2 inches (51 mm) penetration into structural floor, unless otherwise recommended by manufacturer.
2. Hang doors and adjust so tops of doors are level with tops of stiles when doors are in closed position.

D. Ceiling Hung Compartments:
1. Secure stiles to supporting structure.
2. Hang doors and adjust door so door bottoms are level with bottoms of stiles when doors are in closed position.

E. Floor to Ceiling Compartments:
1. Secure divider panels to built-in anchorage devices using concealed fasteners.
2. Hang doors and adjust so door bottoms are as specified off floor when doors are in closed position.

F. Screens:
1. Attach with anchoring devices as recommended by manufacturer to suit supporting structure.
2. Set unit to provide support and to resist lateral impact.

3.4 ADJUSTING AND CLEANING

A. Clean and Protect: Clean exposed surfaces of compartment systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10440 - SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wayfinding systems and signage including the following:
1. Exterior architectural sign systems including:
a. Main identification signage. b. Post and panel signs.
c. Wall mount signs.
d. Dimensional letters.
e. Electronic messaging.
2. Interior architectural sign systems including: a. Modular sign systems, freestanding.
b. Modular sign systems, window signs. c. Arc sign systems.
d. Klik sign systems. e. Enhanced signs.
f. Adaptive signage. g. VitalSign.
h. InfoBoard.
i. Specialty signage. j. Digital Signage:
1) EZ ID.
2) Digital directories.
3) Digital bulletins.
4) Digital room displays.
5) Queuing systems.
3. Artwork including:
a. 3StepArt.

1.2 RELATED SECTIONS

A. Section 06 20 00 - Finish Carpentry. B. Section 07 91 26 - Joint Fillers.
C. Section 09 25 23 - Lime Based Plastering.

D. Section 09 70 00 - Wall Finishes.

E. Section 09 90 00 - Painting and Coating. F. Section 10 13 13 - Electronic Directories. G. Section 10 14 16 - Plaques.
H. Section 26 50 00 - Lighting.

1.3 REFERENCES

A. ASTM International (ASTM):
1. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.B. United States Access Board, Americans with Disability Act (ADA):

1. Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG).
2. ADAAG 703.3.1 - Braille dimension measurements.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Materials, fabrication, finishing, fastenings, hardware, and accessories.
4. Mounting details and installation methods.

C. Shop Drawings: Provide project specific, scaled, shop drawings including:
1. Extents of installation, room sizes, layouts, profiles, signage dimensions, penetrations if any, control dimensions and architectural alignments.
2. Interface with building services and adjacent construction.
3. Material thicknesses and joints, anchorage, trim, hardware and locks, finishes, substrate materials, and accessories.
4. Base building requirements, and installation procedures.
5. Identify typography, artwork, finishes, message locations and similar.
6. Coordinate nomenclature and terminology with sign drawings, message schedule, and location plan.

D. Qualifications: For manufacturer and installer.

E. Certificates: Product certificates signed by the manufacturer certifying materials comply with specified performance characteristics, physical requirements, and project specific requirements.
F. Manufacturers Field Reports: Submit no later than 2 business days after each site visit. G. Samples:
1. Selection Samples: Provide manufacturers standard samples for selection of finishes, colors, and textures.
2. Verification Samples: Provide two samples for each product to be installed, minimum size 6 by 6 inch (150 by 150 mm).
a. Interior Signs: Submit one full size sample of each type, style, and color including method of attachment. Accepted samples may be incorporated into finished work.

H. Closeout Submittals:
1. Operations and maintenance data.
2. Warranty.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Except as noted below, all materials and components shall be fabricated by a single manufacturer including mounting hardware and materials, fittings, fastenings, lighting, electronics, finished surfaces and concealed internal supports.
1. Changeable messages and inserts are provided by the owner.
2. Exterior concrete footings engineered and installed by general contractor.

B. Manufacturer Qualifications: Minimum 10 years or more experience in fabrication of solid phenolic materials, experienced in performing work of similar size and scope, and with production facilities to meet the project schedule.

C. Installer Qualifications: Specialized in performing signage work, with minimum 2 years experience installing similar products.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship and finishes.
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.
4. Accepted mock-up may be incorporated into the finished work and shall establish the standard of workmanship and acceptance for remaining work.

1.6 PRE-INSTALLATION MEETINGS

A. Convene at the project site minimum two weeks prior to starting work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Do not deliver signs until facility is enclosed and conditioned within temperature and humidity ranges expected of final occupancy.

C. Deliver and store products in manufacturer's original, unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
1. Package and label signs in groups indicated on the drawings.
2. Prevent contact with materials or project conditions that may cause corrosion, discoloration, or staining.
3. Store signage materials in a safe, dry, above ground location until mounting surfaces are ready for installation.
4. Protect from damage from other trades. D. Handling: Handle materials to avoid damage.

1.8 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 recommended limits.

1.9 SEQUENCING

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

1.10 WARRANTY

A. Provide manufacturer's standard one-year product warranty against defects in materials.

1.11 EXTRA MATERIALS

A. Provide extra signage equal to 2 percent of each sign type, no less than one complete sign of each type requested by the owner.

B. At completion of installation, submit extra stock of signs and components as indicated in the Sign Message Schedule.

C. Expedited Sign Maintenance Program: Provide manufacturer's coupon books for redemption of expedited replacement inserts and additional signage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: 2/90 Sign Systems.

B. Substitutions: Similar product.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Aluminum: Manufacturer's standard 6063-T6/T5 or 6061-T6 alloy.

B. Interior Panel Substrates:
1. 0.080 to 0.125 (2 to 3.2 mm) aluminum to ASTM B209.

2. Acrylic.
3. Aluminum composite material.
4. Polycarbonate.

C. Interior Enhanced Backer Materials: Applied to back of signs with adhesive.
1. Standard Backer: 1/4 inch (6 mm) acrylic.
a. Patterned Backer: Modified with digital receptive polymer to accept VOC free, ultra-violet inks digitally applied directly to the substrate subsurface. b. Solid Color Backers: Painted subsurface in acrylic lacquer.
2. Aluminum Backer: 0.028 inch (0.71 mm) coil anodized aluminum laminated to 0.090 inch (2.2 mm) ABS plastic.
3. Wood Backer: 0.031 inch (0.78 mm) vertical grade laminated to 0.090 inch (2.2 mm) extruded ABS plastic.

D. Interior Sign Insert Materials:
1. ABS Inserts:
a. Composition: 0.090 inch (2.2 mm) extruded ABS plastic core with 0.003 inch (0.07 mm) UV resistant acrylic cap bonded during extrusion/texturing process.
b. Fixing Accessories: Pressure bonded to extruded PVC hook using high-bond, pressure sensitive adhesive.
c. Color: Integral color or painted in acrylic lacquer as specified with signs. d. Protective Coating: Chromium industries #HM335RA texture pattern to prevent glare and disguise fingerprints.
2. Aluminum Inserts:
a. Composition: 0.028 inch (0.71 mm) coil anodized aluminum precision slit and laminated to extruded 6063-T5 aluminum Carrier.
b. Fixing Accessories: Acrylic adhesive.
3. Wood Inserts:
a. Composition: 0.031 inch (0.78 mm) vertical grade laminate precision slit and laminated to extruded 6063-T5 aluminum
b. Fixing Accessories: Acrylic adhesive.
4. Window Inserts:

a. Composition: Extruded 6063-T5 aluminum to hold die-cut paper insert with a clear 0.020 inch (0.5 mm) textured polycarbonate lens.
b. Fixing Accessories: Integral hooks for connection to Structural Rail.
c. Colors: Anodized black, anodized satin or painted acrylic lacquer as specified with signs.
5. Subsurface Copy Inserts:
a. Composition: Textured 0.020 inch (0.5 mm) clear polycarbonate face with subsurface Direct Print, High Performance Cast PVC Vinyl, or Silkscreen copy. Back sprayed with acrylic lacquer and laminated to an extruded aluminum Carrier Insert.
6. UDO Subsurface Copy Inserts:

a. Composition: Textured 0.020 inch (0.5 mm) clear polycarbonate face with subsurface Direct Print, High Performance Cast PVC Vinyl, or Silkscreen copy which slides into Window Insert.

7. Jewel Inserts:

a. Composition: 0.060 inch (1.5 mm) non-glare acrylic painted subsurface in acrylic lacquer laminated to 0.030 inch (0.7 mm) ABS pressure bonded to extruded PVC hook using high bond, pressure sensitive adhesive with first surface Direct Print, applied High Performance Cast PVC vinyl, Silkscreen, or Tactile/Raster Braille copy.

8. Sliding Inserts:

a. Composition: Extruded 6063-T5 aluminum with a black, or anodized satin finish with integral hooks for connection with Structural Rail.

b. Fixing Accessories: Holds 0.010 inch (0.2 mm) textured polycarbonate with subsurface Direct Print, High Performance Cast PVC Vinyl, or Silkscreen copy.

c. Sliding Insert moves horizontally with an inset finger press exposing different graphic information.

9. Photo-Luminescent Inserts:

a. Composition: 0.065 inch (1.65 mm) PVC Strontium-Aluminates laminated with pressure-sensitive permanent acrylic adhesive to 0.030 inch (0.7 mm) ABS material.

b. Fixing Accessories: Pressure bonded to extruded PVC hook using high bond, pressure sensitive adhesive.

c. Color: Photo-luminescent material is light green. Reference manufacturer data for Best Level Luminance Test Conditions.

10. ADA, Integral Tactile Inserts:

a. Composition: Graphics and Insert materials are one piece. Tactile Photopolymer Inserts are 0.080 inch (2 mm) phenolic photopolymer with raised copy etched to 0.032 inch (0.8 mm).

b. Fixing Accessories: Pressure bonded to extruded PVC hooks with adhesive. c. Colors: Background is painted in acrylic lacquer in the specified Insert color.

Top surface of copy characters is then added by roller printing in the specified copy color using Silkscreen inks.

11. ADA, Applied Tactile Inserts:

a. Composition: Computer Aided Router cuts acrylic characters 0.032 inch (0.8 mm) thick; bonded to ABS, aluminum or wood laminate Inserts using 3M 467 adhesive.

b. Raster Method of Braille consists of 0.059 inch (1.5 mm) diameter clear acrylic beads set into pre-drilled holes on ABS, aluminum or wood laminate Inserts resulting in 0.032 inch (0.8 mm) Braille text.

12. ADA, Subsurface Tactile Inserts:

a. Composition: High Performance Cast PVC vinyl bonded with a profile film reverse cut by computer, and applied subsurface to clear, vacuum thermoformable PETG. Materials are put into a Heat Vacuum Applicator (HVA) to form around the three dimensional graphics, afterwards the Braille is then punched.

b. Fixing Accessories: Insert is back sprayed with acrylic lacquer and laminated to an extruded aluminum carrier Insert.

13. ADA, Exterior Integral Inserts:

a. Composition: Graphics and Insert materials are one piece 0.015 inch (0.4 mm) aluminum pressure bonded with adhesive to 0.060 inch (1.5 mm) acrylic with 0.031 inch (0.8 mm) raised copy.
b. Fixing Accessories: Pressure bonded to extruded PVC hooks with adhesive. c. Colors: Background color is painted in acrylic lacquer in the specified Insert
color. Top surface of copy characters is then added by roller printing in the specified copy color using Silkscreen inks.

E. Interior Graphic Types:
1. Direct Print: VOC free, ultra-violet cured inks digitally applied directly to the substrate surface.
2. Vinyl First Surface: High Performance Cast PVC Vinyl.
3. Laser Print: Computer generated graphics laser printed on die-cut paper Insert.
4. Subsurface: Textured 0.020 inch (0.5 mm) clear polycarbonate face with subsurface Direct Print, High Performance Cast PVC Vinyl, or Silkscreen copy. Insert is back sprayed with acrylic lacquer and laminated to an extruded aluminum carrier Insert.
5. UDO Subsurface: Textured 0.020 inch (0.5 mm) clear polycarbonate face with subsurface Direct Print, High performance Cast PVC Vinyl, or Silkscreen Copy. Slides into Window Insert.
6. Silkscreen: Lacquer-based Silkscreen inks.
7. Engraved: Extruded ABS Insert painted with acrylic lacquer finish. Copy is engraved into one of the six standard ABS materials exposing desired copy for color.
8. Braille: As indicated with ADA materials above.
9. .

2.3 INTERIOR SIGN SYSTEMS

A. Modular Sign Systems: Provide the following by 2/90 Sign Systems:
1. Components: Structural rails, copy inserts, and interlocking end caps. Capable of being arranged in a variety of configurations with minimum of attachments, devices and connectors.
a. Structural Rails: Extruded 6063-T5 aluminum anodized black to accept various insert materials and mounting devices, able to be converted in the field to add height or width. Rail Joiners are extruded black PVC plastic connecting structural rails together with a butt joint along the edge, not visible in the final assembly. Provide the following rail profiles:
1) Standard Profile Rails: 9/16 inch (14.28 mm) thick with inserts both sides. a) Rail Height: 2 inch (50 mm).
b) Rail Height: 3 inch (76 mm). c) Rail Height: 4 inch (101 mm). d) Rail Height: 6 inch (152 mm). e) Rail Length: .
2) Thin Profile Rails: 9/32 inch (7.13 mm) thick with inserts one side only. a) Rail Height: 2 inch (50 mm).
b) Rail Height: 3 inch (76 mm). c) Rail Height: 4 inch (101 mm). d) Rail Length: .
3) Box Rails: 9/32 inch (7.13 mm) thick with inserts one side only. a) Rail Height: 2 inch (50 mm).

b) Rail Height: 3 inch (76 mm). c) Rail Height: 4 inch (101 mm).

d) Rail Length: . b. Sign Size:
1) Overall Height:
2) Overall Width:
c. Inserts: Slide horizontally onto rails.
1) Insert Material:
2) Insert Color:
3) Paper Insert Replacements: Printed by Owner.
4) Paper Insert Replacements: Printed by Manufacturer.
d. Graphic Types: Applied to insert material in colors indicated on the drawings.
1) Blank (no graphics).
2) Direct Print.
3) Vinyl First Surface.
4) Laser Print.
5) Subsurface.
6) Silkscreen.
7) Engraved.
8) Integral ADA.
9) Applied ADA.
10) Subsurface ADA.
e. End Caps: Extruded 6063-T5 aluminum or injection molded ABS interlock to structural rails with steel spring clips to form an integral unit, and secure changeable copy inserts without requiring tools for assembly. May be joined with other system signs of equal heights. Provide the following style:
1) Round corners.
2) Square corners.
3) Slimline.
4) Angleback.
5) Stepback.
6) Bullnose.
7) Waterfall.
f. Accent Strips: Extruded 6063-T5 aluminum, visible in the final assembly. Color as specified below.
g. Top and Bottom Trim: Extruded 6063-T5 aluminum butts flush to copy inserts and encloses top or bottom structural rail and copy insert.
2. Modular Free-Standing Signs:
a. Modular Light-Duty: Aluminum frame mounted to welded steel base, with filler panels and clear acrylic pockets as shown on the drawings and the following:
1) Stand Height: .
2) Sign Size:
b. Modular Medium-Duty: Welded steel square tubing, with filler panels and clear acrylic pockets as shown on the drawings and the following:

1) Stand Height: .
2) Sign Size:
c. Modular Heavy-Duty: 2-1/4 inch (57 mm) round extruded aluminum, with filler panels and clear acrylic pockets as shown on the drawings and the following:
1) Stand Height: .
2) Sign Size:
d. Accent Strips Color: Black.
e. Accent Strips Color: Painted .
f. Accent Strips Color: Satin natural aluminum.
g. Accent Strips Color: As shown on the drawings.h. Trim Color: Black.
i. Trim Color: Painted .
j. Trim Color: Satin natural aluminum.
k. Trim Color: As shown on the drawings. l. Insert Material: .
3. Modular Window Signs:
a. Viewing Area Dimensions: Standard 8-1/2 by 11 inch (215 by 279 mm). b. Viewing Area Dimensions: .
c. Viewing Area Dimensions: As shown on the drawings. d. Attachment and Access: Side mounted hooks.
e. Attachment and Access: Front-loading magnetic strip. f. Attachment and Access: Thumb notch.
g. Attachment and Access: As recommended by the manufacturer. h. Attachment and Access: As shown on the drawings.
i. Mounting: Desk mounted. j. Mounting: Wall mounted.
k. Mounting: Free-standing, refer above for additional requirements. l. Mounting: As shown on the drawings.

B. Arc Sign Systems: Provide the following by 2/90 Sign Systems:
1. Description: Curved panel sign system comprised of concealed black metal frame, extruded aluminum edge rails, internal structural backer, factory pre-printed PETG inserts, and tamper-resistant removable paper inserts secured by non-removable edge rails.
a. Overall Dimensions: . b. Insert Dimensions: .
c. Arc Orientation: Horizontal. d. Arc Orientation: Vertical.
e. Insert Material: Painted, color .
f. Insert Material: Wood laminate, color . g. Insert Material: Faux aluminum.
h. Insert Material: Paper.
1) Paper Insert Replacements: Printed by Owner.
2) Paper Insert Replacements: Printed by Manufacturer. i. Insert Material: As shown on the drawings.
j. Graphic Types: Applied to insert material in colors indicated on the drawings.
1) Blank (no graphics).
2) Direct Print.
3) Vinyl First Surface.

4) Laser Print.
5) Subsurface.
6) Silkscreen.
7) Engraved.
8) Integral ADA.
9) Applied ADA.
10) Subsurface ADA. k. Accent Strips: Black.
l. Accent Strips: Painted .
m. Accent Strips: Satin natural aluminum.
n. Accent Strips: As shown on the drawings.

C. Klik Sign Systems: Provide the following by 2/90 Sign Systems:
1. Description: Flat panel sign system with front-loading, changeable, beveled edge inserts on frameless base-plate. Inserts are mounted directly to the base-plate with a shaped reveal above the insert area and exposed base-plate below the insert. Insert clicks into the base-plate then slides horizontally to secure. Provide with locking option when indicated on the drawings.
a. Sign Dimensions: . b. Configuration: .
c. Support Back Plate: Machined holes spaced to allow uniform, modular sizing of inserts. Internal structural member is painted, extruded acrylic.
d. Base Plate: 1/4 inch (6 mm) flush mounted acrylic. e. Base Finish: Standard, first surface finish.
f. Base Finish: Enhanced, subsurface finish. g. Base Color: .
h. Insert Material: 3/16 inch (4.7 mm) thick painted acrylic painted first surface.
1) Insert Color:
i. Insert Material: Aluminum window with paper and protective lens.
1) Window Color: .
2) Paper Color: .
j. Provide with the following accessories:
1) Overhead sign with ceiling mount, two sided.
2) Overhead sign with screw mount, two sided.
3) Perpendicular sign with screw mount, two sided.
4) Sliding Occupancy Insert: Green for available, red for occupied.
5) Smart Strip: Satin natural aluminum strip with black caps holds temporary messages securely.

D. Enhanced Signs: Provide the following by 2/90 Sign Systems:
1. Description: Beautiful selection of standard shapes and patterns to incorporate changeable elements as shown on the drawings.
a. Configuration: Custom, one-of-a-kind backer and shapes as shown on the drawings.
b. Design: Single arch, color .
c. Design: Double arch, colors and . d. Design: Single curve, color .
e. Design: Double curve, colors and . f. Design: Single flare, color .

g. Design: Double flare, colors and . h. Design: Single diagonal, color .
i. Design: Double diagonal, colors and . j. Design: Single quad, color .
k. Design: Double quad, colors and .
l. Design: Single wave, color .
m. Design: Double wave, colors and . n. Design: As shown on the drawings.
o. Pattern: Organic, applied to surface. p. Pattern: Textural, applied to surface. q. Pattern: Linear, applied to surface.
r. Pattern: Natural, applied to surface.
s. Pattern: Abstract, applied to surface.
t. Pattern: As selected from manufacturers full line, applied to surface.
u. Pattern: As shown on the drawings.

E. Adaptive Signage: Provide the following by 2/90 Sign Systems:
1. Description: Patterns, shapes and colors combine accessible compliance with aesthetics. Adaptive products contain up to 40 percent post-industrial recycled material with a clear, high-resolution polyester photopolymer finish.

a. Size: .
b. Design: .
c. Material: 3form, color .
d. Material: Wood grain, color . e. Material: Laminate, color .
f. Material: Paint, color .
g. Material: As shown on the drawings.

F. VitalSign: Provide the following by 2/90 Sign Systems:
1. Description: The only medical alert and critical care information message system designed to prevent the spread of infections disease. Self-contained messages without extensions or tabs are changeable with a magnetic tool, eliminating the need to touch, while ensuring continuous smooth surfaces that are easily and thoroughly cleaned.
a. Size: . _____
b. Configuration: . c. Material: .
d. Finish: .
e. As shown on the drawings.

G. InfoBoard: Provide the following by 2/90 Sign Systems:
1. Description: Dry-erase board with durable subsurface graphics to promote brands or create custom templates to write or check messages. Anodized marker holder keeps writing tools close at hand.
a. Material: . b. Finish: .
c. Material and Finish: As shown on the drawings.
d. Pre-printed messages: As shown on the drawings.

H. Specialty Signage: Provide the following by 2/90 Sign Systems:
1. Description: Fabricated to meet each project's unique requirements. a. Material: .
b. Finish: .
c. Material and Finish: As shown on the drawings.

I. Digital Signage: Provide the following by 2/90 Sign Systems:
1. EZ ID: Wireless ADA-compliant digital sign system to manage identification signage from any location using secure diffused infrared communication technology with no internet connection required. Signs can store multiple levels of secure information and communicate bi-directionally to confirm updates allowing self- scheduling of rooms, meetings, and other tasks. Powered by 5 year long-life batteries to eliminate the need for hard wiring or disruption of adjacent building structure or finishes.
a. Material: . b. Finish: .
c. Material and Finish: As shown on the drawings. d. Size: Small.
e. Size: Large.
1) Orientation: Horizontal mounting.
2) Orientation: Vertical mounting.
f. Size and Orientation: As shown on the drawings.
2. Digital Directories: Interactive touch screens instantly provide users with directions that coordinate with and enhance facility signage. Digital directories are searchable by name, department, room number and other fields to keep visitors on pre-determined efficient paths to their destination while allowing owners to route visitors away from sensitive or back-of-house areas.

a. Provide with the following optional capabilities:
1) Printer.
2) Phone.
b. Material: . c. Finish: . _____
d. Material and Finish: As shown on the drawings.
3. Digital Bulletins: Organize messages on an unlimited canvas while eliminating cluttered walls. Update scrolling text, flash animations and videos system wide to save staff hours time posting flyers. Maximize investment by incorporating digital bulletins into facility or campus emergency preparedness plans using pre- programmed messages, alerts, and evacuation maps to broadcast safety procedures.
a. Material: . b. Finish: .
c. Material and Finish: As shown on the drawings.
4. Digital Room Displays: Meeting room signage displays provide identification and scheduling information. Change meeting times, presentation titles, speakers or any message from one central location using content management software. When rooms are not in use screens can display general announcements, motivational quotes, news or weather feeds. Room displays can be combined with event directories to simplify users finding their destinations.
a. Material: . b. Finish: .

c. Material and Finish: As shown on the drawings.
5. Queuing Systems: Queuing and Customer Flow Management (CFM) systems create an orderly flow in high traffic environments while capturing operational information for future planning. Customizable solutions improve operational efficiency, enhance customer satisfaction, and reduce wait-times.
a. Material: . b. Finish: .
c. Material and Finish: As shown on the drawings.

2.4 ARTWORK

A. Artwork: Provide the following by 2/90 Sign Systems:
1. 3StepArt: Custom artwork created specifically for individual projects. Dimensional paintings created by designer and entrepreneur Charlie Tyke, creator of Tykes Toys, premiere designer of modular architectural signage systems, and founder of
2/90 Sign Systems.
a. Description: Design engraved into substrate revealing black lines to create dimension. Exposed relief detail and finishes sides make framing optional.
b. Provide with Certificate of Authenticity including artist's signature and date.

2.5 FABRICATION

A. Assemble units to the greatest extent possible in the fabrication shop to minimum onsite splicing or assembly.
1. Ensure welds are behind finished surfaces and will not transmit distortion or discoloration to finished surfaces.
2. Joints, miters and connections shall be tight and free of fractures.
3. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
4. Fasteners shall be concealed unless specifically shown on the drawings.
5. Form work to required shapes and sizes, with true curves, lines and angles. Provide necessary rebates, lugs and brackets for assembly.
6. Exposed ends and edges mill smooth, with corners slightly rounded

B. Components shall allow for expansion and contraction for a minimum material temperature range of 56 degrees C (100 degrees F), without causing buckling, excessive opening of joints or over stressing of adhesives and fasteners.

C. Plane surfaces should be smooth, flat and without oil-canning, free of rack and twist. Restore texture to filled or cut areas.
1. Maximum variation from plane of surface plus or minus 0.032 inch (0.8 mm).

D. Movable parts, including hardware, shall be cleaned and adjusted to operate as designed without binding or deformation. Doors and covers centered in opening of frame. All contact surfaces fit tight and even without forcing or warping components.

E. Painted surfaces shall be primed in accordance with the paint manufacturers instructions. Finish coating of paint to have complete coverage with no light or thin applications that show substrate or primer. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.

F. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation as indicated on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
1. Verify areas are finished and ready to receive signage
2. Verify location of cast-in anchors, mounting hardware, concrete foundations or similar supports are properly installed, in the proper locations, and of the type and size required for each type of sign.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Do not begin installation until unacceptable conditions are corrected.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Protect adjacent work and finished surfaces from damage during installation.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, including product technical bulletins, product catalog installation instructions, and product carton installation instructions.

B. Locate as indicated on the drawings, sign location plan, and in accordance with approved shop drawings.

C. Avoid warps, buckles, distortion, opening joints, or overstressing welds or fasteners. D. Exterior Signs, Direct Burial Installations: Exterior concrete footings engineered and installed by general contractor within the following guidelines:
1. Bore holes to a diameter at least 4 times as large as the largest post cross section, to a minimum depth of 36 inch (914 mm) below grade.
2. Cover below grade portion with bituminous coating to prevent oxidation or moisture damage.
3. Place gravel, sand, or crushed stone in the bored hole to facilitate drainage.
4. Place concrete around post, ensure units are square, level, and plumb.

E. Exterior Signs, Base Mounted Installations:
1. Set unit on prepared base and secure with anchor bolts.
2. Secure joint between module and base using exterior sealants specified in Section 07 91 26 - Joint Fillers.
3. Ensure units are square, level, and plumb.

F. Interior Signs:
1. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings.
2. Where otherwise not dimensioned, signs shall be installed where best suited to provide a consistent appearance throughout the project.
3. Clarify exact placements and alignments with the architect if required.

G. Make final adjustments to components to ensure proper alignment, fit, and smooth operation of any removable or moveable parts.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: If requested by the Owner, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

3.5 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Wipe clean with water-dampened cloth. Do not use chemicals or solvents.

C. Remove construction debris from project site and legally dispose of debris.

D. Clean all exposed surfaces in accordance with the manufacturer instructions.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10440

SECTION 10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes toilet accessories, as indicated in Drawings.

1.2 REFERENCES

A. ASTM International:
1. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
2. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

B. Federal Specification Unit:
1. FS A-A-3002 - Mirrors, Glass.

1.3 DESIGN REQUIREMENTS

A. Design grab bars and attachments to resist minimum 250 lb (0.22 kN) concentrated load applied at any point in any direction.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Product Data: Submit data on accessories describing size, finish, and details of function, attachment methods.

C. Manufacturer's Installation Instructions: Submit special procedures, conditions requiring special attention.

1.5 COORDINATION

A. Coordinate the Work with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.PART 2 PRODUCTS

2.1 GENERAL

A. Available manufacturers subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work, include but are not limited to the manufacturers listed herewith.

B. Substitutions allowed according to Architect's approval via Substitution Request Forms provided as attachments to Section 01 60 00: Product Requirements.

2.2 TOILET AND BATH ACCESSORIES

A. BASIS OF DESIGN or EQUAL to: Fixture Schedule indicated on Drawings.

2.3 PLASTIC TOILET PARTITIONS

A. Components:

1. Stiles: 1" (25mm) finished thickness, 45-lb (20,4-kg) density, resin- Impregnated particle board bonded to each side of 11-gauge (3mm) sheet steel that serves as reinforcing core; surfaces are 0.050" (1.3mm) thick, high pressure plastic laminate with colored face sheets and matte finish. Edges are routed to allow flush fit of edge trim. Edge trim is 18-8S, type 304 stainless steel channel with satin finish.

2. Leveling Device: 3.8" x 1" (10 x 25mm) steel bar welded to sheet-steel core of stile, forming a single structural unit; furnished with 3/8" (10mm) diameter threaded rods, hex nuts, lock washers, flat washers, expansion shields, and shoe retainers.

3. Shoe: 18.8S, type 304, 22 gauge (0.8mm) stainless steel with satin finish; 4"(100mm) high.

4. Panels and Doors: 1" (25mm) finished thickness; 45 lb (20.4 kg) density, resin impregnated particleboard; surfaces are 0.050" (1.3mm) thick, high pressure plastic laminate with colored face sheets and matte finish. Edges are routed to allow flush fit of edge trim. Edge trim is 18.8S, type 304 stainless steel channel with satin finish.

2.4 GENERAL COMPONENTS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
1. Grind welded joints smooth.

2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces. B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269, stainless steel.

D. Adhesive: Two-component epoxy type, waterproof.

E. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof.
1. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for edges.

F. Grab Bars: Stainless steel, minimum 0.05 inch wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
1. Length and configuration: As indicated on Drawings.

2.5 FACTORY FINISHING

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300: Administrative Requirements.

B. Verify exact location of accessories for installation.

C. Verify field measurements are as indicated on product data.

D. See drawings sections for installation of blocking and concealed anchors in walls.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation. B. Provide templates and rough-in measurements as required.
3.3 INSTALLATION

A. Install plumb and level, securely and rigidly anchored to substrate.

B. Mounting Heights and Locations: As required by accessibility regulations

C. Attach panel brackets securely using anchor devices. D. Attach panels and pilasters to brackets.
E. Adjust and align door hardware so free movement is attained.

F. Maintain 3/8 to ½ space between wall and panels and between wall and end pilasters.

G. Field touch up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

END OF SECTION 10 28 00

Division 15 – Mechanical

SECTION 15100 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general duty valves common to several mechanical piping systems. B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Special purpose valves are specified in Division 15 piping system Sections.
2. Valve tags and charts are specified in Division 15 Section "Mechanical Identification."

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Divi- sion 1 Specification Sections.

B. Product Data for each valve type. Include body material, valve design, pressure and tempera- ture classification, end connection details, seating materials, trim material and arrangement, di- mensions and required clearances, and installation instructions. Include list indicating valve and its application.

C. Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Comply with the requirements specified in Division 1 Section "Materials and Equipment," under "Source Limitations" Paragraph.

B. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

C. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

1.5 DELIVERY, STORAGE, AND HANDLING A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set globe and gate valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store indoors and maintain valve temperature higher than ambient dew-point tempera- ture. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use hand- wheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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

1. Gate Valves:

a. Crane Company; Valves and Fitting Division. b. Hammond Valve Corporation.
c. Kitz Corp. of America.
d. Lunkenheimer/Cincinnati Valve Co. e. Milwaukee Valve Company, Inc.
f. NIBCO Inc.
g. Powell: Wm. Powell Company (The). h. Red-White Valve Corp.
i. Stockham Valves & Fittings, Inc.

2. Ball Valves:

a. Conbraco Industries, Inc.; Apollo Division. b. Hammond Valve Corporation.
c. Milwaukee Valve Company, Inc. d. NIBCO Inc.

e. Stockham Valves & Fittings, Inc. f. Tyler Pipe.
g. Victaulic Company of America.

3. Plug Valves:

a. Grinnell Corp.
b. Huber: J.M. Huber Corp.; Flow Control Division (Resun Valves). c. NIBCO Inc.
d. Stockham Valves & Fittings, Inc. e. Victaulic Company of America.

4. Globe Valves:

a. Crane Company; Valves and Fitting Division. b. Hammond Valve Corporation.
c. Kitz Corp. of America.d. Lunkenheimer/Cincinnati Valve Co. e. Milwaukee Valve Company, Inc.
f. NIBCO Inc.
g. Powell: Wm. Powell Company (The). h. Red-White Valve Corp.
i. Stockham Valves & Fittings, Inc.

5. Butterfly Valves:

a. Center Line, Mark Controls Corporation.
b. Crane Company; Valves and Fitting Division. c. General Signal; DeZurik Unit.
d. Grinnell Corp.
e. Hammond Valve Corporation. f. Keystone Valve USA, Inc.
g. Milwaukee Valve Company, Inc. h. NIBCO Inc.
i. Red-White Valve Corp.
j. Stockham Valves & Fittings, Inc. k. Tyler Pipe.
l. Ultraflo Corporation.
m. Victaulic Company of America.

6. Swing Check Valves:

a. Cla-Val Co.
b. Crane Company; Valves and Fitting Division. c. Hammond Valve Corporation.
d. Kitz Corp. of America.
e. Lunkenheimer/Cincinnati Valve Co. f. Milwaukee Valve Company, Inc.
g. NIBCO Inc.
h. Powell: Wm. Powell Company (The). i. Red-White Valve Corp.
j. Stockham Valves & Fittings, Inc. k. Victaulic Company of America.

7. Wafer Check Valves:

a. Cla-Val Co.

b. Conbraco Industries, Inc.; Apollo Division. c. Hammond Valve Corporation.
d. Keystone Valve USA, Inc. e. Kitz Corp. of America.
f. Metraflex Company.
g. Milwaukee Valve Company, Inc. h. NIBCO Inc.
i. Red-White Valve Corp.
j. Stockham Valves & Fittings, Inc. k. Tyler Pipe.
l. Val-Matic Valve & Mfg. Corp. m. Victaulic Company of America.

8. Lift Check Valves:

a. Crane Company; Valves and Fitting Division. b. Kitz Corp. of America.
c. Milwaukee Valve Company, Inc. d. NIBCO Inc.
e. Powell: Wm. Powell Company (The). f. Red-White Valve Corp.
g. Stockham Valves & Fittings, Inc.

2.2 BASIC, COMMON FEATURES

A. Design: Rising stem or rising outside screw and yoke stems, except as specified below.

1. Nonrising stem valves may be used only where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this
Section and as required to suit system pressures and temperatures. C. Sizes: Same size as upstream pipe, unless otherwise indicated.
D. Operators: Use specified operators and handwheels, except provide the following special oper- ator features:

1. Handwheels: For valves other than quarter turn.
2. Lever Handles: For quarter-turn valves 6 inches (DN150) and smaller, except for plug valves, which shall have square heads. Furnish Owner with 1 wrench for every 10 plug valves.
3. Chain-Wheel Operators: For valves 4 inches (DN100) and larger, installed 96 inches (2400 mm) or higher above finished floor elevation.
4. Gear-Drive Operators: For quarter-turn valves 8 inches (DN200) and larger.

E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections. G. Threads: ASME B1.20.1.

H. Flanges: ASME B16.1 for cast iron, ASME B16.5 for steel, and ASME B16.24 for bronze valves.

I. Solder Joint: ASME B16.18.

1. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F (450 deg C) for gate, globe, and check valves; below 421 deg F (216 deg C) for ball valves.

2.3 GATE VALVES

A. Gate Valves, 2-1/2 Inches (DN65) and Smaller: MSS SP-80; Class 125, 200-psi (1380-kPa) cold working pressure (CWP), or Class 150, 300-psi (2070-kPa) CWP; ASTM B 62 cast-bronze body and bonnet, solid-bronze wedge, copper-silicon alloy rising stem, teflon-impregnated pack- ing with bronze packing nut, threaded or soldered end connections; and with aluminum or mal- leable-iron handwheel.

B. Gate Valves, 3 Inches (DN80) and Larger: MSS SP-70, Class 125, 200-psi (1380-kPa) CWP, ASTM A 126 cast-iron body and bonnet, solid cast-iron wedge, brass-alloy stem, outside screw and yoke, teflon-impregnated packing with 2-piece packing gland assembly, flanged end con- nections; and with cast-iron handwheel.

2.4 BALL VALVES

A. Ball Valves, 4 Inches (DN100) and Smaller: MSS SP-110, Class 150, 600-psi (4140-kPa) CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; chrome-plated brass ball, standard port for 1/2-inch (DN15) valves and smaller and conventional port for 3/4-inch (DN20) valves and larger; blowout proof; bronze or brass stem; teflon seats and seals; threaded or sol- dered end connections:

1. Operator: Vinyl-covered steel lever handle.
2. Stem Extension: For valves installed in insulated piping.

2.5 PLUG VALVES

A. Plug Valves: MSS SP-78, 175-psi (1200-kPa) CWP, ASTM A 126 cast-iron body and bonnet, cast-iron plug, Buna N, Viton, or teflon packing, flanged or grooved end connections:

1. Operator: Square head with 1 wrench for every 10 valves.

2.6 GLOBE VALVES

A. Globe Valves, 2-1/2 Inches (DN65) and Smaller: MSS SP-80; Class 125, 200-psi (1380-kPa) CWP, or Class 150, 300-psi (2070-kPa) CWP; ASTM B 62 cast-bronze body and screwed

bon- net, rubber, bronze, or teflon disc, silicon bronze-alloy stem, teflon-impregnated packing with bronze nut, threaded or soldered end connections; and with aluminum or malleable-iron hand- wheel.

B. Globe Valves, 3 Inches (DN80) and Larger: MSS SP-85, Class 125, 200-psi (1380-kPa) CWP, ASTM A 126 cast-iron body and bolted bonnet with bronze fittings, renewable bronze seat and disc, brass-alloy stem, outside screw and yoke, teflon-impregnated packing with cast-iron fol- lower, flanged end connections; and with cast-iron handwheel.

2.7 BUTTERFLY VALVES

A. Butterfly Valves: MSS SP-67, 200-psi (1380-kPa) CWP, 150-psi (1035- kPa) maximum pres- sure differential, ASTM A 126 cast-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals, wafer, lug, or grooved style:

1. Disc Type: Aluminum bronze.
2. Operator for Sizes 2 Inches (DN50) to 6 Inches (DN150): Lever handle with latch lock.
3. Operator for Sizes 8 Inches (DN200) to 24 Inches (DN600): Gear operator with position indicator.
4. Operator for Sizes 8 Inches (DN200) and Larger, 96 Inches (2400 mm) or Higher above Floor: Chain-wheel operator.

2.8 CHECK VALVES

A. Swing Check Valves, 2-1/2 Inches (DN65) and Smaller: MSS SP-80; Class 125, 200-psi (1380- kPa) CWP, or Class 150, 300-psi (2070-kPa) CWP; horizontal swing, Y-pattern, ASTM B 62 cast-bronze body and cap, rotating bronze disc with rubber seat or composition seat, threaded or soldered end connections:
B. Swing Check Valves, 3 Inches (DN80) and Larger: MSS SP-71, Class 125, 200-psi (1380-kPa) CWP, ASTM A 126 cast-iron body and bolted cap, horizontal-swing bronze disc, flanged or grooved end connections.

C. Wafer Check Valves: Class 125, 200-psi (1380-kPa) CWP, ASTM A 126 cast-iron body, bronze disc/plates, stainless-steel pins and springs, Buna N seals, installed between flanges.

D. Lift Check Valves: Class 125, ASTM B 62 bronze body and cap (main components), horizontal or vertical pattern, lift-type, bronze disc or Buna N rubber disc with stainless-steel holder threaded or soldered end connections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves from fully open to fully closed positions. Examine guides and seats made ac- cessible by such operation.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

A. Install valves as indicated, according to manufacturer's written instructions.

B. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

C. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

D. Locate valves for easy access and provide separate support where necessary. E. Install valves in horizontal piping with stem at or above the center of the pipe. F. Install valves in a position to allow full stem movement.G. For chain-wheel operators, extend chains to 60 inches (1500 mm) above finished floor eleva- tion.

H. Installation of Check Valves: Install for proper direction of flow as follows:

1. Swing Check Valves: Horizontal position with hinge pin level.
2. Wafer Check Valves: Horizontal or vertical position, between flanges.
3. Lift Check Valve: With stem upright and plumb.

3.3 SOLDERED CONNECTIONS

A. Cut tube square and to exact lengths.

B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket.

C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube. D. Open gate and globe valves to fully open position.
E. Remove the cap and disc holder of swing check valves having composition discs.

F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Ro- tate tube or valve slightly to ensure even distribution of the flux.

G. Apply heat evenly to outside of valve around joint until solder melts on contact. Feed solder un- til it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the sol- der starts cooling, remove excess amounts around the joint with a cloth or brush.

3.4 THREADED CONNECTIONS
A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.5 FLANGED CONNECTIONS A. Align flange surfaces parallel.
B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.
C. For dead-end service, butterfly valves require flanges both upstream and downstream for prop- er shutoff and retention.

3.6 VALVE END SELECTIONA. Select valves with the following ends or types of pipe/tube connections:

1. Copper Tube Size, 2-1/2 Inches (DN65) and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
2. Steel Pipe Sizes, 2-1/2 Inches (DN65) and Smaller: Threaded or grooved end.
3. Steel Pipe Sizes, 3 Inches (DN80) and Larger: Grooved end or flanged.

3.7 APPLICATION SCHEDULE

A. General Application: Use gate, ball, and butterfly valves for shutoff duty; globe, ball, and butter- fly for throttling duty. Refer to piping system Specification Sections for specific valve applica- tions and arrangements.

B. Heating Water Systems: Use the following valve types:

1. Gate Valves: Class 150, bronze or cast-iron body to suit piping system.
2. Ball Valves: Class 150, 600-psi (4140-kPa) CWP, with stem extension and memory stop.
3. Plug Valves: Viton or teflon packing.
4. Globe Valves: Class 150, bronze or cast-iron body to suit piping system, and bronze disc.
5. Butterfly Valves: Nickel-plated ductile iron, aluminum bronze, or epoxy-coated ductile iron disc; EPDM or Buna N sleeve and stem seals.
6. Bronze Swing Check: Class 150, with composition seat.
7. Check Valves: Iron swing, wafer, or lift type, as indicated. Swing check shall be Class 150 with bronze seat ring.

C. Low-Pressure Steam and Condensate Return Systems: Use the following valve types:

1. Gate Valves: Class 150, bronze body; or Class 125, cast-iron body.
2. Ball Valves: Class 150, 600-psi (4140-kPa) CWP, with stem extension.
3. Plug Valves: Viton or teflon packing.
4. Globe Valves: Class 150, bronze body with teflon disc; or Class 125, cast-iron body.
5. Check Valves: Class 150, bronze body swing check with composition seat; Class 150, cast-iron body swing check with bronze seat ring; or Class 125, cast-iron body wafer check.

D. Chilled-Water Systems: Use the following valve types:

1. Gate Valves: Class 150, bronze body; or Class 125, cast-iron body.
2. Ball Valves: Class 150, 600-psi (4140-kPa) CWP, with stem extension and memory stop.
3. Plug Valves: Buna N packing.
4. Globe Valves: Class 125, bronze body with bronze or teflon disc; or Class 125, cast-iron body.
5. Butterfly Valves: Nickel-plated ductile iron, aluminum bronze, or elastomer-coated ductile iron disc; EPDM sleeve and stem seals.
6. Check Valves: Class 125, bronze body swing check with rubber seat; Class 125, cast-iron body swing check; Class 125, cast-iron body wafer check; or Class 125, cast-iron body lift check.

E. Condenser Water Systems: Use the following valve types:

1. Gate Valves: Class 125, bronze body; or Class 125, cast-iron body.
2. Ball Valves: Class 150, 600-psi (4140-kPa) CWP, with memory stop.
3. Plug Valves: Buna N packing.

4. Globe Valves: Class 125, bronze body with bronze or teflon disc; or Class 125, cast-iron body.
5. Butterfly Valves: Aluminum bronze, epoxy-coated ductile iron disc; EPDM sleeve and stem seals.
6. Check Valves: Class 125, bronze body swing check with rubber seat; Class 125, cast-iron body swing check; Class 125, cast-iron body wafer check; or Class 125, cast-iron body lift check.

3.8 ADJUSTING

A. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION

SECTION 15140 - WATER PIPING

PART 1 - PART 1 – GENERAL

1.1

A. RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes domestic water piping from locations indicated to fixtures and equip- ment inside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Distribution Piping: 80 psig

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Water Samples: Specified in "Cleaning" Article in Part 3.

C. Field Test Reports: Indicate and interpret test results for compliance with performance re- quirements.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic, pota- ble domestic water piping and components.

C. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PART 2 – PRODUCTS

2.1 PIPING MATERIALS

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

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fit- ting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

C. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBING

A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. 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.

B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.

4. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
5. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
6. 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.
7. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze cast-ings.

2.3 VALVES

A. Refer to Division 15 Section "Valves" for bronze and cast- iron, general-duty valves. B. Refer to Division 15 Section "Plumbing Specialties" for balancing and drain valves.

PART 3 - PART 3 – EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated. C. Grooved joints may be used on aboveground grooved-end piping.
D. Fitting Option: Mechanically formed tee-branch outlets and brazed joints may be used on aboveground copper tubing.

E. Underground Domestic Water Service Piping: Use any of the following piping materials for each size range:

1. NPS 2 and Smaller: Soft copper tube, Type K, Type L, copper pressure fittings; and soldered joints.
2. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Soft copper tube, Type K, Type L; copper pressure fittings; and soldered joints.

F. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:

1. NPS 1-1/2 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. NPS 2: Hard copper tube, Type L, Type M; copper pressure fittings; and soldered joints.
3. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type L, Type M; copper pressure fittings; and soldered joints.
4. NPS 4 to NPS 6: Hard copper tube, Type L, Type M; copper pressure fittings; and soldered joints.
5. NPS 8: Hard copper tube, Type L, Type M with grooved ends; copper grooved-end fittings; copper-tubing, keyed couplings; and grooved joints.

G. Underground Domestic Water Piping NPS 4 and Smaller: Soft Copper tube, Type L; copper pressure fittings; and soldered joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast- iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

3.4 PIPING INSTALLATION

A. Refer to Division 2 Section "Water Distribution" for site water distribution and service pip- ing.

B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping in- stallation.

C. Extend domestic water service piping to exterior water distribution piping in sizes and loca- tions indicated.

D. Install underground copper tubing according to CDA's "Copper Tube Handbook."

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe pene- tration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Meth- ods" for sleeves and mechanical sleeve seals.

F. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, in- side building at each domestic water service. Refer to Division 15 Section "Meters and Gag- es" for pressure gages, and to Division 15 Section "Plumbing Specialties" for drain valves and strainers.

G. Install water-pressure regulators downstream from shutoff valves. Refer to Division 15 Sec- tion "Plumbing Specialties" for water-pressure regulators.

H. Install aboveground domestic water piping level with 0.25 percent slope downward toward drain and plumb.

I. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

J. Perform the following steps before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. 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.

K. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

L. Check plumbing specialties and verify proper settings, adjustments, and operation.

1. Water-Pressure Regulators: Set outlet pressure at 80 psig maximum, unless otherwise indicated.

3.5 M. Energize pumps and verify proper operation.

JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. 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.

3.6 VALVE INSTALLATION

A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use but- terfly or gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment, at base of each water riser, at low points in horizontal pip- ing, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. 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. Refer to Division 15 Section "Plumbing Specialties" for calibrated balancing valves.

3.7 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section "Mechanical Vibration Controls and Seismic Restraints" for seismic-restraint devices.

B. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. In- stall the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 15 Section "Hangers and Supports." D. Support vertical piping and tubing at base and at each floor.
E. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

F. Install hangers for copper tubing with the following maximum horizontal spacing and mini- mum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

3.8 G. Install supports for vertical copper tubing every 10 feet.

CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:

1. Booster Systems: Cold-water suction and discharge piping 2. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
4. 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 and larger.

3.9 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. 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.
2. 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.
3. Cap and subject piping to static water pressure of 50 psig 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.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.11 ADJUSTING

A. 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.

3.12 CLEANING

A. Clean and disinfect potable and nonpotable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 151

SECTION 15150 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL
1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.

B. Related Sections include the following:

1. Division 15 Section "Plumbing Specialties" for soil, waste, and vent piping systems specialties.
2. Division 15 Section "Sewage Pumps" for drainage connections for effluent pumps.

1.3 DEFINITIONS

A. The following are industry abbreviations for piping materials:

1. CI: Cast iron pipe.
2. DI: Ductile Iron.
3. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Sanitary Sewer, Force-Main Piping: 100 psig.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.
B. Shop Drawings: For sovent drainage system, include plans, elevations, sections, and details.
C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, “Plastics Piping Systems Components and Related Materials,” for plastic piping components. Include marking with “NSF-dwv” for plastic drain, waste, and vent piping; “NSF-drain” for plastic drain piping; “NSF-tubular” for plastic continuous waste piping; and “NSF-sewer” for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

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

B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elas- tomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

C. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type cou- pling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 CAST-IRON SOIL PIPING

A. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.

1. Gaskets: ASTM C 564, rubber.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.

C. Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

1. NPS 1-1/4 and NPS 8: Use NPS 1-1/2 hubless, cast-iron soil piping and one of the following for the building:

a. Couplings: Heavy-duty, Type 304, stainless steel.

2. NPS 2 to NPS 10: Service class, cast-iron soil piping; gaskets; and gasketed joints for the building.

3. NPS 2 to NPS 10: Hubless, cast-iron soil piping and one of the following for the building:

a. Couplings: Heavy-duty, Type 304, stainless steel.

4. NPS 2 to NPS 4: Steel pipe; cast-iron, threaded drainage fittings; and threaded joints.

3.3 PIPING INSTALLATION

A. Refer to Division 2 Section "Sanitary Sewerage" for Project-site sanitary sewer piping.

B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping instal- lation.

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sani- tary sewers.

D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetra- tion through foundation wall. Select number of interlocking rubber links required to make in- stallation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

F. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for wall penetration systems.

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

1. Encase underground piping with PE film according to ASTM A 674 or AWWA C105.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and re-
ducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes, unless other- wise indicated:

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

K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by con- struction manager.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fit- tings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.6 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section "Mechanical Vibration Controls and Seismic Restraints" for seis- mic-restraint devices.

B. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. In- stall the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers. b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 15 Section "Hangers and Supports." D. Support vertical piping and tubing at base and at each floor.
E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6: 60 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
6. NPS 15: 60 inches with 1-inch rod.
7. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. 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.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. 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.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with wa- ter to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

Plug vent-stack openings on roof and building drains where they leave building. Intro- duce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer in- serted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fix- ture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.9 CLEANING

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

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 15150

SECTION 15410 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES A. Valve boxes.
B. Acid Neutralization tanks. C. Dialysis boxes.
D. Fixture carriers. E. Floor sinks.
1.2 RELATED SECTIONS

A. Section - . B. Section - .
1.3 SUBMITTALS
A. Submit under provisions of Section 01 30 00 - Administrative Requirements. B. Product Data:
1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Typical installation methods.

C. Verification Samples: Two representative units of each type, size, pattern, and color.

D. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

D. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.
1. Intent of mock-up is to demonstrate quality of workmanship and visual

appearance.
2. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
3. Retain mock-up during construction as a standard for comparison with completed work.

4. Do not alter or remove mock-up until work is completed or removal is authorized.

1.5 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

1.7 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 recommended limits.

1.8 WARRANTY

A. Manufacturer's standard limited warranty unless indicated otherwise. PART 2 PRODUCTS
2.1 MANUFACTURERS

A. Acceptable Manufacturer: MIFAB, Inc.

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 VALVE BOXES

A. MI-VB Valve Box: For access and protection of valves in a wall.
1. Material: Satin coat steel. Door and Frame: 16 gauge. Box: 20 gauge. Finish: Primed white.
2. Material: 305 stainless steel. Door and Frame: 16 gauge. Box: 20 gauge.
a. Finish: No. 4 brush satin finish on door and frame and a 2B finish on the box. b. Door: Flush to frame. Turned back around edges for extra rigidity.
1) Opening cut out of door to allow installation of glass or plastic window.
a) Glazing supplied by others.

c. Frame: Welded to box. Pre-punched mounting holes for simple installation.
3. Box Depth: Customizable to meet rough in requirements.4. Hinge: Concealed pivot pins.
5. Latch: Flush mounted, screwdriver operated cam.
6. Latch: Allen key, cylinder key, or paddle latch. Cylinder key locks are keyed alike.

B. MI-VB-SM Valve Box: For access and protection of valves extending outside of wall.
1. Material: Satin coat steel. Door and Frame: 16 gauge. Box: 20 gauge. Finish: Primed white.
2. Material: 305 stainless steel. Door and Frame: 16 gauge. Box: 20 gauge.
a. Finish: No. 4 brush satin finish on door and frame and a 2B finish on the box. b. Door: Overlaps box, providing a tight secure fit.
1) Opening cut out of door to allow installation of glass or plastic window.
a) Glazing supplied by others.
c. Frame: Welded to box. Pre-punched mounting holes for simple installation.
3. Box Depth: Can be customized to meet rough in requirements.
4. Hinge: Concealed pivot pins.
5. Latch: Flush mounted, screwdriver operated cam.
6. Latch: Allen key, cylinder key, or paddle latch. Cylinder key locks are keyed alike.

2.3 ACID NEUTRALIZATION TANKS

A. MI-NEUT Acid Neutralization Tank: For laboratories, industrial processes, or other polluting sources to dilute and neutralize harmful discharged wastes. For chemical treatment plants or municipal water treatment facilities for diluting polluted effluent. Tank is filled with neutralization medium lump limestone, 1 to 3 inch diameter size. Water is then added to tank to help dilution.
1. Body: Solid construction seamless polyethylene with inlet and outlet.
2. Lid: Acid resistant, epoxy coated, and neoprene gasketed. Secured with stainless steel hardware. Vent Connections: Optional.
3. Capacity: 2 to 3000 gallons.
4. Routine Maintenance: Every 1 to 3 months. May be more frequent due to waste going through unit.

B. MI-NEUT-P Point of Use Application Acid Neutralization Tank: For laboratories, industrial processes to dilute and neutralize harmful discharged wastes. For chemical treatment plants or municipal water treatment facilities for diluting polluted effluent.
1. Replaces standard P-trap and need for downstream acid waste piping. Max. Flow Rate: 8 GPM. Uses solid alkali non-resin materials to neutralize acids in a self- contained system. Bucket (Pail), Siphon with Tubing, and Support Pipe with Flange.

2.4 DIALYSIS BOXES

A. MI-DIAL Series: For dialysis machines using reverse osmosis and deionized water, mixed with dialysate saline concentrate. This corrodes steel, some stainless steels, cast iron, copper, and brass metals regularly used in supply/waste systems.

1. Product: MI-DIAL Dialysis Box with One Valve: 16 gauge, Type 316 stainless steel, satin finish, continuous welded corners, four mounting anchor tabs, removable finishing frame and door, one 1/2 inch NPT PVC supply connection with PVC ball valve and 3/4 inch hose connection. Bracket with grommets for two 3/8 inch diameter hose, and 2 inch stainless steel drain connection with sloped bottom.
2. Product: MI-DIAL-2 Dialysis Box with Two Valves: 16 gauge, Type 316 stainless steel, satin finish, continuous welded corners, four mounting anchor tabs, removable finishing frame and door, two 1/2 inch NPT PVC supply connections with PVC ball valves and 3/4 inch hose connections. Bracket with grommets for two 3/8 inch diameter hose and 2 inch stainless steel drain connection with sloped bottom.
3. Product: MI-DIAL-2-LD Dialysis Box with Two Valves: Construction: 16 gauge, Type 16 stainless steel, satin finish, continuous welded corners, four mounting anchor tabs, removable finishing frame and door, two 1/2 inch NPT PVC supply connections with PVC ball valves and 3/4 inch hose connections. Bracket with grommets for two 3/8 inch diameter hose and 2 inch stainless steel drain connection with sloped bottom.
4. Product: MI-DIAL-BPS: Stainless Steel Dialysis Supply and Separate Waste Box with FRP Valve and Trap Seal Primer: 16 gauge, Type 316 stainless steel, satin finish, continuous welded corners, four mounting anchor tabs, removable 304 stainless steel finishing frame and cover, 1/2 inch sweat supply connection, 3/4 inch hose connection with trap seal primer, shut off valve, reduced pressure zone backflow preventer, and 2 inch NPT stainless steel drain connection. All boxes slope towards outlet.
5. Product: MI-DIAL-CB Stainless Steel Compartmentalized Dialysis Supply and Waste Box: 16 gauge, Type 316 stainless steel, continuous welded corners, four mounting anchor tabs, and removable 304 stainless steel, finishing frame and cover 1/2 inch NPT supply connection, 3/4 inch hose connection with trap seal primer, shut off valve, reduced pressure zone backflow preventer, and 1-1/2 inch NPT stainless steel drain connection. All boxes slope towards outlet.
6. Product: MI-DIAL-DB Compartmentalized Dialysis Supply & Waste Box with FRP Valve and Trap Seal Primer: 16 gauge, Type 316 stainless steel, continuous welded corners, four mounting anchor tabs, and removable 304 stainless steel finishing frame and cover 1/2 inch NPT supply connection, 3/4 inch hose connection with trap seal primer, shut off valve, reduced pressure zone backflow preventer, and 1-
1/2 inch NPT stainless steel drain connection. All boxes slope towards outlet.
7. Product: MI-DIAL-LD Dialysis Box with One Valve: 16 gauge, Type 316 stainless steel, satin finish, continuous welded corners, four mounting anchor tabs, one 1/2 inch NPT PVC supply connection with PVC ball valve and 3/4 inch hose connection. Bracket with grommets for two 3/8 inch diameter hose and 2 inch stainless steel drain connection with sloped bottom.

2.5 FIXTURE CARRIERS

A. Standards compliance: Complies with ASME A112.6.1M applicable requirements.

B. Long Barrel Horizontal Fixture Carriers: For off the floor fixtures. Barrel Fitting: 37 inch long. Auxiliary Inlet: Receives waste from urinals and lavatories beside or opposite the carrier reducing space required in pipe chase. Concealed within wall and supports the fixture load through a faceplate and foot support anchored to the floor.

1. Product: MC-10-27-37 Adjustable Water Closet Carrier with Auxiliary Inlet and Barrel: Horizontal, lacquered, 37 inch long barrel cast iron fitting, 4 inch no hub waste, 2 inch no hub vent connection, 2 inch no hub auxiliary inlet connection, lacquered cast iron gasketed adjustable faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support.
2. Product: MC-10-27-37-HS Adjustable Hub and Spigot Water Closet Carrier with Aux. Inlet and Long Barrel: Horizontal, lacquered, 37 inch long barrel cast iron fitting, 2 inch no hub vent connection, 2 inch no hub auxiliary inlet connection, lacquered cast iron gasketed adjustable faceplates, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipples with integral test caps, neoprene bowl gaskets, hardware, threaded rod protectors and polished chrome plated finishing cap nuts.
3. Product: MC-10D-27-37 Double, Adjustable Water closet Carrier with Aux 2" Inlet and Barrel: Lacquered, 37 inch long barrel cast iron fitting, 4 inch no hub waste, 2 inch no hub vent connection, 2 inch no hub auxiliary inlet connection, lacquered cast iron gasketed adjustable faceplates, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipples with integral test caps, neoprene bowl gaskets, hardware, threaded rod protectors and polished chrome plated finishing cap nuts.
4. Product: MC-10D-27-37-HS Double, Adjustable Hub and Spigot Water Closet Carrier with Aux Inlet: Lacquered, 37 inch long barrel cast iron fitting, 2 inch no hub vent connection, 2 inch no hub auxiliary inlet connection, lacquered cast iron gasketed adjustable faceplates, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipples with integral test caps, neoprene bowl gaskets, hardware, threaded rod protectors and polished chrome plated finishing cap nuts.

C. Regular Horizontal Fixture Carriers: For wall mounted, off the floor plumbing fixtures. Auxiliary inlet is designed to receive waste from urinals and lavatories beside or opposite carrier to reduce space in the pipe chase. Carrier concealed within the wall and supports the fixture load through a faceplate and foot support system anchored to the floor.

1. Attributes: Lacquered cast iron fitting, 2 inch no hub vent connection: lacquered cast iron gasketed adjustable faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support.
a. Product: MC-10-27 Horizontal, Adjustable, Water Closet Carrier with Auxiliary

Inlet: 4 inch no hub waste, 2 inch no hub auxiliary inlet connection.
b. Product: MC-10-3NH 3" Fitting, Horizontal, Adjustable Water Closet Carrier: 3 inch no hub waste
c. Product: MC-10-EXT Horizontal, Adjustable Water Closet Carrier for ADA in Middle of Battery: 4 inch no hub waste.
d. Product: MC-10D-27 Double, Horizontal, Adjustable Water Closet Carrier with Auxiliary Inlet: 4 inch no hub waste, 2 inch no hub auxiliary inlet connection, e. Product: MC-10D-3NH 3" Fitting, Double, Horizontal Adjustable Water Closet Carrier: 3 inch no hub waste,
f. Product: MC-10D-EXT Double, Horizontal, Adjustable Water Closet Carrier for ADA in Middle of Battery: 4 inch no hub waste,
g. Product: MC-10D-HS Double, Horizontal Adjustable Hub and Spigot Water Closet:
2. Attributes: Lacquered cast iron fitting, 2 inch hub and spigot vent connection, lacquered cast iron gasketed adjustable faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support.
a. Product: MC-10-EXT-HS Horizontal, Adjustable Water Closet Carrier for ADA in Middle of Battery with Hub & Spigot Connection: 4 inch hub and spigot waste
b. Product: MC-10D-EXT-HS Double, Horizontal, Adjustable Water Closet Carrier for ADA in Middle of Battery with Hub & Spigot Connection: 4 inch hub and spigot waste,

D. Other Horizontal Fixture Carriers:
1. Attributes: Lacquered cast iron fitting, 2 inch no hub vent connection, lacquered cast iron gasketed adjustable faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support. 10-1/2 inch front of foot and rear of anchor support. 8 inch wall space back of rear anchor support and back of in wall foot supports. Factory assembled foot supports and faceplate in siphon jet configuration. Reversible for blowout design.

a. Product: MC-10 Horizontal, Adjustable Water Closet Carrier: For wall mounted, off floor plumbing fixtures Concealed in wall. Supports fixture load through faceplate and foot support system anchored to floor. 4 inch no hub waste
b. Product: MC-10-HS Horizontal Adjustable Hub and Spigot Water Closet Carrier: For wall mounted off floor plumbing fixtures. Carrier is concealed in wall and supports fixture load through faceplate and foot support system anchored to the floor. 4 inch hub waste
c. Product: MC-10D Double, Horizontal Adjustable Water Closet Carrier: For wall mounted back to back off floor plumbing fixtures Concealed in wall;
supports fixture load through faceplate and foot supports anchored to floor.
14-1/2 inch space between front of foot supports. 9 inch wall space between back of in wall foot supports. 4 inch no hub waste

d. Product: MC-10-HDX Extra Heavy Duty 1,000 lbs Load Rated Water Closet Carrier: Adjustable support frame and rear anchor tie-down. Feet and rear anchors are bolted to floor using anchors achieving the specified "pull-out" force of 750 lbs.

E. Fixed Vertical Fixture Carriers:

1. Attributes: For single water closets with waste line below the floor slab. Typical wall mounted off floor plumbing fixtures having no contact with finished floor. Carrier is concealed in the wall and supports fixture load through a faceplate and foot support system anchored to the floor.

a. Product: MC-14 Fixed On-Stack Water Closet Carrier: Lacquered cast iron fitting, 3 or 4 inch no hub waste, 2 or 4 inch no hub vent connection, lacquered cast iron faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support.

b. Product: MC-14-HS Fixed Hub and Spigot on Stack Water Closet Carrier: Lacquered cast iron fitting, 4 inch waste, 2 inch vent connection, lacquered cast iron faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support.

2. Attributes: For water closets offset from a common stack by 4 inches in multi-floor installations where minimum pipe space is required. Typical wall mounted off floor plumbing fixtures having no contact with finished floor. Carrier is concealed in the wall and supports fixture load through a faceplate and foot support system that is anchored to the floor.

a. Product: MC-15 Fixed, Offset from Stack Water Closet Carrier: Offset lacquered cast iron fitting, 4 inch no hub waste, 2 inch no hub vent connection, lacquered cast iron faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support.

b. Product: MC-15-HS Fixed Hub & Spigot Water Closet Carrier Offset from Stack: Offset lacquered cast iron fitting, 4 inch waste, 2 inch vent connection, lacquered cast iron faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support.

c. Product: MC-15D Double, Fixed, Offset from Stack Water Closet Carrier: Offset lacquered cast iron fitting, 4 inch no hub waste, 2 inch no hub vent connection, lacquered cast iron gasketed adjustable faceplates, universal loor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipples with integral test caps, neoprene bowl gaskets, hardware, threaded rod protectors and polished chrome plated finishing cap nuts.

d. Product: MC-15D-HS Double, Fixed Hub and Spigot Water Closet Carrier Offset from Stack: Offset lacquered cast iron fitting, 4 inch waste, 2 inch vent connection, lacquered cast iron gasketed adjustable faceplates, universal floor mounted cast iron foot supports,

adjustable 8 inch tapered thread ABS nipples with integral test caps, neoprene bowl gaskets, hardware, threaded rod protectors and polished chrome plated finishing cap nuts.

F. Adjustable Vertical Fixture Carriers:

1. Attributes: For through slab pipe connection with water closets installed on a common stack. Adjustable faceplate permits installer to set water closet to desired height from finished floor, relative to vertical carrier fitting within the stack. Wall mounted off floor fixtures Carrier is concealed in wall and supports fixture load through faceplate and foot support system anchored to floor.

a. Product: MC-12 Adjustable Water Closet Carrier: Lacquered cast iron fitting, 4 inch no hub waste, 2 inch no hub vent connection, lacquered cast iron gasketed adjustable faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support. 11 inch space between front of foot and rear of anchor support. 7-1/4 inch wall space between back of rear anchor support and back of in wall foot supports. Factory assembled foot supports and faceplate in siphon jet configuration. Reversible for blowout design.

b. Product: MC-12-HS Adjustable Hub and Spigot Water Closet Carrier: Lacquered cast iron fitting, 2 inch no hub vent connection, lacquered cast iron gasketed adjustable faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support. 11 inch space between front of foot and rear of anchor support. 7-1/4 inch wall space between back of rear anchor support and back of in wall foot supports. Factory assembled foot supports and faceplate in siphon jet configuration. Reversible for the blowout water closet design.

c. Product: MC-12D Double, Adjustable Back to Back Water Closet Carrier: Lacquered cast iron fitting, 4 inch no hub waste, 2 inch no hub vent connection, lacquered cast iron gasketed adjustable faceplates, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipples with integral test caps, neoprene bowl gaskets, hardware, threaded rod protectors and polished chrome plated finishing cap nuts. 14-1/2 inch space between front of foot supports. 9 inch wall space required between back of in wall foot supports. Factory assembled foot supports and faceplate in siphon jet configuration. Reversible for blowout water closet design.

d. Product: MC-12D-HS Double, Adjustable Hub and Spigot Water Closet Carrier: Lacquered cast iron fitting, 2 inch no hub vent connection, lacquered cast iron gasketed adjustable faceplates, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipples with integral test caps, neoprene bowl gaskets, hardware, threaded rod protectors and polished chrome plated finishing cap nuts. 14 1/2 inch space required between front of foot supports. 9 inch wall space required

between back of in wall foot supports. Factory assembled foot supports and faceplate in siphon jet configuration. Reversible for blowout water closet design.

2. Attributes: For through slab pipe connection with water closets installed on a common stack, with one or two side inlets receiving waste from horizontal piping or waste from other fixtures with waste lines roughed in above floor slab. Adjustable faceplate permits installer to set water closet to desired height from finished floor, relative to the vertical carrier fitting within the stack and position horizontal waste piping from horizontal carriers within the battery. Wall mounted off floor fixtures. Carrier is concealed in wall and supports fixture load through faceplate and foot support system anchored to floor. Factory assembled foot supports and faceplate in siphon jet water configuration. Reversible for blowout water closet design.

a. Product: MC-13 Adjustable Water Closet Carrier with Side Inlets: Lacquered cast iron fitting, left, right or both 4 inch side inlets, 4 inch no hub waste, 2
inch no hub vent connection, lacquered cast iron gasketed adjustable faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support. 11 inches required between front of foot and rear of anchor support. 8 1/2 inch in wall space required between back of rear anchor support and back of in wall foot supports.

b. Product: MC-13-HS Adjustable Hub and Spigot Water Closet Carrier with Side Inlets: Lacquered cast iron fitting, left, right or both, 4 inch side inlets, 2 inch vent connection, lacquered cast iron gasketed adjustable faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware,
threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support. 11 inches required between front of foot and rear of anchor support. 8-1/2 inch minimum in wall space required between
back of rear anchor support and back of in wall foot supports.

c. Product: MC-13D Double, Adjustable Back to Back Water Closet Carrier with Side Inlets: Lacquered cast iron fitting, left, right or both 4 inch side inlets, 4 inch no hub waste, 2 inch no hub vent connection, lacquered cast iron gasketed adjustable faceplates, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipples with integral test caps, neoprene bowl gaskets, hardware, threaded rod protectors and polished chrome plated finishing cap nuts. 14-1/2 inch required between front of foot supports. 9 inch wall space required between back of wall foot supports.

d. Product: MC-13D-HS Double, Adjustable Back to Back Hub and Spigot Water Closet Carrier with Side Inlets: Lacquered cast iron fitting, left, right or both 4 inch side inlets, 4 inch no hub waste, 2 inch no hub vent connection, lacquered cast iron gasketed adjustable faceplates, universal floor
mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipples with integral test caps, neoprene bowl gaskets, hardware, threaded rod protectors and polished chrome plated finishing cap nuts. 14-1/2 inch minimum space required between front of foot supports. 9 inch minimum in wall space required between back of in wall foot supports.

G. Plate Type Fixture Carriers: Concealed Arms

1. Attributes: For Support off-floor fixture. Vertical load bearing components are concealed within the wall. Fixture carrier has no contact with finished floor inside of the room.

a. Product: MC-41 Single Carrier with Concealed Arms: Floor mounted concealed arm lavatory carrier. Lacquered, adjustable, ductile iron concealed support arms. Lacquered cast iron invertible and adjustable arm supporting brackets, adjustable steel nipples with locknut and set screws, alignment rod, two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 welded steel feet. Fixture leveling and locking hardware.

b. Product: MC-41-R Single Carrier with Concealed Arms and Round Uprights: Floor mounted concealed arm lavatory carrier. Lacquered, adjustable, ductile iron concealed support arms. Lacquered cast iron invertible and adjustable arm supporting brackets, alignment rod, two lacquered 2 inch diameter x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and fixture leveling and locking hardware. The round uprights allow for lateral adjustment to the arms.

c. Product: MC-41-TR Single Carrier with Concealed Arms and Measuring Plates: Lacquered, adjustable, ductile iron concealed support arms and measuring plates. Complete with lacquered cast iron invertible and
adjustable arm supporting brackets, adjustable steel nipples with locknut and set screws, measuring plates, two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and fixture leveling and locking hardware.

2. Attributes: For Supporting back to back off-floor fixtures. Vertical load bearing components are concealed within the wall. Fixture carrier has no contact with the finished floor inside of the room.

a. Product: MC-41D Double Fixture Carrier with Concealed Arms: Lacquered, adjustable, ductile iron concealed support arms. Lacquered cast iron invertible and adjustable arm supporting brackets, adjustable steel nipples with locknut and set screws, alignment rod, two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet, fixture
leveling and locking hardware.

b. Product: MC-41D-R Double Fixture Carrier with Concealed Arms and Round Uprights for ADA: Lacquered, adjustable, ductile iron concealed support arms. Lacquered cast iron invertible and adjustable arm supporting brackets, alignment rod, two lacquered 2 inch diameter x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and fixture leveling and locking hardware. The round uprights allow for lateral adjustment to the arms.

3. Attributes: Support off-floor ADA elongated fixtures. Vertical load bearing components are concealed within the wall. Carrier has no contact with finished floor inside of room.

a. Product: MC-42 Single Carrier with Concealed Arms for ADA Lacquered, adjustable, ductile iron concealed support arms. Lacquered cast iron invertible and adjustable arm supporting brackets, adjustable steel nipples with locknut and set screws, alignment rod, two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and fixture leveling and locking hardware.

b. Product: MC-42-R Single Carrier with Concealed Arms and Round Uprights for ADAL Lacquered, adjustable, ductile iron concealed support arms. Lacquered cast iron invertible and adjustable arm supporting brackets, alignment rod, two lacquered 2 inch diameter x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and fixture leveling and locking hardware. The round uprights allow for lateral adjustment to the arms.
c. Product: MC-42D-R Double Fixture Carrier with Concealed Arms and Round Uprights for ADA Lavatories: Lacquered, adjustable, ductile iron concealed support arms. Lacquered cast iron invertible and adjustable arm supporting
brackets, alignment rod, two lacquered 2 inch diameter x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and fixture leveling and locking hardware. Round uprights allow for lateral adjustment to the arms.

4. Attributes: For supporting back to back off-floor ADA elongated fixtures. Vertical load bearing components are concealed within the wall. The fixture carrier has no contact with the finished floor inside of the room.
a. Product: MC-42D Double Fixture Carrier with Concealed Arms and Round Uprights for ADA Lavatories: Lacquered, adjustable, ductile iron concealed support arms. Lacquered cast iron invertible and adjustable arm supporting brackets, adjustable steel nipples with locknut and set screws, tie rod, two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and fixture leveling and locking hardware.
5. Attributes: For securing fixture to wall in areas where a floor mounted carrier cannot be installed. Wall structure must be strong enough to bear weight of the fixture. Vertical load bearing components are concealed within the wall. Carrier
has no contact with finished floor inside of room.
a. Product: MC-51 Single Carrier Wall Mounted Lavatory Support with Concealed Arms: Lacquered, adjustable, ductile iron concealed support arms. Lacquered cast iron adjustable wall plate, adjustable steel nipples with locknut and set screws, and fixture leveling and locking hardware.
b. Product: MC-51-LP Single Carrier Concealed Arms for Lavatory Support: Specification: MIFAB Series MC-51-LP lacquered, adjustable, ductile iron concealed support arms with locknut, set screws and fixture leveling and locking hardware. Installer must provide their own mounting plate and hardware.
c. Product: MC-53 Single Wall Mounted Support with Concealed Arms and Backing Plates: Lacquered, adjustable, ductile iron concealed support arms. Lacquered cast iron adjustable wall plate, backing plates, adjustable steel nipples with locknut and set screws, and fixture leveling, locking, and mounting hardware. Backing plates provide additional rigidity to system.
d. Product: MC-54 Single Wall Mounted Lavatory Support with Concealed Arms: Lacquered, adjustable, ductile iron concealed support arms. Fabricated steel wall plate, welded steel nipples with set screws, and fixture leveling and locking hardware. Steel wall plate to be mounted to wall structure per site requirements; bolted, welded, anchored, etc.
e. Product: MC-54-ADJ Wall Mounted Lavatory Support with Concealed Arms: Lacquered, adjustable, ductile iron concealed support arms. Fabricated, horizontal adjustable steel wall plate, welded steel nipples with set screws, and fixture leveling and locking hardware.

6. Attributes: For securing wall-hung lavatories to wall in areas where a floor mounted carrier cannot be installed. Wall structure must be strong enough to bear weight of fixture. Heavy duty exposed cast iron supports provide extra support for the fixture.

a. Product: MC-55 Single Wall Mounted Lavatory Support with Exposed Arms and Backing Plates: White, lacquered, adjustable, cast iron exposed support arms. Complete with lacquered cast iron adjustable wall plate with mounting studs, backing plates and fixture leveling hardware. Backing plates provide additional rigidity to system.

b. Product: MC-56 Single Wall Mounted Lavatory Support with Exposed Arms: White, lacquered, adjustable, cast iron exposed support arms. Lacquered cast iron adjustable wall plate with mounting studs and fixture leveling hardware.

c. Product: MC-56-LP Single Wall Mounted Support: White, lacquered, adjustable, cast iron exposed support arms. Complete with fixture leveling and mounting hardware. Installer to provide means of mounting exposed arms to the wall.

H. Plate Type Fixture Carriers: Exposed Arms

1. Attributes: Used to support heavy duty wall-hung lavatories that are independentof the wall. Heavy duty cast iron support arms provide extra support for the fixture. Designed for use in conjunction with the fixture hangar plate supplied by the fixture manufacturer.

a. Product: MC-34 Single Hanger Plate Carrier with Two Uprights: Universal, adjustable, top support plate and white lacquered, adjustable, cast iron exposed support arms assembled to lacquered cast iron invertible and adjustable arm supporting brackets. Complete with two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and mounting hardware.

b. Product: MC-35 Single Hanger Plate Carrier with Three Uprights: Universal, adjustable, top support plate and white lacquered, adjustable, cast iron exposed support arms assembled to lacquered cast iron invertible and adjustable arm supporting brackets. Complete with two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and mounting hardware.

2. Attributes: Used to support back to back heavy duty wall-hung lavatories independent of the wall. Heavy duty cast iron support arms provide extra support for the fixture. For use in conjunction with the fixture hangar plate supplied by the fixture manufacturer.

a. Product: MC-34D Double Hanger Plate Carrier with Two Uprights: Back to back hanger plate with two universal, adjustable, top support plates and four white, lacquered, adjustable, cast iron exposed support arms assembled to lacquered cast iron invertible and adjustable arm supporting brackets. Complete with two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and mounting hardware.

3. Attributes: Used to support heavy duty lavatories independent of wall. Heavy duty cast iron support arms provide extra support for the fixtures that are unavailable drilled for concealed arms such as semi-countertop lavatories.

a. Product: MC-40 Fixture Carrier: Floor mounted exposed arm lavatory carrier with white, lacquered, adjustable, cast iron exposed support arms. Lacquered cast iron invertible and adjustable arm supporting brackets, alignment rod, two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and mounting hardware.
b. Product: MC-40D Double Fixture Carrier: Floor mounted exposed arm lavatory carrier with back to back white, lacquered, adjustable, cast iron exposed support arms. Complete with back to back lacquered cast iron
invertible and adjustable arm supporting brackets, alignment rod, two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and mounting hardware.

I. Plate Type Fixture Carriers: Regular Plate Type Fixture Carriers
1. Attributes: For use with floor mounted, back outlet water closets
a. Product: MC-26 Single Stack Fitting for Floor Mounted Back Outlet Water Closet: Lacquered cast iron fitting, 4 inch no hub waste, 2 inch no hub vent connection, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and side anchor tie down support.
2. Attributes: For use with floor mounted, back outlet water closets installed at right angles to each other serving two rooms. Optional vent connections are for connection to lavatory waste when required.
a. Product: MC-27 Single Stack Fitting for Floor Mounted Back Outlet Water Closets: Lacquered cast iron 90 degree double no hub stack fitting with 4 inch no hub waste and anti-crossover baffles for floor mounted back outlet water closets. Complete with adjustable 8 inch ABS nipples with integral test caps, neoprene bowl gaskets, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and side anchor tie down supports.
3. Attributes: For use in institutions where one stack fitting serves two rooms while providing separate vent hubs. Also typical with floor mounted, back outlet water closets installed at right angles to each other. The optional vent connections are for connection to lavatory waste when required.
a. Product: MC-28 90 Degree Double No Hub Stack Fitting for Floor Mounted Back Outlet Water Closets: Lacquered cast iron 90 degree double no hub stack fitting with 4 inch no hub waste, 2 inch no hub center vent connection and anti-crossover baffles for floor mounted back outlet water closets.
4. Attributes: For supporting wall-hung fixtures such as urinals and water coolers that are independent of wall. For use in conjunction with fixture hangar plate supplied by fixture manufacturer.
a. Product: MC-31 Single Hanger Plate Carrier with Two Uprights: Lacquered 2 x
1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and mounting hardware
b. Product: MC-32 Hanger Plate Carrier with Bearing Plate and Uprights: Universal, adjustable, top support plate and bottom bearing plate. Lacquered 2 x 1 x 1/8 inch thick

structural steel uprights with 3 x 4-1/2 inch welded steel feet and mounting hardware. Bottom bearing plate provides extra support for the fixture.

c. Product: MC-33 Hanger Plate Carrier with Uprights: Two universal, adjustable, top support plates. Three lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4 -1/2 inch welded steel feet and mounting hardware.

d. Product: MC-33-2 Hanger Plate Carrier with Uprights and Bottom Bearing Plates: Two universal, adjustable, top support plates, and bottom bearing plate. Three lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x
4-1/2 inch welded steel feet and mounting hardware. Bottom bearing plate provides extra support for the fixture.

5. Attributes: For supporting back to back wall-hung fixtures such as urinals and water coolers that are independent of wall. For use in conjunction with fixture hangar plate supplied by the fixture manufacturer.

a. Product: MC-31D Double Hanger Plate Carrier with Two Uprights: Lavatory hanger plate carrier with universal, adjustable, top support plates. Complete with lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and mounting hardware.

b. Product: MC-32D Double Hanger Plate Carrier with Bearing Plates and
Uprights: Universal, adjustable, top support plates and bottom bearing plates. Complete with lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet and mounting hardware. Bottom bearing plate provides extra support for the fixture.

6. Attributes: For supporting urinals, lavatories, drinking fountains, water coolers and other off the floor fixtures with the mounting studs and hardware provided. Plates are typically mounted directly onto walls up to 7 inches thick. Universally drilled
slots in the mounting plates will suit most fixtures. The fixture hanger plate is supplied by the fixture manufacturer.

a. Product: MC-36 to MC-39D Wall Supported Fixture Mounting Plates: 22 x 4 inch lacquered steel plate with universal slots and six pieces of 1/4-20 x 8 inch long all threaded plated mounting studs with nuts and washers. MIFAB Series MC-36-2, 22 x 4 inch top lacquered steel plate with universal slots and
six pieces of 1/4-20 x 8 inch long all threaded plated mounting studs and 22 x 2 inch bottom bearing plate with slots and two pieces of 5/16 x 10 inch long all threaded plated mounting studs with nuts and washers.

J. Residential Fixture Carriers

1. Attributes: A floor mounted frame assembly with off the floor plumbing fixtures in compact areas with minimum in wall space. Carrier is concealed within wall and supports fixture load through a faceplate and foot support system anchored to floor.

a. Product: MC-21 Compact Rear Outlet Water Closet Carrier: Floor mounted single, horizontal, adjustable, water closet carrier without fitting, 4 inch back outlet waste connection, no hub or threaded, lacquered cast iron adjustable faceplate, universal floor mounted cast iron foot supports, adjustable 8 inch tapered thread ABS nipple with integral

test cap, neoprene bowl gasket, hardware, threaded rod protectors, polished chrome plated finishing cap nuts and rear anchor tie down support.

2. Attributes: A water closet carrier for floor mounted plumbing fixtures in stud wall construction. The closet carrier is concealed within the wall. The side mounting hardware bolts to the stud walls framing the carrier.

a. Product: MC-24 Residential Water Closet Carrier: Lacquered cast iron finish, 3 inch PVC adapter, mounting hardware, threaded rod protectors and polished chrome plated finishing cap nuts.

b. Product: MC-25 Residential Water Closet Carrier: Lacquered cast iron no hub fitting, (specify size and style), lacquered cast iron faceplate, mounting hardware, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, vertical waste fitting, and polished chrome plated finishing cap nuts.

K. Service sink Carriers:

1. Attributes: For off floor wall urinals and service sinks having no contact with finished floor. Typically installed in utility, emergency, and clean-up rooms. Carrier and fitting is concealed in wall and supports fixture load through a faceplate and foot support system. Anchored to floor.

a. Product: MC-61 Floor Mounted Service Sink Carrier without Fitting: Two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet, and lacquered cast iron fitting with no hub waste and vent connection (specify size of each). Lacquered cast iron faceplate assembly, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors and polished chrome plated finishing cap nuts. Factory assembled foot supports and faceplate are in siphon jet water closet configuration. Reversible for blowout design.

b. Product: MC-62 Floor Mounted Service Sink Carrier with Fitting: Two lacquered 2 x 1 x 1/8 inch thick structural steel uprights with 3 x 4-1/2 inch welded steel feet, and lacquered cast iron fitting with no hub waste and vent connection (specify size of each). Lacquered cast iron faceplate assembly, adjustable 8 inch tapered thread ABS nipple with integral test cap, neoprene bowl gasket, hardware, threaded rod protectors and polished chrome plated finishing cap nuts. Factory assembled foot supports and faceplate are in siphon jet water closet configuration. Reversible for blowout design.

2.6 FLOOR SINKS

A. PVC Floor Sinks PVC Floor Sinks

1. Attributes: For use in kitchens, restaurants, grocery stores, hospitals, schools, and other areas that require a medium volume sanitary drain. The light duty grate is recommended for foot traffic. The PVC light duty grate is not recommended for vehicle traffic.

a. Product: FS520-30 Deep PVC Floor Sink: 8 inch square by 6 inches deep.

Available with optional dome bottom strainer and with full, three-quarter, or half PVC, nickel bronze or stainless steel grate configurations. Sizes: 2, 3, and 4 inch. Outlet Socket: 4 inch connection body fits into 4 inch PVC pipe and over 3 inch PVC pipe.

B. Rectangular Floor Sinks:

1. Attributes: Used in kitchens, restaurants, grocery stores, hospitals, schools, and other areas requiring a small volume sanitary drain. The light duty grate is not suitable for foot traffic. Regular top is for installation under counters and along walls.

a. Product: FS1530 Floor Area and Indirect Sanitary Waste Drain 8 x 4 x 4 inches: Deep cast iron floor area and indirect sanitary waste drain with white acid resistant porcelain enamel coated interior and loose set grate. Anti-splash aluminum dome strainer included. Pipe Sizes: 2,3, and 4 inch.

b. Product: FS1530-FL Floor Area and Indirect Sanitary Waste Drain 8 x 4 x 4 inch: Deep cast iron floor area and indirect sanitary waste drain with white acid resistant porcelain enamel coated interior and loose set grate and Anti- splash aluminum dome strainer included. Anchor flange with weepholes engineered to receive water proofing membrane. Membrane clamps are recommended for use with anchor flange. Pipe Sizes: 2,3, and 4 inch.

C. Round Floor Sinks:

1. Attributes: Used in kitchens, restaurants, grocery stores, hospitals, schools, and other areas that require a small volume sanitary drain. The light duty grate is not recommended for foot traffic.

a. Product: FS1750 Floor Area and Indirect Sanitary Waste Drain: 8 inch Round x 6 inch deep cast iron floor area and indirect sanitary waste drain with white acid resistant porcelain enamel coated interior and loose set grate. Anti- splash aluminum dome strainer included. Pipe Sizes: 2,3, and 4 inch.

b. Product: FS1750-FL Floor Area and Indirect Sanitary Waste Drain Anchor Flange: 8 inch Round x 6 inch deep cast iron floor area and indirect sanitary waste drain with white acid resistant porcelain enamel coated interior, loose set grate and anchor flange with weepholes. Anti-splash aluminum dome strainer included. Anchor flange is engineered to receive water proofing membrane. Membrane clamps are recommended for use with the anchor flange. Pipe Sizes: 2,3, and 4 inch.

c. Product: FS1760 Floor Area and Indirect Sanitary Waste Drain: 12 inch round x 8 inch deep cast iron floor area and indirect sanitary waste drain complete with white acid resistant porcelain enamel coated interior and loose set grate. Anti-splash aluminum dome strainer included. Pipe Sizes: 2,3, and 4 inch.

d. Product: FS1760-FL Floor Area & Indirect Sanitary Waste Drain with Anchor Flange: 12 inch Round x 8 inch deep cast iron floor area and indirect sanitary waste drain complete with white acid resistant porcelain enamel coated interior, loose set grate and anchor flange with weepholes. Anti- splash aluminum dome strainer included. Anchor flange is engineered to receive water proofing membrane. Membrane clamps are recommended for use with the anchor flange. Pipe Sizes: 2,3, and 4 inch.

2. Attributes: Used in areas that require a sanitary coated, shallow body for indirect waste applications.
a. Product: FS1950 Shallow Floor Sink: 9 inch round, shallow, cast iron floor sink with acid resistant electrostatically applied epoxy coated body, grate, and integral sediment bucket. Pipe Sizes: 2,3, 4, 5, and 6 inch.

D. Square Floor Sinks
1. Attributes: Used in kitchens, restaurants, grocery stores, hospitals, schools, and other areas that require a medium volume sanitary drain. The light duty grate is not recommended for foot traffic.
a. Product: FS1520 Floor Area and Indirect Sanitary Waste Drain. 8 x 8 x 6" deep cast iron floor area and indirect sanitary waste drain complete with white acid resistant porcelain enamel coated interior and loose set grate. Anti- splash aluminum dome strainer included. Pipe Sizes: 2,3, and 4 inch.
b. Product: FS1520-FL Floor Area and Indirect Sanitary Waste Drain 8 x 8 x 6" with Anchor Flange. Deep cast iron floor area and indirect sanitary waste drain complete with white acid resistant porcelain enamel coated interior and loose set grate and anchor flange with weepholes. Anti-splash aluminum dome strainer included. Anchor flange is engineered to receive water proofing membrane. Membrane clamps are recommended for use with the anchor flange. Pipe Sizes: 2,3, and 4 inch.
2. Attributes: Used in kitchens, restaurants, grocery stores, hospitals, schools, and other areas that require a large volume sanitary drain. The light duty grate is not recommended for foot traffic.
a. Product: FS1720 Floor Area and Indirect Sanitary Waste Drain: 12 x 12 x 6" deep cast iron floor area and indirect sanitary waste drain complete with white acid resistant porcelain enamel coated interior and loose set grate. Anti-splash aluminum dome strainer included. Pipe Sizes: 2,3, and 4 inch.
b. Product: FS1720-FL Floor Area and Indirect Sanitary Waste Drain 12 x 12 x 6" with Anchor Flange: Deep cast iron floor area and indirect sanitary waste drain complete with white acid resistant porcelain enamel coated interior and loose set grate. Anti-splash aluminum dome strainer included. Anchor flange is engineered to receive water proofing membrane. Membrane clamps are recommended for use with the anchor flange. Pipe Sizes: 2,3, and 4 inch.
c. Product: FS1730 Floor Area and Indirect Sanitary Waste Drain. 12 x 12 x 8 inch deep cast iron floor area and indirect sanitary waste drain complete with white acid resistant porcelain enamel coated interior and loose set grate. Anti-splash aluminum dome strainer included. Pipe Sizes: 2,3, and 4 inch.
d. Product: FS1730-FL Floor Area and Indirect Sanitary Waste Drain 12 x 12 x 8" with Anchor Flange: Deep cast iron floor area and indirect sanitary waste drain complete with white acid resistant porcelain enamel coated interior, loose set grate and anchor flange with weepholes. Membrane clamps are recommended for use with the anchor flange. Anti-splash aluminum dome strainer included.

e. Product: FS1740 Floor Area and Indirect Sanitary Waste Drain. 12 x 12 x 10" f. deep cast iron floor area and indirect sanitary waste drain complete with white acid resistant porcelain enamel coated interior and loose set grate.
Anti-splash aluminum dome strainer included. Pipe Sizes: 2,3, and 4 inch.

g. Product: FS1740-FL Floor Area and Indirect Sanitary Waste Drain 12 x 12 x 10" with Anchor Flange: Deep cast iron floor area and indirect sanitary waste drain complete with white acid resistant porcelain enamel coated interior, loose set grate and anchor flange with weepholes. Membrane clamps are recommended for use with the anchor flange. Anti-splash aluminum dome strainer included. Pipe Sizes: 2,3, and 4 inch.

h. Product: FS1770 Deep Floor Area and Indirect Sanitary Waste Drain: 16 x 16 x 9 inch deep floor area and indirect sanitary waste drain complete with white acid resistant coated steel interior and heavy duty ductile iron loose set grate with white acid resistant coating. Anti-splash aluminum dome strainer included. Pipe Sizes: 2,3, and 4 inch.

i. Product: FS1770-FL Floor Area and Indirect Sanitary Waste Drain 16 x 16 x 9" with Anchor Flange: Deep floor area and indirect sanitary waste drain complete with white acid resistant coated steel interior and heavy duty ductile iron loose set grate with white acid resistant coating and anchor flange. Anti-splash aluminum dome strainer included. Pipe Sizes: 2,3, and 4 inch.

j. Product: FS1790 - 24 x 24 x 17" Deep Floor Sink with Anchor Flange: Deep floor area and indirect sanitary waste drain complete with white acid resistant coated steel interior and heavy duty fabricated steel loose set grate with white acid resistant coating and anchor flange. Anti-splash aluminum dome strainer included. Pipe Sizes: 2,3, and 4 inch.

E. Stainless steel floor sinks

1. Attributes: Used in kitchens, restaurants, breweries, dairies, creameries, food processing locations, nuclear, gas and coal fired power stations, chemical plants, laboratories, and other areas where the corrosion resistance of Type 304 stainless steel is required for superior sanitation. Anchor flange is designed to receive water proofing membrane. A membrane clamp is recommended to secure the water proofing membrane to the anchor flange.

a. Product: FS1920-FL Floor Area and Indirect Sanitary Waste Drain 12 x 12 x 6" with Anchor Flange: 16 gauge, Type 304 stainless steel sanitary floor area and indirect waste drain complete with cast stainless steel secured rim and grate with allen key vandal proof stainless steel screws, stainless steel anchor flange with weepholes and anti-splash dome strainer. Pipe Sizes: 2,3, and 4 inch.

b. Product: FS1930-FL Floor Area & Indirect Sanitary Waste Drain 12 x 12 x 8" with Anchor Flange: 16 gauge, Type 304 stainless steel sanitary floor area and indirect waste drain complete with cast stainless steel secured rim and grate with allen key vandal proof stainless steel screws, stainless steel anchor
flange with weepholes and anti-splash dome strainer. Pipe Sizes: 2,3, and 4 inch.

c. Product: FS1940-FL Floor Area & Indirect Sanitary Waste Drain 12 x 12 x 10"

with Anchor Flange: 16 gauge, Type 304 stainless steel sanitary floor area and indirect waste drain complete with cast stainless steel secured rim and grate with allen key vandal proof stainless steel screws, stainless steel anchor flange with weepholes and anti-splash dome strainer. Pipe Sizes: 2,3, and 4 inch.

F. Other Floor Sinks Other Floor Sinks
1. Attributes: Used in areas to support floor sinks off the structural slab.
a. Product: FS1959 Floor Sink Installation Stabilization Plate: 8 x 8 inch, 16 gauge, steel, electrostatically applied powder epoxy coated floor sink installation stabilization plate. 12-1/2 inch square and 1-1/2 inch high. Complete with four 5/16 inch all threaded rods and adjustable knock outs to
accommodate 3 and 4 inch outlet connections. Pipe Sizes: 2,3, and 4 inch. b. Product: FS1960 Floor Sink Installation Stabilization Plate: 12 x 12 inch, 16
gauge, steel, electrostatically applied powder epoxy coated floor sink installation stabilization plate. 14-1/2 inch square and 1-1/2 inch high. Complete with four 5/16 inch all threaded rods and adjustable knock outs to accommodate 3 and 4 inch outlet connections. Pipe Sizes: 2,3, and 4 inch.
2. Attributes: Used in areas where porcelain enamel floor sink has chipped and / or worn off from already installed floor sinks. The stainless steel liner is inserted into existing porcelain enamel floor sink.
a. Product: FS1970 Replacement Floor Sink Liner 8 x 8 x 6 inches. 16 gauge stainless steel, type 304 floor sink replacement liner with internal dome strainer. External pipe gasket seal and light duty slotted loose set stainless steel grate. Pipe Sizes: 2,3, and 4 inch.
b. Product: FS1980 Replacement Floor Sink Liner 12 x 12 x 6 inches. 16 gauge stainless steel, type 304 floor sink replacement liner with internal dome strainer. External pipe gasket seal and light duty slotted loose set stainless steel grate. Pipe Sizes: 2,3, and 4 inch.

c. Product: FS1990 Replacement Floor Sink Liner 12 x 12 x 8 inches. 16 gauge, stainless steel, type 304 floor sink replacement liner with internal dome strainer. External pipe gasket seal and light duty slotted loose set stainless steel grate. Pipe Sizes: 2,3, and 4 inch.
d. FS2000 Replacement Floor Sink Liner 12 x 12 x 10 inches. 16 gauge, stainless steel, type 304 floor sink replacement liner with internal dome strainer. External pipe gasket seal and light duty slotted loose set stainless steel grate. Pipe Sizes: 2,3, and 4 inch.

PART 3 EXECUTION

3.1 EXAMINATION
A. Do not begin installation until substrates have been properly constructed and prepared. B. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

B. Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

3.5 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturer's recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Mechanical demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexca- vated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient tem- peratures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Ex- amples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons. B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes in- volved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical character- istics may be furnished provided such proposed equipment is approved in writing and connect- ing electrical services, circuit breakers, and conduit sizes are appropriately modified. If mini- mum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place con- crete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8
Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following require- ments apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offer- ing products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manu- facturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping sys- tem manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers (or approved equal):

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div. d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.

4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, sol- vent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co. b. Fernco, Inc.
c. Mission Rubber Company.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder- joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pres- sure at 180 deg F1. Manufacturers:

a. Capitol Manufacturing Co. b. Central Plastics Company. c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div. g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig min- imum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co. b. Central Plastics Company. c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full- face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc. b. Calpico, Inc.
c. Central Plastics Company.

d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 300-psig minimum work- ing pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lin- ing; threaded ends; and 300-psig minimum working pressure at 225 deg F

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining;
plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F

1. Manufacturers:
a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc. d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1.Manufacturers:
a. Advance Products & Systems, Inc. b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel, include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longi- tudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers open- ing.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi , 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying pip- ing systems.

B. 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.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections. J. Install piping to allow application of insulation.
K. Select system components with pressure rating equal to or greater than system operating pres- sure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type. b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast- brass type with polished chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with pol- ished chrome-plated finish.
f. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
g. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6 .
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board parti- tions.

c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing.
Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section
"Sheet Metal Flashing and Trim" for flashing.

1. Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Re- fer to Division 7 Section "Joint Sealants" for materials and installation.

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements re- quired for pipe material and size. Position pipe in center of sleeve. Assemble mechani- cal

sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements re- quired for pipe material and size. Position pipe in center of sleeve. Assemble mechani- cal sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in re- quirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specify- ing piping systems.

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

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assem- bly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

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

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and weld- ing operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service applica- tion. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings ac- cording to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Non

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping ma- terials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section
Painting Professional Line Products.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi , 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section, Cast-in-Place Concrete.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.9 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equip- ment base plates, and anchors.

B. Clean surfaces that will come into contact with grout. C. Provide forms as required for placement of grout.
D. Avoid air entrapment during placement of grout. E. Place grout, completely filling equipment bases.
F. Place grout on concrete bases and provide smooth bearing surface for equipment. G. Place grout around anchors.
H. Cure placed grout.

END OF SECTION 15050

SECTION 15050
BASIC MECHANICAL MATERIALS AND METHODS (HVAC)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete base construction requirements.
3. Escutcheons.
4. Dielectric fittings.
5. Flexible connectors.
6. Mechanical sleeve seals.
7. Equipment nameplate data requirements.
8. Labeling and identifying mechanical systems and equipment.
9. Nonshrink grout for equipment installations.
10. Field-fabricated metal and wood equipment supports.
11. Installation requirements common to equipment specification sections.
12. Mechanical demolition.
13. Cutting and patching.
14. Touchup painting and finishing.

B. Pipe and pipe fitting materials are specified in Division 15 piping system Sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spac- es, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, un- excavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient tem- peratures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Ex- amples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.

3. NP: Nylon plastic.
4. PE: Polyethylene plastic.
5. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.

2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identifi- cation materials and devices.

B. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

C. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building compo- nents. Show space requirements for installation and access. Indicate if sequence and coordi- nation of installations are important to efficient flow of the Work. Include the following:

1. Planned piping layout, including valve and specialty locations and valve-stem movement.
2. Clearances for installing and maintaining insulation.
3. Clearances for servicing and maintaining equipment, accessories, and specialties, includ- ing space for disassembly required for periodic maintenance.

4. Equipment and accessory service connections and support details.
5. Exterior wall and foundation penetrations.
6. Fire-rated wall and floor penetrations.
7. Sizes and location of required concrete pads and bases.
8. Scheduling, sequencing, movement, and positioning of large equipment into building dur- ing construction.
9. Floor plans, elevations, and details to indicate penetrations in floors, roofs, walls, and ceilings and their relationship to other penetrations, structural components, other trades and installations.
10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

D. Samples: Of color, lettering style, and other graphic representation required for each identifica- tion material and device.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, ca- pacities, 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 equip- ment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
E. Protect air handling equipment and ductwork from moisture, construction dust and dirt.
1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place con- crete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for ef- ficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service compa- nies, and controlling agencies.

F. 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 Sec- tion "Access Doors."

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and simi- lar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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

1. Dielectric Unions:

a. Capitol Manufacturing Co. b. Central Plastics Co.
c. Eclipse, Inc.; Rockford-Eclipse Div. d. Epco Sales Inc.
e. Hart Industries International, Inc.

f. Watts Industries, Inc.; Water Products Div. g. Zurn Industries, Inc.; Wilkins Div.

2. Dielectric Flanges:
a. Capitol Manufacturing Co. b. Central Plastics Co.
c. Epco Sales Inc.

d. Watts Industries, Inc.; Water Products Div.

3. Dielectric-Flange Insulating Kits:

a. Calpico, Inc.
b. Central Plastics Co.

4. Dielectric Couplings:

a. Calpico, Inc.
b. Lochinvar Corp.

5. Dielectric Nipples:

a. Grinnell Corp.; Grinnell Supply Sales Co. b. Perfection Corp.
c. Victaulic Co. of America.

6. Metal, Flexible Connectors:

a. ANAMET Industrial, Inc. b. Central Sprink, Inc.
c. Flexicraft Industries. d. Flex-Weld, Inc.
e. Grinnell Corp.; Grinnell Supply Sales Co. f. Hyspan Precision Products, Inc.
g. McWane, Inc.; Tyler Pipe; Gustin-Bacon Div. h. Mercer Rubber Co.
i. Metraflex Co.
j. Proco Products, Inc. k. Uniflex, Inc.

7. Rubber, Flexible Connectors:

a. General Rubber Corp. b. Mercer Rubber Co.
c. Metraflex Co.
d. Proco Products, Inc. e. Red Valve Co., Inc.
f. Uniflex, Inc.

8. Mechanical Sleeve Seals:

a. Calpico, Inc. b. Metraflex Co.

c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods. B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges. b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping sys- tem manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead con- tent.

F. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvent cements for the following:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138. I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.

5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to pre- vent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum work- ing pressure at 180 deg F (82 deg C).

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

F. 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.

1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lin- ing; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.5 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, unless higher work- ing pressure is indicated, and ends according to the following:

1. 2-Inch NPS (DN50) and Smaller: Threaded.
2. 2-1/2-Inch NPS (DN65) and Larger: Flanged.
3. Option for 2-1/2-Inch NPS (DN65) and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

E. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig (860-kPa) minimum work- ing-pressure rating at 220 deg F (104 deg C). Units may be straight or elbow type, unless oth- erwise indicated.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.7 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet Metal: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
a. Underdeck Clamp: Clamping ring with set screws.

5. PVC: Manufactured, permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe: ASTM D 1785, Schedule 40.
7. PE: Manufactured, reusable, tapered, cup shaped, smooth outer surface, with nailing flange for attaching to wooden forms.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to con- ceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw. a. Finish: Rough brass.
b. Finish: Polished chrome-plate.
4. Cast Brass: Split casting, with concealed hinge and set screw. a. Finish: Rough brass.
b. Finish: Polished chrome-plate.
5. Stamped Steel: One piece, with set screw and chrome-plated finish.
6. Stamped Steel: One piece, with spring clips and chrome-plated finish.
7. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
8. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
9. Stamped Steel: Split plate, with exposed-rivet hinge, set screw, and chrome-plated finish.
10. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
11. Cast-Iron Floor Plate: One-piece casting.

2.8 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each applica- tion as referenced in other Division 15 Sections. If more than one type is specified for applica- tion, selection is Installer's option, but provide one selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; perma- nently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
2. Location: Accessible and visible location.

C. 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 ac- cess door signs and similar operational instructions.

1. Material: Fiberboard.
2. Material: Brass.
3. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicat- ed; either brushing grade or pressurized spray-can form and grade.
4. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap on, color- coded, complying with ASME A13.1.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl, complying with ASME A13.1.

F. Plastic Duct Markers: Manufacturer's standard color-coded, laminated plastic. Comply with the following color code:

1. Green: Cold air.
2. Yellow: Hot air.
3. Yellow/Green or Green: Supply air.
4. Blue: Exhaust, outside, return, and mixed air.
5. For hazardous exhausts, use colors and designs recommended by ASME A13.1.
6. Nomenclature: Include the following:
a. Direction of airflow. b. Duct service.
c. Duct origin.
d. Duct destination.
e. Design cubic feet per minute (liters per second).

G. 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.

1. Fabricate in sizes required for message.
2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
3. Punch for mechanical fastening.
4. Thickness: 1/16 inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) long; 1/8 inch (3.2 mm) for larger units.
5. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.

H. Plastic Equipment Markers: Color-coded, laminated plastic. Comply with the following color code:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.
4. Brown: Energy reclamation equipment and components.
5. Blue: Equipment and components that do not meet any criteria above.
6. For hazardous equipment, use colors and designs recommended by ASME A13.1.
7. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

a. Name and plan number. b. Equipment service.
c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and rpm.

8. 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.

I. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in me- chanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: If multiple systems of same generic name are indicated, provide iden- tification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

2.9 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applica- tions.
2. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual
Division 15 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate gen- eral 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 consid- erations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and ser- vice areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation. J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board parti- tions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips. N. Sleeves are not required for core drilled holes.
O. Permanent sleeves are not required for holes formed by PE removable sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is speci- fied.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrat- ing gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing.
Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7
Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.
5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless other-wise indicated.

R. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechani- cal sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written in- structions. Tighten bolts that cause rubber sealing elements to expand and make water- tight seal.

S. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written in- structions. Tighten bolts that cause rubber sealing elements to expand and make water- tight seal.

T. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Sec- tion "Firestopping" for materials.

U. Verify final equipment locations for roughing-in.

V. Refer to equipment specifications in other Sections of these Specifications for roughing-in re- quirements.

W. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in indi- vidual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
5. 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:

a. 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.

b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
c. Align threads at point of assembly.
d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
e. 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.

6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.

7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. As- semble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:

a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and sol- vent cements.
b. ABS Piping: ASTM D 2235 and ASTM D 2661. c. CPVC Piping: ASTM D 2846 and ASTM F 493.
d. PVC Pressure Piping: ASTM D 2672.
e. PVC Nonpressure Piping: ASTM D 2855.
f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement ac- cording to ASTM D 3138.

9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.

a. Plain-End Pipe and Fittings: Use butt fusion.
b. Plain-End Pipe and Socket Fittings: Use socket fusion.

X. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at fi- nal connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping mate- rials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated. B. Install equipment according to approved submittal data. Portions of the Work are shown only in
diagrammatic form. Refer conflicts to Engineer.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. 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.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.
3. 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:

a. Near each valve and control device.
b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
c. Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.
d. At access doors, manholes, and similar access points that permit view of con- cealed piping.

e. Near major equipment items and other points of origination and termination.
f. 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.
g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of mechanical equipment.

1. Lettering Size: Minimum 1/4-inch- (6.4-mm-) high lettering for name of unit if viewing dis- tance 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.
2. Text of Signs: Provide name of identified unit. Include text to distinguish between multi- ple units, inform user of operational requirements, indicate safety and emergency precau- tions, and warn of hazards and improper operations.

C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.

1. Location: In each space, if ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 50 feet (15 m).

D. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construc- tion.

3.4 PAINTING AND FINISHING

A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two fin- ish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

C. Do not paint piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Follow supported equipment manufacturer's setting tem- plates 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 Con- crete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor me- chanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 DEMOLITION

A. Disconnect, demolish, and remove Work specified in Division 15 Sections.

B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches (50 mm)
beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.9 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.10 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout. C. Provide forms as required for placement of grout.
D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment. G. Place grout around anchors.
H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION

Division 16 – Electrical

SECTION 16005 - ELECTRICAL

PART 1 GENERAL

1.1 REFERENCES:

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI):

a. C80.1, Rigid Steel Conduit-Zinc Coated.
b. C80.3, Electrical Metallic Tubing-Zinc Coated. c. C80.5, Rigid Aluminum Conduit.
d. C80.6, Intermediate Metal Conduit (IMC)-Zinc Coated.
e. Z55.1, Gray Finishes for Industrial Apparatus and Equipment.

2. Federal Specifications (FS):

a. W-C-596, Connector, Receptacle, Electrical. b. W-S-896E Switches, Toggle, Flush Mounted.

3. National Electrical Contractor's Association, Inc. (NECA): 5055, Standard of Installation.
4. National Electrical Manufacturers Association (NEMA):

a. AB 1 Molded Case Circuit Breakers and Molded Case Switches.
b. ICS 2, Standard for Industrial Control Devices, Controllers, and Assemblies.
c. PB 1, Panelboards.
d. ST 20, Dry-Type Transformers for General Applications.
e. TC 2, Electrical Plastic Tubing (EB) and Conduit (EPC-40 and EPC-80)
f. TC 3, PVC Fittings for Use with Rigid PVC Conduit and Tubing g. WD 1, General Requirements for Wiring Devices.
h. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).

5. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
6. Underwriters Laboratories, Inc. (UL):

a. 1, Standard for Safety Flexible Metal Conduit.
b. 651, Standard for Safety Schedule 40 and 80 PVC Conduit.
c. 845, Standard for Safety Motor Control Centers.

d. 1561, Standard for Dry-Type General Purpose and Power Transformers.

1.2 SUBMITTALS:

A. Shop Drawings:

1. Panelboard.
2. Lighting fixtures.
3. Manufactured or Fabricated Control Panels: Summary and catalog cuts.
4. Service entrance details.
5. Motor control center.
6. Substation.
7. Pull box.

B. Contract Closeout:

1. Signed permits indicating Work is acceptable to regulatory authorities with jurisdiction.

1.3 UL COMPLIANCE:

A. Materials manufactured within scope of Underwriters Laboratories shall conform to UL Standards and have an applied UL listing mark.

PART 2 PRODUCTS

2.1 GENERAL:

A. Products shall comply with all applicable provisions of NFPA 70.

B. Like Items of Equipment: End products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts and manufacturer's service.

C. Equipment and Devices Installed Outdoors or in Unairconditioned Enclosures: Capable of continuous operation within ambient temperature range of 125 degrees F.

D. Hazardous Areas: Products shall be acceptable to the regulatory authority having jurisdiction for the class, division, and group of hazardous area indicated.

E. Equipment Finish:
1. Manufacturer's standard finish color, except where specific color is indicated.

2. If manufacturer has no standard color, finish equipment in accordance with ANSI Z55.1, No. 61, light gray color.

2.2 SERVICE ENTRANCE:

A. Meet requirements of the local electric utility.

2.3 MOTOR CONTROL:

A. Controller: NEMA ICS 2.

B. Thermal Overload Protection:

1. Inverse time limit type.
2. Ungrounded phases for each motor.
3. Thermal overload relays sensitive to motor current mounted within the motor controller.

C. Controller Mounted Overload Relay:

1. Manual reset type with externally operated reset button.
2. Select overload relay heaters after actual nameplate full-load current rating of motor has been determined.

D. Individual Control Power Transformer:

1. Capacity: Sufficient to serve connected load and limit voltage regulation to 10 percent during contact or pick up.
2. Fuse one side of secondary winding and ground other side.
3. Primary winding fuses where shown, or where required by applicable codes and standards.

E. Motor Starter Unit:

1. Magnetic type.
2. Minimum Size: NEMA ICS 2, Type 1.
3. Pull-apart unit control wiring. F. Circuit Breaker:
1. Magnetic trip, or motor circuit protector type, with tripping indicated by operating handle.
2. Interrupting capacity required for connection to system with as indicated in drawings amps short-circuit capacity.
G. Overload Relay: Temperature compensated three-pole bimetallic with manual reset.

H. Control Wiring:

1. Minimum Wire Size: 14 AWG copper.

2. Permanent sleeve type markers.

2.4 MOTOR STARTER PANELS:

A. System: Three-phase, 480 volt.

B. Panel Enclosure: Wall mounted, NEMA 250, Type 12, minimum 12-gauge steel cabinet, in accordance with UL 845.

C. Bus Assembly: Continuous from main incoming terminal to main and branch circuit breakers without use of cables.

1. As specified on drawings. D. Circuit Breakers:
1. Circuit Breaker: Plug-on connection, quick-make, quick-break, trip indicator and common trip on multiple circuit breakers.
2. Magnetic only for starter units.
3. Thermo-magnetic for main and branch circuit breakers.
4. Enclosure: Interlocked to prevent opening with breaker energized. a. Interlock Release: For inspection purposes.
E. Motor Starter:

1. Across-the-line magnetic type in own enclosure.
2. Contact: Double-break silver alloy type.
3. Overload Relay: Melting alloy type.

F. Thermal Unit: One-piece construction and interchangeable. G. Door Lock: Provide with two keys.
H. Starter Circuit Identification: Typewritten sheet installed on door with proper identification.

2.5 PANELBOARDS:

A. NEMA PB 1, circuit breaker type.
B. Available Short-Circuit Rating: As specified on drawings. C. Adjacent Single-Pole Breaker: Opposite potential.
D. Furnish with ground bus when bonding is required. E. Door Lock: Provide with two keys.
F. Directory: Typewritten sheet installed on inside of door. G. Manufacturer:
1. General Electric.
2. Westinghouse.
3. Square D.

2.6 DRY TYPE POWER TRANSFORMERS (0- TO 600-VOLT PRIMARY):

A. Type: Self-cooled, two-winding. B. UL 1561 and NEMA ST 20.

C. Insulation Class/Temperature Rise: Standard. D. Core and Coil:
1. 30 kVA or Less: Encapsulated.
2. 37.5 kVA and Larger: Varnish impregnated. E. Enclosure:
1. 30 kVA or Less: NEMA 250, Type 3R, nonventilated.
2. 37.5 kVA and Larger: NEMA 250, Type 2, ventilated.

F. Voltage Taps: Full capacity, 2-1/2 percent, two above and two below normal voltage rating.

G. Sound Level: Not to exceed NEMA ST 20 levels.

H. Vibration isolators to minimize and isolate sound transmission. I. Manufacturer:
1. General Electric.
2. Westinghouse.
3. Square D.

2.7 CONTROL PANELS:

A. Enclosure:

1. NEMA 250, Type 12.
2. Minimum Metal Thickness: 14-gauge.
3. Doors: Rubber gasketed with continuous hinge.
4. Incandescent Light: Hand switch controlled, 100-watt.
5. Receptacle: Breaker protected 120-volt, 15-amp duplex.
6. Finish: Internal and external surfaces:

a. Sand panel; remove mill scale, rust, grease, and oil. b. Fill imperfections and sand smooth.
c. Paint with one coat of epoxy coating metal primer, two finish coats of two-component type epoxy enamel.
d. Sand surfaces lightly between coats.
e. Final Dry Film Thickness: Minimum 3 mils.

7. Size small panels to adequately dissipate heat generated by equipment mounted in or on panel.
8. Manufacturer:

a. Hoffman.
b. H. F. Cox.

Wiring:

1. Power and Control Wiring: 600-volt class, insulated, stranded copper.

a. Size: Minimum 14 AWG enclosed in either sheet metal raceway or plastic wiring duct.

2. Signal Circuit Wiring: Twisted shielded pairs minimum No. 16 AWG, separated at least 6 inches from power wiring.
3. Identification: Permanent heat impregnated polyvinyl chloride (PVC) alpha-numeric labels.

2.8 SAFETY SWITCHES:

A. Type: Visible blade, fusible. B. Class: Heavy-duty.
C. Enclosures:

1. Indoor Installations: NEMA 4X stainless steel.

2. Outdoor Installations: NEMA 4X stainless steel.

2.9 CIRCUIT BREAKERS:

A. NEMA AB 1.

B. Indicating type, with ON/OFF and TRIPPED positions of the operating handle.

C. Bolt-on thermal-magnetic, quick-make, quick-break noninterchangeable.

D. Tandem or dual circuit breakers in normal single-pole spaces not permitted. E. Multipole Circuit Breakers:
1. All poles to automatically open when an overload occurs on one-pole.
2. Single-pole with handle ties not permitted.

2.10 CONDUIT AND FITTINGS:

A. Rigid Galvanized Steel Conduit (RGS):

1. ANSI C80.1.
2. Fittings: Threaded type.
3. Galvanize by hot-dipping, electroplating, sherardizing, or metalizing process, including fittings.

B. Intermediate Metal Conduit (IMC):

1. ANSI C80.6.
2. Hot-dip galvanize, including fittings.

3. Fittings: Threaded type.

C. Electric Metallic Tubing (EMT): ANSI C80.3.

1. Fittings: Compression type. D. Polyvinyl Chloride Conduit (PVC):
1. Rigid, Schedule 40, NEMA TC 2.
2. UL 651 listed for concrete encased, direct burial, concealed and direct sunlight exposed use.
3. UL 651 listed and marked for use with conductors having 90 degrees C
insulation.
4. Fittings: NEMA TC 3, for intended use. E. Flexible Metal Conduit:

1. UL 1 listed for liquid-tight service.
2. Galvanized steel, flexible conduit covered with extruded PVC jacket.
3. Termination: Nylon bushings or bushings with steel or malleable iron body and insulated throat and sealing O-ring.

2.11 CONDUCTORS:

A. Material:

1. Annealed copper. B. Insulation:
1. No. 8 AWG and Smaller: Type THHN/THWN.
2. No. 6 AWG and Larger: Type XHHW.
3. Direct Buried: Type XLPE-USE.
4. Flexible Cord and Cable: Type SO, 600 volts. C. Type:
1. No. 10 AWG and Smaller: Stranded.
2. No. 8 AWG and Larger: Stranded.

2.12 TERMINAL BLOCKS:

A. Type: Compression screw clamp, with current bar providing direct contact with wire and yoke, with individual rail mounted terminals.

B. Yokes and Clamping Screws: Zinc-plated, hardened steel. C. Rating: 600V ac.
2.13 MAGNETIC CONTROL RELAYS:

A. NEMA ICS 2, Class A600 (600 volts, 10 amperes continuous, 7,200VA make,
720VA break), machine tool type with field convertible contacts.

B. Time Delay Relays: Magnetic control relays with timer attachment adjustable from 0 to 15 minutes and field convertible from ON delay to OFF delay and vice-versa.

C. Manufacturer

1. Cutler-Hammer.
2. General Electric.

2.14 PUSHBUTTONS, INDICATING LIGHTS, AND SELECTOR SWITCHES:
A. NEMA ICS 2, Type 600.

B. Type: Heavy-duty, oiltight, push-to-test.

C. Lockout: Pushbuttons and selector switches shall lock in OFF position wherever lockout provisions are indicated.

D. Nameplates:

1. Individual, large, laminated plastic.
2. Function indicated.
3. Pushbutton station nameplates shall indicate the drive controlled. E. Manufacturer:
1. General Electric.
2. Square D.
3. Cutler-Hammer.

2.15 ELAPSED TIME METERS:

A. Type: Synchronous motor driven, 0 to 99,999.9 hours range, nonreset, suitable for semiflush, panel mounting.

B. Manufacturer:

1. Automatic Timing and Controls.
2. Eagle Signal.

2.16 LUMINAIRES:

A. Specific requirements relating to fixture type, lamp type, and mounting hardware is located in the Luminaire Schedule on Drawings.

2.17 RECEPTACLES:

A. NEMA WD 1 and FS W-C-596. B. Specification Grade:
1. Type: Three-wire grounding, with screw type terminals suitable for No. 10 AWG wire. Contact to be made on two sides of each inserted blade without detent.
2. Number of Poles: Two.
3. Rating: 125 volts, NEMA WD 1, Configuration 5-20R, 20 amps.

4. Base: Phenolic composition.
5. Color: Gray.

2.18 SWITCHES:

A. NEMA WD 1 and FS W-S-896E.

B. Totally enclosed, ac type, quiet tumbler switches, with screw terminals.

C. Capable of control of 100 percent tungsten filament and fluorescent lamp loads.

D. Rating: 20 amps, 120/277 volts. E. Color: Gray.
2.19 BOXES:

A. Large Cast Metal Boxes:

1. NEMA 250, Type 4, malleable iron, with hot-dip galvanized finish.
2. Neoprene gasketed, watertight, with cast metal covers, stainless steel screws, and drilled and tapped conduit entrances.

2.20 COVER PLATES:

A. Metal:

1. Material: Specification grade, one-piece, stainless steel.
2. Thickness: Minimum 0.40-inch nominal.
3. Finish: No. 302/304 satin.
4. Mounting Screws: Oval head, stainless steel, to match plate. B. Weatherproof Device Plates:
1. Material: Cast metal, gasketed, weatherproof, with individual cap over each opening held with stainless steel springs.
2. Finish: Stainless steel or fiberglass reinforced plastic.
3. Mounting Screws: Stainless steel.

PART 3 EXECUTION

3.1 GENERAL:

A. Workmanship shall comply with all applicable provisions of NECA 5055.
B. Install materials and equipment in hazardous areas in a manner acceptable to regulatory authority having jurisdiction for the class, division, and group of hazardous area indicated.

C. Ground equipment, enclosures, and complete conduit system securely in accordance with applicable sections of NFPA 70.

3.2 MOTOR STARTER:

A. Field adjust trip settings of motor starter magnetic, trip-only circuit breakers in accordance with manufacturer's instructions.

B. Existing Connection: Reconnect control wiring to new magnetic starters to perform same functions as existing connections.

3.3 CONDUIT AND FITTINGS:

A. General:

1. Do not install crushed or deformed raceways.
2. Avoid trapped raceways in damp and wet locations.
3. Prevent plaster, dirt, or trash from lodging in raceways, boxes, fittings, and equipment during the course of construction. Clear clogged raceways of obstructions.
4. Maintain conduit runs within furring lines of building, unless otherwise shown.
5. Secure conduits entering cabinets, pull boxes or outlet boxes with galvanized locknuts and bushings, on both sides of box wall.

B. Applications:

1. Concealed Interior, Dry: Type RGS.
2. Exposed Interior, Dry (Heights Above Finished Floor):

a. 6 Feet and Above:

1) Type RGS.
2) Where conduit run originates as RGS below 6 feet, continue with RGS to first connection device.

b. Below 6 Feet: Type RGS.

3. Exposed Interior, Wet: Type RGS.
4. Exposed Corrosive: Type PVC.
5. Exposed Exterior: Type RGS.
6. Concrete Embedded: Type PVC.
7. Direct Buried: Type PVC.
8. Vertical Runs Through Slab: Convert PVC conduit to RGS. C. Final Connection to Motors:

1. Conduit Size 4 Inches or Less: 18-inch minimum, 60-inch maximum length of flexible metal conduit.

D. Penetrations:

1. Flash and counterflash conduits penetrating roofing membrane.
2. Seal penetrations with oakum or expandable plastic compound.
3. Provide sleeves and chases where conduits pass through floors or walls.
Finish to match adjacent surfaces.
4. Provide escutcheon plates where exposed conduits pass through walls, floors or ceilings.

E. Slab-On-Grade or Direct Buried:

1. Install horizontal runs below floor slab. Horizontal runs within slab will not be permitted.
2. Field wrap conduit and joints installed below slab or direct buried with
0.010-inch thick pipe wrapping plastic tape applied with a 50 percent overlay, or factory apply a plastic resin, epoxy, or coal-tar coating system.

F. Slabs Other Than On-Grade:

1. Install as close to horizontal center of concrete slabs as practicable without disturbing reinforcement.
2. Maximum outside diameter of conduit shall not exceed 1/3 of the slab thickness.
3. Space raceways a minimum of six times the raceway outside diameter, on center, except at cabinet locations where slab thickness shall be increased as required.

G. Exposed Raceways: Install parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings.

H. Changes in Direction of Runs:

1. Make with symmetrical bends or cast metal fittings.
2. Bends and offsets shall be made with a hickey or conduit bending machine.

I. Supports:
1. Provide pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps with retainers, or ceiling trapeze.
2. Securely and rigidly fasten in place.
3. Maximum Interval: 10 feet.

3.4 CONDUCTORS:

A. Conduit system shall be complete prior to drawing conductors.

B. Lubricate prior to drawing into conduit. Lubrication type shall be as approved by conductor manufacturer.

C. Connections: Pressure type solderless, complete with insulator and security ring.

D. Control Circuits:

1. Where multiple units perform parallel operations, do not group all devices on same branch circuit.
2. Do not exceed the ampacity of the branch circuit, or 12 amperes continuous.
3. Terminate feeder and interconnecting conductors between panel mounted equipment and external equipment at numbered terminal blocks.

E. Identification:

1. Where two or more conduits run to a single outlet box, color codes each circuit as a guide in making connections.
2. Carry colors continuously throughout the system if more than one multiwire branch circuit is carried through a single raceway.
3. Connect circuit conductors of same color to same underground feeder conductor throughout installation.
4. Colors:

a. Neutral Wire: White.
b. Live Wire, 120/208-Volt System: Black, red, or blue.
c. Live Wire, 277/480-Volt System: Brown, orange, or yellow. d. Ground Wire: Green.

3.5 TERMINAL BLOCKS:

A. Install for termination of all control circuits leaving or entering equipment, panels, or boxes.

3.6 LUMINAIRES:
A. Install in accordance with manufacturer's recommendations. B. Install plumb and true.
C. Provide swivel type hangers and canopies to match pendant mounted fixtures. D. Pole Mounted Fixtures: Provide cast-in-place concrete bases.
E. Install symmetrically with tile pattern in finished areas.

3.7 BOXES:

A. Support to the structure, independent of conduit attachment.
B. Boxes installed belowgrade shall be installed flush with finished grade.

C. Boxes and covers in paved areas, roadways, or walkways shall be suitable for weights to which they may be subjected.
D. Box Extensions: Not permitted.

3.8 COVER PLATES:

A. Shall fit tightly to box.

B. Shall not extend beyond sides of box on surface mounted boxes, unless covers have no sharp corners or edges.

3.9 FIELD QUALITY CONTROL:

A. Balance electrical load between phases on switchboards, panelboards, and motor control centers after installation.

B. Voltage Testing:

1. When installation is complete and facility is in operation, check voltage at point of termination of electric utility supply system to project.
2. Check voltage amplitude and balance between phases for loaded and unloaded conditions.
3. Record supply voltage for 24 continuous hours.
4. If unbalance exceeds 1 percent, or if voltage varies throughout the day and from loaded to unloaded conditions more than plus or minus
4 percent of nominal, make written request to electric utility to correct condition.
5. If corrections are not made, obtain written statement from a responsible electric utility official that voltage variations and/or unbalance are within their normal standards.
C. Equipment Line Current:

1. Check line current in each phase for each piece of equipment.
2. If electric utility makes adjustments to supply voltage magnitude or balance, make line current check after adjustments are made.

3.10 PROTECTION FOLLOWING INSTALLATION:

A. Protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation.

B. Cap conduit runs during construction with manufactured seals. C. Close openings in boxes or equipment during construction.
D. Energize space heaters furnished with equipment.

END OF SECTION

SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 RELATED SECTIONS:

A. Requirements specified within this section apply to all sections in Division 16, ELECTRICAL. Work specified herein shall be performed as if specified in the individual sections.

1.2 DESIGN REQUIREMENTS:

A. All equipment anchoring and mounting shall be in accordance with manufacturer's requirements for the seismic zone criteria.

1.3 ELECTRICAL COORDINATION:

A. Work Provided Outside this Contract:

1. Details of facility equipment and construction for all Specification Divisions which affect work covered under Division 16, ELECTRICAL.
2. Incoming underground power cables, materials, installation, termination, and connection; under this Contract, provide trench, and backfill, and duct system.
3. Transformers supplying main electrical service to the facility; site preparation and transformer pad(s) included in this Contract.
4. Interior telephone system, except raceways, outlet and junction boxes, cover plates, pull wires, as indicated in drawings.

1.4 SUBMITTALS:

B. Quality Control Submittals:

1. Voltage Balance Report.
2. Equipment Line Current Report.
3. Factory test certification and reports for all major electrical equipment.
4. Site test certification and reports as specified in other Division 16, ELECTRICAL sections.

PART 2 PRODUCTS

2.1 GENERAL:A. Provide materials and equipment listed by UL wherever standards have been established by that agency.

B. Equipment Finish:

1. Provide manufacturers' standard finish and color, except where specific color is indicated.
2. If manufacturer has no standard color, provide equipment with: ANSI No. 61, light gray color.

PART 3 EXECUTION

3.1 GENERAL:

A. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

B. Install work in accordance with NECA Standard of Installation, unless otherwise specified.

3.2 LOAD BALANCE:

A. Drawings and Specifications indicate circuiting to electrical loads and distribution equipment.

B. Balance electrical load between phases as nearly as possible on switchboards, panelboards, motor control centers, and other equipment where balancing is required.

C. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

3.3 CHECKOUT AND STARTUP:

A. Voltage Field Test:

1. Check voltage at point of termination of power company supply
2. System to project when installation is essentially complete and is in operation.
3. Check voltage amplitude and balance between phases for loaded and unloaded conditions.

END OF SECTION

SECTION 16050 - BASIC METHODS AND REQUIREMENTS (ELECTRICAL)

PART 1 GENERAL

1.1 DESCRIPTION:

A. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, switchgear, panelboards, motor control, and other items, arrangement for specified items are shown on drawings.

B. Electrical service entrance equipment (arrangements for temporary and permanent connections to the power company's system) shall conform to the power company's requirements. Coordinate fuses, circuit breakers and relays with the power company's system, and obtain power company approval.

C. Ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS:

A. References to the National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) are a minimum installation requirement standard.

B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in NEC.

1.3 TEST STANDARDS:

A. All material and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and material which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.B. Definitions:

1. Listed; equipment or device of a kind mentioned which:

a. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.
b. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

2. Labeled; equipment or device is when:

a. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
b. The laboratory makes periodic inspections of the production of such equipment.
c. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.

3. Certified; equipment or product is which:

a. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
b. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
c. Bears a label, tag, or other record of certification.

4. Nationally recognized testing laboratory; which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES):

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.
C. Service Qualifications:

1. There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within eight hours of receipt of notification that service is need. Submit name and address of service organizations.

1.5 MANUFACTURED PRODUCTS:

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts should be available.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

1. The Owner shall have the option of witnessing factory tests. The contractor shall notify the AFI Representant through the Resident Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.
2. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.
3. When equipment fails to meet factory test and reinspection is required, the contractor shall be liable for all additional expenses, including expenses of the Ownmer.

1.6 EQUIPMENT REQUIREMENTS:A. Where variations from the contract requirements are requested, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.7 EQUIPMENT PROTECTION:

Equipment and material shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.

A. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing, operating and painting.

B. Damaged equipment shall be, as determined by the Resident Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.

C. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

D. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.8 WORK PERFORMANCE:

A. Arrange, phase and perform work to assure electrical service for other buildings at all times.

B. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions.

C. Coordinate location of equipment and conduit with other trades to minimize interferences.

1.9 EQUIPMENT INSTALLATION AND REQUIREMENTS:

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working spaces shall not be less than specified in the NEC for all voltages specified.C. Inaccessible Equipment:

1. Where the Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and ductwork.

1.10 EQUIPMENT IDENTIFICATION:

A. In addition to the requirements of the NEC, install an identification sign which will clearly indicate information required for use and maintenance of items such as panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchgear and motor control assemblies, control devices and other significant equipment.

B. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 3/16-inch high. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

1.11 SUBMITTALS:

A. Submit SAMPLES AND SHOP DRAWINGS for Control panel, Substation, Motor Control Centers.

B. The Owner's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Owner to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more that one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION ".
2. Submittals shall be marked to show specification reference including thesection and paragraph numbers.
3. Submit each section separately.

E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements.
Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

F. Manuals:

1. Maintenance and Operation Manual, submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, manufacturer's standard binders or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manual shall include:

a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
b. A control sequence describing startup, operation, and shutdown. c. Description of the function of each principal item of equipment. d. Installation and maintenance instructions.
e. Safety precautions.
f. Diagrams and illustrations. g. Testing methods.
h. Performance data.i. Lubrication schedule including type, grade, temperature range, and frequency.
j. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
k. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

G. Approvals will be based on complete submission of manuals together with shop drawings.

H. After approval and prior to installation, furnish the Resident Engineer with one sample of each of the following:

1. A twelve inch length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
2. Each type of conduit coupling, bushing and termination fitting.
3. Conduit hangers, clamps and supports.
4. Duct sealing compound.
5. Each type of receptacle, toggle switch, outlet box, manual motor starter, device plate, engraved nameplate, wire and cable splicing and terminating material and single pole molded case circuit breaker.

I. In addition to the requirement of SUBMITTALS, the AFI reserves the right to request the manufacturer to arrange for a AFI representative to see typical active systems in operation, when there has been no prior experience with the manufacturer or the type of equipment being submitted.

1.12 SINGULAR NUMBER:

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

END OF SECTION

SECTION 16110 - ELECTRICAL RACEWAY SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION:

A. Furnish and install complete raceway systems, with all accessories, fittings, boxes, etc., as indicated and specified.

B. All raceway runs are shown diagrammatically to outline general routing of raceway. Avoid interfering with pipes, ducts, structural members, or other equipment. Deviations in accordance with Engineer, after acceptance, are without additional compensation.

C. Furnish and install electric metal conduit in interiors of buildings except in chlorine areas and sulfur dioxide areas where polyvinylchloride (PVC) conduit is to be used. Furnish and install RGS conduit for all above ground exterior buildings use, unless otherwise noted.

1.2 REFERENCE STANDARDS:

A. National Fire Protection Association (NFPA):

1. National Electrical Code (NEC) B. Underwriter's Laboratories, Inc. (UL):
1. U.L.-1 Electrical Flexible Metal Conduit
2. U.L.-6 Rigid Metal Electrical Conduit
3. U.L.-360 Electrical Liquid-Tight Flexible Steel
4. U.L.-651 Schedule 40 and 80 PVC Conduit
5. U.L.-886 Electrical Outlet Boxes and Fittings for Use in Hazardous Locations, Class 1, Groups A, B, C, and D and Class 11, Groups E, F, and G.
6. U.L.-1242 Intermediate Metal Conduit

C. National Electrical Manufacturers Association (NEMA):

1. TC-2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

1.3 SUBMITTALS:A. Submit shop drawings and manufacturers' product data in accordance with requirements of General Specifications and Section 16050.

PART 2 PRODUCTS

2.1 MANUFACTURER'S COMPLIANCE:

A. Manufacturer's acceptance contingent upon products compliance with specifications:

B. Rigid Metal Conduit, intermediate metal conduit and polyvinylchloride-coated rigid steel conduit.

1. Triangle Conduit & Cable Company, New Brunswick, NJ.
2. Republic Steel Corporation, Cleveland, OH.
3. Robroy Industries Verona, PA.
4. Allied Tube and Conduit, Harvey, IL. C. Polyvinylchloride (PVC) Conduit:
1. Triangle Conduit & Cable Company, Inc., New Brunswick, NJ.
2. Republic Steel Corp., Cleveland, OH.
3. Carlon Electrical Sciences, Inc., Cleveland, OH. D. Flexible Conduit:
1. American Flexible Conduit Company, New Bedford, MA.
2. Anaconda Metal Hose, Waterbury, CT.
3. International Metal Hose Company, Bellevue, OH. E. Boxes and Fittings:
1. O.Z./Gedney Company, Terryville, CT.
2. Crouse-Hinds Electrical Construction Materials, Syracuse, NY.
3. Appleton Electric Company, Chicago, IL. F. Fiberglass-Reinforced Polyester Boxes:
1. Crouse-Hinds Electrical Construction Materials, Syracuse, NY.
2. Hoffman Engineering Company, Anoka, MN.

2.2 MATERIALS AND COMPONENTS:A. Rigid Metal Conduit:

1. Provide galvanized rigid metal conduit with a coupling on one end and thread protector on other.
2. Hot-dip galvanize rigid steel conduit over entire length, including threads.
Conduit conforming to U.L.-6. B. Intermediate Metal Conduit:
1. Provide galvanized intermediate metal conduit with a coupling on one end and a tread protector on the other.
2. Hot-dip galvanize intermediate metal conduit over entire length, including threads. Conduit conforming to U.L.-1242.

C. Flexible-Metal Conduit:

1. Provide flexible-metal conduit for use in dry areas and match fittings, size, and material to rigid conduit to which it is connected. Flexible-metal conduit conforming to U.L.-1.

2. Provide liquid-tight flexible-metal conduit for use in damp and corrosive areas consisting of flexible-metal conduit, with liquid-tight, sunlight- resistant jacket extruded over the conduit. On 1-1/4-in. and larger conduits, furnish separate external ground wire. Liquid-Tight flexible-metal conduit conforming to U.L.-360.

D. Polyvinylchloride (PVC) Conduit:

1. Provide PVC conduit, Schedule 40 conforming to industry NEMA Standard TC-2 and UL-651.

E. Polyvinylchloride-Coated Rigid Steel Conduit:

1. Provide polyvinylchloride-coated (PVC-Coated), rigid steel conduit consisting of hot-dipped galvanized rigid steel conduit, as specified hereinbefore, with a polyvinylchloride jacket not less than 40 mils thick, bonded to the conduit. The adhesive strength of the bonding to equal or exceed tensile strength of the coating. Provide couplings and fittings for this conduit with an integral, bonded, overlapping pressure-sealing sleeve of the same insulation thickness. Extend sleeves one pipe diameter or 2-in. (whichever is less) beyond the end of the coupling so sleeve of coupling makes a watertight fit with the plastic jacket on the conduit when coupled together.

F. Boxes:
1. Provide standard, sheet-metal, outlet and junction boxes constructed of code- gauge, galvanized sheet steel. Size each box as required by the NEC.
2. Provide boxes containing fixture studs for hanging fixtures. Use concrete- tight boxes for installation in concrete. Do not use shallow boxes unless building construction is such that it is impossible to use standard-depth boxes.
3. Provide outlet boxes and fittings for hazardous locations conforming to U.L.-886 for class, group, and division indicated.
4. Provide boxes and covers for polyvinylchloride-coated steel conduit made of galvanized cast iron, with a polyvinylchloride factory-applied coating over the galvanizing. Provide coating thickness of 40- mil minimum. Boxes to have hubs with extruded sleeves extending beyond the hub in the same manner as specified for conduit couplings. Provide cover screws of stainless steel.
5. Provide cast boxes with covers or device plates suitable for the area classification. Use cover screws of stainless steel or high brass for iron boxes.
6. Provide polyvinylchloride boxes for use as junction boxes and provide high impact strength fiberglass-reinforced polyester boxes for use as device boxes, pull boxes, and terminal boxes for use with polyvinylchloride conduit. Size each box as required by the National Electrical Code.
7. Provide pull boxes used below motor control centers and large pull boxes (10 inches by 10 inches by 6 inches deep and larger) hung from ceilings constructed of angle or channel frames, and sheet metal with welded joints. All welds to be ground smooth. Provide neoprene gaskets

for complete sealing. Sectionalize covers longer than 40-in. to facilitate handling and gasket sectionalized covers where covers meet, using angle iron or channel cross members at the joint. Sheet metal to be not less than No. 12 gage galvanized sheet steel. Make interior angles and supports of galvanized steel, or carbon steel with a corrosion-resistant phosphate coating and primer. Provide each box with a grounding lug for connection to the nearest ground bus. Current capacity of ground lug at least that required by the National Electrical Code for the largest feeder entering the equipment.
8. Construct telephone cabinets of code-gauge galvanized steel with a hinged flush door. Provide backboard of 3/4-in. exterior grade plywood in the cabinet. Cabinet sizes and locations shall be as indicated on the drawings and required by the telephone company. Furnish and install telephone cabinets as directed by the telephone company.

G. Fittings:

1. Provide cast-iron fittings of malleable iron or a mixture of gray iron and cast steel.2. Provide suitable expansion fittings where conduits cross expansion joints.
Equip these fittings with grounding straps, clamps, and copper bonding jumpers.

PART 3 EXECUTION

3.1 GENERAL:

A. Perform all work in accordance with the National Electric Code.

B. Use no conduit less than 3/4 inches in diameter, unless otherwise indicated.

3.2 INSTALLATION OF FITTINGS:

A. Install expansion fittings wherever conduits cross structural expansion joints.
Keep the fittings in line with conduit, and install with regard to temperature so that full working range of expansion is available.

B. Do not install fittings to replace elbows and pull boxes, unless space or other problems make use of fittings necessary. Use oversize fittings whenever large cable is installed, in order to maintain proper bending radius.

C. Terminate ends of all floor conduits installed for future use with couplings and readily removable plugs set flush with finished floor surface. Cap spare wall conduits at wall where they enter building.

D. Equip ends of all conduits with suitable conduit fittings. Fit conduits terminating at motor control center or power distribution equipment or in box above or below, with grounding type bushings, or solidly ground by locknuts or other acceptable fittings. Connect each grounding bushing to ground bus by a bare or green-covered copper wire. Do not use ground wire smaller than 12 awg. Install ground wire larger than 12 gauge when required by NEC. Where conduits terminate in unprotected areas or where bonding is required over expansion joint, flexible conduit or equivalent; use ground wires No. 6 Awg. copper or larger.

E. Terminate conduits entering gasketed sheet-metal boxes or gasketed sheet-metal equipment enclosures with gasketed hubs.

F. Terminate conduits entering nongasketed sheet-metal boxes or enclosures with double locknuts and insulated bushings, or with acceptable equivalent.

3.3 INSTALLATION OF RACEWAYS:A. Install exposed raceways parallel or at right angles to walls and ceiling beams.
Make all changes in directions with approved bends, elbows, and pull boxes. Space parallel runs uniformly throughout. Secure in place by approved hangers and approved fasteners. Effectively ground raceways by connection to properly grounded enclosures, bonding, or other approved means, to obtain permanent low resistance path to ground throughout installation. Ensure that raceway sections in single run and in parallel runs are of same type and finish.

B. Support raceways concealed above suspended ceilings from slab above ceiling in same manner as exposed raceways. Do not support raceways from ceiling supports.

C. Provide cast-in-place inserts in concrete to support all runs, unless otherwise permitted. Use stainless steel sleeve type concrete anchors for installing boxes, conduit supports, etc. Provide stainless steel nut, bolts, washers, etc. for use with concrete anchors.

D. Provide bolts or machine screws on steel work. Support conduits by hangers or pipe straps spaced according to NEC, but in no case more than 10 feet on centers.

E. Provide galvanized supports for galvanized conduit.

F. Install conduits in slabs as close to middle of concrete slabs as practicable without disturbing reinforcement. Do not use conduit with outside diameter exceeding one-third of slab thickness. Do not place conduits closer than three diameters on centers, except at cabinet locations where slab thickness is increased as permitted by Engineer.

G. Where conduits are concealed in bottom floor slab, place in concrete slab and not in fill below slab.

H. Provide sleeves passing through exterior walls and slabs which are wall entrance seals of watertight construction. For new construction furnish watertight seal between slab and sleeve, and between sleeve and conduit or cable similar to O.Z./Gedney Type "FSK". For existing construction furnish watertight seal for use in core bit drilled holes that provides seal between concrete and conduit or cable similar to O.Z./Gedney Type "CSM1". Use wall-entrance seals or malleable iron with watertight sealing gland which may be tightened any time after installation.

I. Do not use dissimilar metals in conjunction with each other. Use suitable insulation between adjoining surfaces so as to eliminate direct contract and any resultant electrolysis. Maintain electrical continuity of system. Use bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials as insulation.
J. Install fittings to match raceway being used.

K. Where conduits pass through firewalls, grout hole around the conduit to the full depth of the material penetrated.

L. Provide separate raceways for all low voltage instrumentation raceways (50 volts and below) from control and power raceways.

3.4 BENDS:

A. Make all bends carefully to prevent distortion of circular cross section. Field bend conduit to have an inside radius of not less than nine diameters.

B. Where bends of less than nine diameters are necessary, use standard factory elbows. Size conduit to permit cable-bending radius within the factory elbow of at least eight times cable diameter.

C. Use concentric bends in parallel runs. Allow no conduit to have more than two 90 degree bends or equivalent thereof between pulling points.

3.5 CUTTING, THREADING AND CONNECTING:

A. Make all field cuts in conduits squarely, file cut ends, ream to remove rough edges and thread in accordance with N.E.C. No running thread permitted. Make all connections mechanically strong and tight, and with acceptable connectors. Where conduit surface coating is damaged or removed in the cutting, threading or reaming process restore the surface to the original condition.

3.6 CONDUIT CLEANING:

A. Clean all conduits carefully before and after installation, ream ends free of burrs, and free inside surfaces from all imperfections likely to injure cable.

B. After installation of each complete new conduit run, snake the run with band to which is attached a tube cleaner with cylindrical mandrel of a diameter not less than 85 percent of nominal diameter of conduit. Remove and replace all conduit through which mandrel will not pass.

C. Use a sponge with steel brush to clean steel conduit and use a sponge with nylon brush to clean PVC conduits.

D. After cleaning, protect ends of all conduits with standard caps to prevent entrance of water, concrete, debris, or other foreign substance.

3.7 CONDUIT DRAINAGE:

A. Where practicable, pitch conduit to drain to outlet boxes, or install so as to avoid trapping moisture. Where dips are unavoidable in exposed conduits, install fitting with suitable drain hole at low point.

3.8 INSTALLATION OF BOXES:

A. Install sheet metal boxes only in dry, accessible location. Install cast metal boxes (unless otherwise indicated) in outside concrete or masonry walls, in floor slabs, in basements and all other below grade locations. Cast metal boxes must be used (unless otherwise indicated) where vapor-tight fixtures are required, for all surface mounting of wall switches and receptacles and for all outdoor use. Install pull boxes for motor control centers and large ceiling hung boxes where indicated.

B. Install boxes in conformity with all requirements of NEC. Install boxes designed for type of construction involved. Support boxes in same manner as required for conduit. Size boxes to provide bending radius for wire or cable of at least eight times diameter or in accordance with NEC, whichever is larger.

C. Center all outlets in panels, or spaces and adjust to structural finish. Where specific locations are not indicated, locate outlets with respect to equipment served.

D. Place all outlet boxes, junction boxes, pull boxes, etc., in accessible locations when they are installed above or behind plastered ceilings, furred spaces, or suspended ceilings. Install access panels of suitable size. Mark all access panels for all boxes so panels can be readily located in future. Mark, using metal tabs or plastic buttons which cannot mark ceilings or walls, appropriate for type of construction being used.

E. Assemble cast-metal boxes with threaded conduit hubs in such manner that conduit connections and gasketed covers are watertight. Close all unused threaded openings with pipe plugs and compound.

F. Provide cast boxes with covers and device plates suitable for the area classification. Install screws of stainless steel or high brass for iron boxes.

3.9 FLEXIBLE CONNECTIONS TO MOTORS AND EQUIPMENT:

A. At all motors and electrically operated equipment to which conduit connections are made, install with a complete connection between end of conduit and terminal box of motor or other equipment.

B. Install the conduits in locations permitting direct connection to motors.

C. Make connections between rigid raceway and motor or equipment subject to vibration and adjustment using flexible conduit. Make each connection with at least one quarter bend so that no vibration can be transmitted beyond flexible connection.

D. Install flexible metal conduit, fittings, and accessories in dry areas in accordance with requirements of NEC.

E. Install liquid-tight flexible metal conduit in damp and corrosive areas. Locate conduit to reduce the possibility of damage to the exterior coating. Use fittings that screw into flexible conduit and provide gaskets where required.

3.10 TELEPHONE RACEWAY INSTALLATION:

A. Install empty conduit between all telephone outlets, terminal boxes, and cabinets. Provide pull cable and leave in conduit for telephone installer use.

3.11 HAZARDOUS AREAS:

A. Install all conduits, fittings, equipment and devices within areas to comply with requirements of NEC for Hazardous Locations, Class, Division, and Group as indicated on the drawings.

B. In such hazardous locations, seal conduits terminating at boxes enclosing circuit- opening equipment at entrance to enclosure with approved, compound-filled, commercial, sealing fittings to prevent passage of explosive or combustible gases through conduits.

C. Seal all conduits leading from or entering such hazardous locations at points of exit or entrance.

D. Install conduit connections with at least five threads tightly engaged, and made up with suitable thread compound.

E. Where drain/seal fittings are required, they shall be of malleable iron construction with an internal drainage path which provides a visual means to ensure that the compound chamber is properly filled. The installation should enable the drain/breather fitting and filler plug to be installed right after the compound is poured.

END OF SECTION

SECTION 16120 - ELECTRIC WIRES AND CABLES

PART 1 GENERAL

1.1 DESCRIPTION:

A. Furnish and install all wires and cables necessary for complete electrical systems, as indicated and specified.

1.2 REFERENCE STANDARDS:

A. ASTM: American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103, U.S.A.

1. B 3 - Soft or Annealed Copper Wire.
2. B 8 - Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
3. B 33 - Tinned Soft or Annealed Copper Wire for Electrical Purposes.

B. NEC: National Electrical Code: National Fire Protection Association, 470 Atlantic Avenue, Boston, MA.

C. U.L.: Underwriters Laboratories, Inc., 333 Pfingston Road, Northbrook, IL.

1. U.L. 44 - Wires and Cables Rubber Insulated.
2. U.L. 83 - Wires Thermoplastic-Insulated.
3. U.L. 854 - Cables, Service Entrance.

D. NEMA: National Electrical Mfg's Association, 2101 L Street, N.W. Washington, D.C. 20037.

1. WC 3 - Rubber Insulated Wire & Cable.
2. WC 5 - Thermoplastic Insulated Wire & Cable.
3. WC 7 - Cross-Linked-Thermosetting Polyethylene-Insulated Wire & Cable.
4. WC 8 - Ethylene-Propylene-Rubber-Insulated Wire & Cable.
5. WC 30 - Color Coding of Wires & Cable.

1.3 SUBMITTALS:

A. Shop drawings and manufacturer's product data in accordance with requirements of Section 16050.
B. Two samples of each type of wire. Samples of necessary length with manufacturer's name and number or type, voltage rating, conductor size, and insulation type on each conductor

sample. Color code all control, indicating and metering wiring, and lighting branch-circuit wiring.

1.4 MANUFACTURER'S COMPLIANCE:

A. Contingent upon products' compliance with specifications. B. 15 kv cable:
1. General Electric Company, 1260 Boston Avenue, Bridgeport, CT - Type.
2. Rome Cable Division of Alcoa, 1501 Alcoa Building, Pittsburgh, PA - Type XLP.
3. Triangle Conduit and Cable Company, Inc., P.O. Box 711, New Brunswick, NJ - Everene cable.
4. The Anaconda Company, Wire and Cable Division, Greenwich, CT. C. 600V, 480V, 380V, 220V, 208V, 200V, 120V, 115V cable:
1. General Electric Company.
2. Rome Cable Division.
3. The Rockbestos Company, 550 Nicoll Street, New Haven, CT. D. Control and metering wire:
1. The Rockbestos Wire and Cable Company, single and multiconductor, 600V control cable.
2. General Electric Company - Vulkene control cable, Type SI.
3. Rome Cable Company - control cable, 600V, Type B, size 12, 7 strand. E. Cable fireproofing tape:
1. MAC Products, Inc., 60 Pennsylvania Avenue, Kearny, NJ.
2. Acceptable equivalent.

PART 2 PRODUCTS

2.1 MATERIALS:

A. Furnish copper conductors. Material and stranding of conductors: Conforms to ASTM B 33-80 ASTM B3-80, and to ASTM B 8-77, for the appropriate class. No. 12 Awg minimum wire size unless otherwise noted.

B. Tinned wire used with natural rubber insulation: Conforms to ASTM B 33. Uncoated, soft or annealed copper wire conforming to ASTM B3-80.

C. 15 kv/5 kv cables: single-conductor, shielded, grounded cross-linked polyethylene insulated, 90 degrees C, copper conductors. The outer jacket: polyvinylchloride.

D. Wires and cables for maximum 600-volt power circuits: Type XHHW rated RHW with cross-linked polyethylene insulation, Type RHW-75C with rubber or rubberlike insulation and neoprene jacket or ethylene propylene rubber EPR.

E. Wires and cables for lighting and other 120/240-volt and 120/208-volt circuits: Type THW-75C.

F. Wires and cables for control, indicating , metering, or alarm circuits: single and multi-conductor control cable, copper conductors, Class B or C stranding. Insulation, 600-volt polyethylene, polyvinylchloride, or E.P.R.

G. Shielded cable for instrumentation wiring: 19-strand copper conductors, size No. 16 AWG. Insulate conductors individually with color coded polyethylene or polyvinylchloride. Twist pairs twisted with varying lay (if more than one pair) and cover with cable tape and copper or aluminum coated mylar shielding tape and tinned copper drain wire. Jacket: polyvinylchloride. Cables: rated 600 volts and 90 degrees C.

H. Furnish silicone rubber insulated wiring with asbestos braid, Type SA, in the incinerator building above the first floor.

I. Direct-burial cables: Type USE multiconductor cables with neoprene jacket and 600-volt insulation.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION:

A. Install wiring in accordance with applicable provisions of National Electrical Code, and as indicated.

B. Wire and cable sizes are indicated however, in no case use smaller cable sizes than required by the National Electrical Code.

C. Unless otherwise indicated, use no conductor smaller than No. 12 AWG.

D. Conductors for branch lighting circuits: Install conductors of sizes that greatest voltage drop between lighting panel and center of load will not exceed 2 percent at rated load.

E. Number and sizes of wires and conduits indicated are guide only and are not necessarily correct number and sizes necessary for actual equipment installed. Install as many wires and conduits as required and necessary for complete electrical system, and provide adequately for the equipment actually installed.

F. Install conductors continuous from outlet to outlet and make no splices except within outlet or junction boxes.

G. Draw a11 conductors contained within single conduit at same time.

H. Apply wire pulling compound if required to conductors being drawn through conduits. Use pulling compound, Minerallac No. 100, Y-er-Eas, Yellow 77 or acceptable equivalent.

I. Use no cable bend with radius of less than eight times its diameter.

J. Wires and cables installed without prior submittal review and Engineer's approval are subject to removal at no additional expense to Owner.

K. Support cables in riser conduits at intervals as required by National Electrical Code.

3.2 15 KV CABLE SPLICING AND TERMINATIONS:

A. Use experienced cable splicers in manholes. Use materials and procedures recommended by cable manufacturer.

B. Use primary 15 kv cable terminations with rating of 15,000 volts/5,000 volt. Ensure that standard withstand conforms to IEEE Std. 48 and is in compliance with specification Section 16999, Field Acceptance Tests. Use potheads, elbow connectors, clamp type connectors or termination as recommended by equipment manufacturer.

B. Ensure that all splicing and terminating of 15 kv cable is in accordance with designs, materials, and instructions set forth by cable manufacturer.

D. Wrap cables in manholes with fireproof tape which meets ASTM D 626. Install tape in accordance with manufacturer's instructions.

3.3 CONDUCTOR IDENTIFICATION:

A. Label each wire at both termination points. Carry individual conductor or circuit identification throughout, with circuit numbers or other identification clearly stamped on terminal boards and printed on directory cards in distribution cabinets and panelboards.

B. Identify each wire in junction boxes, cabinets, and terminal boxes where total number of control, indicating, and metering wires is three or more and no terminal board is provided, including all power wire by means of plastic-coated, self- adhesive, wire marker.

C. In cases similar to above where terminal boards are provided for the control, indicating, and metering wires, identify all wires including motor leads and other power wires too large for connection to terminal boards, by wire markers as specified above.

D. In manholes, identify each wire by laminated plastic tag located so easily seen.

3.5 CONNECTORS, TERMINAL LUGS AND BOARDS:

A. For wiring of circuits consisting of No. 10 or No. 12 AWG solid wires, such as for lighting branch circuits, utilize self-insulated pressure type connectors for all splices or joints.

B. Terminate all wires connected to terminal boards, terminal blocks, or to other similar terminals by means of ring and tongue, nylon self-insulated, tin-plated copper pressure terminals.

C. Fabricated terminal boards, installed where indicated, of type 600 volts, 30 amperes, screw terminals, with white marking strips for wire identification, of the
4-, 6-, 8-, or 12-pole type, as necessary.

D. Clearly and permanently mark terminal strips with ink or indelible pencil. Mark each wire consistently throughout entire system; using notation of wires given on manufacturer's wiring diagrams wherever possible.

END OF SECTION

SECTION 16127 - CABLES, LOW VOLTAGE (600 VOLTS AND BELOW)

PART 1 GENERAL

1.1 DESCRIPTION:

This section includes the furnishing, installation, and connection of the low voltage power and lighting wiring.

1.2 RELATED WORK:

A. Excavation and backfill for direct burial cable.

B. General electrical requirements that are common to more than one section in Division 16.

1.3 SUBMITTALS:

In accordance with section 16050.

A. Manufacturer's Literature and Data: Showing each cable type and rating.

B. Certificates: Two weeks prior to final inspection, deliver to the Resident Engineer four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS:

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

A. Federal Specifications (Fed. Spec.):

- J-C-30A (1).....Cable and Wire Electrical (Power, Fixed Installation)
- HH-I-595C.....Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic

B. National Fire Protection Association (NFPA):

- 70-84.....National Electrical Code (NEC) Amendments 84-1 thru 84-2

C. Underwriters Laboratories, Inc. (UL):
• 44-83.....Rubber-Insulated Wire and Cables-8/5/85
• 83-83.....Thermoplastic-insulated Wires-8/14/85
• 486-A-80.....Wire Connectors and Soldering Lugs for Use with Copper-8/26/85
• 486B-83.....Splicing Wire Connectors-8/26/85
• 486D-82.....Insulated Wire Connectors for Use with Underground Conductors-11/19/84
• 493-83.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables-1/25/85

PART 2 PRODUCTS

2.1 CABLE AND WIRE (POWER AND LIGHTING):

A. Cable and Wire: Fed. Spec. J-C-30, except as hereinafter specified. B. Single Conductor:
1. Annealed copper.
2. Stranded for sizes No. 8 and larger. Solid for sizes No. 10 and smaller.
3. Minimum size No. 12, except where larger sizes are shown. C. Insulation:
1. THW, XHHW, or dual rated THHN-THWN, UL 44, 83 and 493.
2. Isolated power system wiring: Type XHHW with a dielectric constant of 3.5 or less.

D. Color code:

1. Secondary service, feeder, and branch circuit conductors, be color coded as follows:

208/120 volt	Phase	480/277 volt
Black	A	Brown
Red Blue White	B C Neutral	Orange Yellow Gray *

*or white with colored (other than green) tracer.

2. Use solid color compound or solid color coating for No. 12 and No. 10 branch circuit conductors and neutral sizes.
3. Phase conductors No. 8 and larger color code using one of thefollowing:

a. Solid color compound or solid color coating.
b. Stripes, bands, or hash marks of color specified above.

c. Colored as specified using 3/4-inch wide tape. Apply tape in half overlapping turns for a minimum of three inches for terminal points, and in junction boxes, pull boxes, troughs, manholes, and handholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type.

4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Color code for isolated power system wiring, in accordance with the
NEC.

2.2 SPLICES AND JOINTS:

A. In accordance with UL 486 A, B, D and NEC. B. Branch circuits (No. 10 and smaller):
1. Connectors: Solderless, screw-on, reusable pressure cable type, 600 volt, 105 degree C. with integral insulation, approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped wires.
3. The number, size, and combination of conductors, as listed on the manufacturers packaging shall be strictly complied with.

C. Feeder Circuits:

1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material.
2. Field installed compression connectors for cable sizes 250 MCM and larger shall have not less than two clamping elements or compression indents per wire.
3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.
4. Plastic electrical insulating tape: Fed Spec. HH-I-595 shall apply, flame retardant, cold and weather resistant.

2.3 CONTROL WIRING:

A. Unless otherwise specified in other sections of these specifications, sizecontrol wiring as specified for power and lighting wiring, except the minimum size shall be not less than No. 12.

B. Size wire large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls.

2.4 COMMUNICATION AND SIGNAL WIRING:

A. Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown.

B. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished.

C. Multi-conductor cables shall have the conductors color coded.

2.5 WIRE LUBRICATING COMPOUND:

A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.

B. Shall not be used on wire for isolated type electrical power systems.

2.6 FIREPROOFING TAPE:

A. The tape shall consist of a flexible, conformable fabric of organic compositioncoated one side with flame-retardant elastomer.

B. The tape shall be self-extinguishing and shall not support combustion. It shall be arcproof and fireproof.

C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

D. The finished application shall withstand a 200 ampere are for not less than 30 seconds.

E. Securing tape: Glass cloth electrical tape not less than 7 mils thick, and
3/4-inch wide.

PART 3 EXECUTION

3.1 INSTALLATION, GENERALLY:A. Install in accordance with the NEC, and as specified.

B. Install all wiring in raceway systems, except where direct burial is shown.

C. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes, or handholes.

D. Install cable supports for all vertical feeders in accordance with the NEC.

Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

E. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.

F. Seal cable and wire entering a building from underground between the wire and conduit, where the cable exits the conduit, with a nonhardening approved compound.

G. Wire Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
2. Use ropes for pulling feeders made of nonmetallic material.
3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Resident Engineer.
4. Pull in together multiple cables in a single conduit.

3.2 INSTALLATION IN MANHOLES:

A. Install and support cables in manholes on the steel racks with porcelain or equal insulators. Train the cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.

B. Fireproofing:

1. Where low voltage cables are installed in the same manholes with high voltage cables, also cover the low voltage cables with arc proof and fireproof tape.
2. Use tape of the same type as used for the high voltage cables, and apply the tape in a single layer, one-half lapped or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than one inch into each duct.
3. Secure the tape in place by a random wrap of glass cloth tape.

3.3 SPLICE INSTALLATION:
A. Splices and terminations shall be mechanically and electrically secure.

B. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Owner.

3.4 CONTROL, COMMUNICATION AND SIGNAL WIRING INSTALLATION:

A. Unless otherwise specified in other sections of these specifications install wiring and connect to perform the functions shown and specified in other sections of these specifications.

B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.

C. Where power supply circuits are not shown for systems, connect them to the nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

D. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

E. System voltages shall not exceed 120 volts and shall be lower voltages where shown on the drawings or required by the NEC.

3.5 CONTROL, COMMUNICATION AND SIGNAL SYSTEM IDENTIFICATION:

A. Install a permanent wire marker on each wire at each termination.

B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

C. Wire markers shall retain their markings after cleaning.

D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.6 FEEDER IDENTIFICATION:

A. In each interior, pullbox and junction box, install metal tags on each circuit cables and wires to clearly designate their circuit identification and voltage.

B. In manholes and handholes, provide tags of the embossed brass type, and also show the cable type and voltage rating. Attach the tags to the cables withslip-free plastic cable lacing units.

3.7 FIELD TESTING:

A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.

B. Test shall be performed by meggar and conductors shall test free from short-circuits and grounds.

C. Test conductors phase-to-phase and phase-to-ground.

D. Megger motors after installation but before start-up and test free from grounds.

E. The Contractor shall furnish the instruments, materials, and labor for these tests.

END OF SECTION

SECTION 16140 - WIRING DEVICES

PART 1 GENERAL

1.1 DESCRIPTION:

A. Furnish, install, field test, and place in operating condition, wiring devices as indicated and as specified.

1.2 REFERENCE STANDARDS:

A. National Electrical Manufacturers Association (NEMA):

1. National Electrical Code (NEC). B. Federal Specifications:
1. W-S-896-F (1P-2P-3W) Switch, Toggle, Single Unit with wall plates.
2. W-C-596-F Plug, Electrical Connector, Receptacle, Electrical. C. Underwriters' Laboratories, Inc. (UL):
1. UL-20, General Use Snap Switches.

D. National Fire Protection Association (NFPA):

1. National Electrical Code (NEC).

1.3 SUBMITTALS:

A. Submit shop drawings and manufacturer's product data in accordance with requirements of General Specifications and Section 16050.

PART 2 PRODUCTS

2.1 MANUFACTURER'S COMPLIANCE:

A. Manufacturers acceptance contingent upon products compliance with specifications.B. Provide all devices with U.L. label.

2.2 MANUFACTURERS:

A. Arrow-Hart, Inc., Florence, KY.

B. Allen-Bradley Co., Milwaukee, WI. C. Appleton Electric Co., Chicago, IL.

D. Bryant Electric, Div. of Westinghouse, Bridgeport, CT. E. Cutler Hammer, Inc., Milwaukee, WI.
F. Crouse-Hinds Co., Syracuse, NY.

G. Harvey Hubbell, Inc., Bridgeport, CT. H. Pass & Seymore, Inc., Syracuse, NY.
2.3 MATERIALS AND COMPONENTS:

A. Wall Switches:

1. Provide alternating current, general-use, snap switches, in flush device boxes or on outlet box covers, totally enclosed in composition case, with insulated mounting yoke and sidewired, binding screw-type terminals. Single-pole, 2- pole, 3-way, or 4-way switches rated 20 amperes at 120/277 volts a.c. Switch to meet Fed. Spec. W-S-896-F and UL-20.
2. Switches for controlling lighting:

a. Arrow-Hart Cat. No. 1991, 1992, 1993 or 1994.
b. Harvey Hubbell Cat. No. 1221, 1222, 1223 or 1224. c. Bryant Electric Cat. No. 4901, 4902, 4903 or 4904.
d. Pass & Seymore, Cat. No. 20AC1, 20AC2, 20AC3 or 20AC4.

3. Provide pilot lights for switches controlling lights in seldom frequented locations consisting of either separate units or a 2-unit combination with separate switch and yoke-mounted candelabra base socket rated 75 watts,
125 volts, and fitted with a ruby lens. Provide a clear 6- or 7-watt lamp with each pilot.

B. Watertight Switches:1. Provide watertight switches consisting of flush mounting switches in NEMA Type 4 gasketed cast metal boxes. Switch operable through shaft in matching cast metal cover, twenty-ampere, 120/277-volt switch enclosures:

a. Crouse-Hinds Type MC or MCC.
b. Allen-Bradley Cat. No. 600-TCX-4. c. Cutler-Hammer Cat. No. 9101 H98.

C. Explosionproof Switches:

1. Provide explosionproof switches consisting of flush mounting switches in cast metal boxes meeting requirements for NEMA Type 7D enclosure approved for use in National Electrical Code Class I, Group D, Div. 1, atmosphere. Switch operable through shaft in matching cast metal cover.
20-ampere, 120/277-volt switch assemblies:

a. Crouse-Hinds Type EFS.
b. Appleton Electric Type EFS. D. Flush Receptacles:

1. Provide 20-ampere, 125-volt flush receptacles constructed in flush device boxes and of grounding type in composition case with insulated mounting yoke, side-wired, binding screw-type terminals. Receptacles to meet Fed. Spec. WC596-F.
2. Duplex receptacles:

a. Arrow-Hart Cat. No. 5342.
b. Harvey Hubbell Cat. No. 5362. c. Bryant Electric Cat. No. 5362. d. Pass & Seymore Cat. No. 5342.

3. Single receptacles:

a. Arrow-Hart Cat. No. 5361.
b. Harvey Hubbell Cat. No. 5361. c. Pass & Seymore Cat. No. 5351.

E. Clock Receptacles:

1. Provide 3-wire, 15-ampere, and 125-volt hanger receptacle with flush stainless steel plate for each clock:

a. Arrow-Hart Cat. No. 5708.b. Harvey Hubbell Cat. No. 5235.
c. Bryant Electric Cat. No. 2828GS. d. Pass & Seymore Cat. No. 2123.

F. Special Receptacles:

1. Provide weatherproof devices rated 20 ampere, 125-volt, consisting of single receptacles with spring-loaded, soft-gasketed hinged covers with stainless steel spring. Covers as follows:

a. Arrow-Hart Cat. No. 4500FS. b. Harvey Hubbell Cat. No. 5206. c. Bryant Electric Cat. No. 4510.
d. Crouse-Hinds Cat. No. WLRS-1.

2. Provide in corrosive areas (NEMA 4X) a receptacle similar to the weatherproof device described above. Cover as follows:

a. Crouse-Hinds Cat. No. WLRS-1-S752.

3. Provide watertight, gasketed cast-metal enclosures with covers in areas subject to hose-down, meeting requirements, and either standard single or duplex type:

a. Appleton Electric Cat. No. AEE3382 and AEP3361, Style 2. b. Crouse-Hinds Cat. No. ARRH33 and APJ3385, Style 2.

4. Provide receptacles with matching plug or cord cap designed to meet NEMA

4 requirements when plug, cord and receptacle are assembled.
5. Provide explosionproof 20-ampere receptacles, of the delayed action type, preventing contact from being broken until arc has been extinguished. Receptacles with angle covers and spring-closed flaps:

a. Crouse-Hinds Type CPS.
b. Appleton Electric Type CPS.

6. Furnish one explosionproof plug for each three receptacles, with minimum of one, plugs to match receptacles and from same manufacturer.
7. Provide welding receptacles whereby plug ground contact makes contact with receptacle ground contact before current carrying contacts engage, and when withdrawing plug, ground contact remains engaged until after current carrying ground contacts disengage. Provide ampere rating as indicated on the drawings.G. Outlet Boxes and Enclosures:

1. Provide outlet boxes and enclosures conforming to Section 16110, Electrical Raceway Systems and enclosure schedule on the drawings unless otherwise indicated.

H. Device Plates:

1. Provide device plates suitable for type of outlet boxes and enclosures used.
Plates for flush-mounting by device manufacturer. Plates for surface- mounting boxes by either device manufacturer or box manufacturer.
2. Provide flush device plates of high corrosion resistant, Type 302 stainless steel.
3. Provide flush device plates of material and finish indicated, in certain designated areas.

I. Nameplates:

1. Provide nameplates or equivalent markings on switch enclosures to indicate ON and OFF positions of each switch. Do not use ON and OFF for 3-way or 4-way switches. Receptacles for special purpose shall have nameplates indicating their use, unless use is obvious. Nameplates shall otherwise conform to requirements specified under Section 16050.

PART 3 EXECUTION

3.1 GENERAL:

A. Perform all work in accordance with the National Electrical Code (NEC).

3.2 CONNECTION:

A. Securely and rigidly attach wiring devices in accordance with regulating agency, and as indicated, avoiding interference with other equipment.

B. Securely fasten nameplates using screws, bolts, or rivets and centered under or on the device, unless otherwise indicated.

3.3 GROUNDING:

A. Ground all devices in accordance with NEC.

B. Ground switches and their metal plates through switch mounting yoke, outlet box,and raceway system.

C. Ground flush receptacles and their metal plates through positive ground connection to outlet box and grounding system. Maintain ground to each receptacle by spring- loaded grounding contact to mounting screw, or by grounding jumper, both making positive connection to outlet box and grounding system at all times.

D. Ground explosion proof receptacles and plugs by making contact between the metal shells, and also by using grounding pin to make contact before power contacts are made.

END OF SECTION

SECTION 16160 - PANELBOARDS

PART 1 GENERAL

1.1 DESCRIPTION:

A. Furnish and install panelboards including circuit breakers and cabinets complete, in conformance with the latest NEMA Standards and Federal Specifications listed below.

1.2 REFERENCE STANDARDS:

A. National Electrical Manufacturers Association (NEMA):

1. PB1- Panelboards
2. AB1- Molded Case Circuit Breakers

B. Federal Specifications (FS):

1. W-P-115A - Panel, Power Distribution.
2. W-C-375B - Automatic Circuit Breakers.
3. QQ-S-365B - Silver Plating, Electro deposited, General Requirements for

C. National Fire Protection Association (NFPA):

1. National Electrical Code (NEC) D. Underwriter's Laboratories, Inc.:
1. UL 67 - Panelboards

PART 2 PRODUCTS

2.1 PANELBOARD MANUFACTURERS:

A. Manufacturers acceptable contingent upon products' compliance with the specifications:

1. General Electric Company, Schenectady, NY.2. Westinghouse Electric Corp., Distribution Equipment Division, St. Louis, MO.
3. Square D Company, Park Ridge, IL.
4. Cutler-Hammer Products, Milwaukee, WI.
5. I-T-E Electrical Products (Siemens), Alpharetta, GA.

2.2 PANELBOARDS:

A. Factory assembled deadfront type panelboards.

B. Furnish panelboards complete with branch circuit breakers and a main circuit breaker or main lugs only as indicated.

C. Furnish panelboards with full capacity separate ground bus, separate insulated neutral bus and furnish panelboards connected to a 3-phase, 4-wire service or single phase, 3-wire service as indicated.

D. Provide panelboards with the voltage, frequency and current ratings as indicated conforming to NEMA Standard PB1, Federal Specification W-P-115A. U.L. 67, and the N.E.C.

E. Furnish the panelboard main and neutral buses, with minimum 98 percent conductivity rectangular copper bars provided with bolted type lugs as necessary.

F. Drill buses to fit either "A", "B" or "C" Phase connectors, and ensure that connectors are interchangeable and installed in a distributed phase sequence.

G. Silver plate buses, connectors and terminals to a minimum thickness of 0.005-in., conforming to the requirements of Federal Spec. QQ-S-365B.

H. Prevent terminal lugs from turning per NEMA standard PBI and ensure they are suitable for the conductor material and size.

I. Provide main bus-bracing for each panel board adequate for 10,000 amperes symmetrical short circuit at 240 volts and 14,000 amperes symmetrical short circuit at 480 volts unless otherwise indicated.

2.3 CIRCUIT BREAKERS:

A. Furnish bolt-on type branch and main circuit breakers. Furnish frame sizes, trip settings and number of poles as indicated. Clearly and visibly mark circuit breakers with ampere trip rating. Furnish breakers meeting the requirements of F.S. W-C-375B and NEMA AB1

B. Furnish all breakers with quick-make, quick-break, toggle mechanisms andthermal-magnetic, inverse time-limit overload and instantaneous short circuit protection on all poles, unless otherwise indicated. Automatic tripping indicated by the breaker handle assuming a clearly distinctive position from the manual ON and OFF position. Furnish breaker handle that is trip-free on overloads.

C. Do not use single pole breakers with handle ties or bails in lieu of multipole breakers.

D. Furnish handle lock device on breakers as indicated to prevent the manual opening of the selected breakers.

E. Furnish padlocking device on breakers as indicated to prevent the opening of indicated breakers.

F. Ensure that voltage and interrupting rating of all breakers in a panelboard is not less than voltage and short circuit rating of the panelboard main buses, as indicated. Furnish breakers suitable to operate satisfactorily at the frequency indicated.

G. Furnish ground fault interrupter circuit breakers for certain circuits as indicated on the drawings.

H. Furnish single pole breakers with full module size. Do not install two pole breakers in a single module.

I. Furnish time-current characteristic curves and catalog information and data for each size of breaker furnished.

2.4 CABINETS:

A. Provide NEMA I cabinets, unless otherwise indicated and without knockouts.
Drill cabinets only for the exact conduit entrances and mounting bolts.

B. Finish cabinet fronts, trims and surface-mounted boxes in ANSI No. 61 or 49, light-gray enamel over a rust-inhibitive primer. Attach the fronts (exterior trims) to the boxes or interior trims, by quarter-turn, indicating trim clamps. Design cabinets for surface or flush mounting as indicated.

C. Unless otherwise specified, construct panelboard cabinets of code-gauge galvanized, sheet steel and equip with gutters of ample size for the risers and outgoing circuits. Ensure that the cabinets do not exceed 78-in. (1980 mm) in height.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Mount all panelboards such that the height of the top operating handle does not exceed 6 ft. 6-in. (1980 mm) from the floor.

B. Hang each door of the cabinet on semi- or fully-concealed hinges with a combination catch and lock.

C. On cabinets 48 in. (1200 mm) high and over, install a 3 point catch assembly latching at top, bottom and approximate middle.

D. Key all panelboard locks alike.

E. Provide directory card filled-out.

END OF SECTION

SECTION 16450 - GROUNDING

PART 1 GENERAL

1.1 DESCRIPTION:

A. Furnish and install a single, complete, integrated grounding system, including all conductors, raceways, and connections, specified and indicated.

B. Include grounding of switchgear, substations, motor control centers, electric equipment enclosures etc., outdoor substations, transformers, switch structures, etc.; ground grid systems with ground rod and water pipe connections; structural steel, and lightning protection system.

C. Include grounding conductors completely interconnecting water supply pipe, ground rods, ground grid, substation, switchgear and motor control center ground buses, other distribution equipment, and other groundable equipment.

1.2 REQUIREMENTS OF REGULATORY AGENCIES:

A. Install complete grounding system in accordance with codes, and standards.

1.3 REFERENCE STANDARDS:

A. American National Standards Institute:

1. ANSI C2.-1978 National Electrical Safety Code

B. National Fire Protection Association, 470 Atlantic Avenue, Boston, MA:

1. NFPA 70-1981 National Electric Code
2. NFPA 78-1975 Lightning Protection Code

TESTS:

A. Measure ground grid resistance with earth test megohmmeter and install additional ground rods and conductors as required until resistance to interconnected ground system is 5 ohms or less. Measure ground resistance in normally dry conditions and not less than 48 hours after rainfall.

PART 2 PRODUCTS

2.1 MANUFACTURERS ACCEPTABLE:

A. Contingent upon products' compliance with the specifications.

B. Ground rods - Copperweld Corporation, 2 Oliver Plaza, and Pittsburgh, PA.

2.2 CONDUCTORS:

A. Furnish soft drawn stranded copper grounding conductors. Minimum size of unenclosed grounding conductor shall be No. 6 Awg. All conductors shall be protected if physical damage would result from exposure.

B. Furnish bare conductors where buried in earth or where embedded in concrete. C. In buildings run insulated grounding conductors with green insulation only.
D. Furnish insulated grounding conductors with insulation rated at 600 volts.

E. Furnish grounding conductors for installation in all non-metallic raceway in addition to, and not to be considered as, the neutral wire of the system.

F. Connect a grounding conductor between panelboard and grounding system. Where a grounding bar is furnished with panelboard, connect grounding conductor to bar.

2.3 GROUND BUS:

A. Furnish a 2-in. by 1/4-in. copper bar complete with bolted type connectors as indicated. Connect grounding conductors from equipment in area to this ground bus. Connect ground bus to grounding system. Mount ground bus on 600v pedestal insulators.

2.4 CONNECTIONS:

A. Make all buried and concealed ground connections by exothermic welding.

B. Make accessible connections to structural members by exothermic welding process or by bolted connector. Connections to equipment or ground bus by acceptable bolted connectors. Furnish bolted ground connectors suitable for, and matching, grounding provisions furnished.C. Furnish copper, brass, or silicon bronze ground clamps for use on copper or brass pipes.

D. Furnish ground clamps, for use on iron pipes, of galvanized or malleable iron, or of standard noncorrosive material.

E. Furnish ground clamps, for use on pipes, with rigid metal base providing good contact by proper seating on the pipe. Do not use strap type clamps.

F. Design cable to ground rod connectors capable of being installed without having to pass over end of ground rod.

G. Where conduits are not effectively grounded by firm contact with a grounded enclosure, apply grounding bushings on at least one end of conduit run.

H. Furnish copper-clad steel or galvanized steel ground rods; type, diameter and length as indicated on drawings.

PART 3 EXECUTION

3.1 INSTALLATION OF GROUNDING CONDUCTORS:

A. Install grounding conductors so not exposed to physical damage. Install connections firm and tight. Arrange conductors and connectors so no strain on connections.

B. Run grounding conductors associated with direct burial cables in common trenches above or if indicated beside cables.

C. Bury equipment grounding conductors 18-in. deep. Bring loops or taps up for connection to equipment or other items to be grounded.

D. Where raceways are used to contain and protect grounding conductors, install in accordance with Electrical Raceway Systems Section.

E. Where bare grounding conductors are contained within metallic raceways, bond ends of raceways to conductors by suitable fittings.

F. Install loop type, low impedance, grounding system interconnecting all components so at least two grounding connections are provided for each major item of electrical equipment. Ensure that severing of any single groundingconductor in this system does not remove grounding protection on any major item.

G. Connect structural steel at locations indicated by an external perimeter loop of grounding conductor installed around all sides of building foundation, buried at least 18-in. (450 mm) below grade, and connect to each vertical column by loop or tap. Connect two opposite points on external loop to two different points on grounding system.

H. Perform exothermic welding with properly sized molds in good condition.

3.2 INSTALLATION OF GROUND RODS:

A. Install ground rods in manholes in accordance with requirements specified under the section Underground Distribution Systems. Connect each grounding conductor entering a manhole to ground rod.

B. Install ground rods where indicated. Install the top of the rod 12-in. below the ground surface. Measure ground resistance of electric power service ground rod and if it is not 25 ohms or less, drive additional rods to obtain resistance of 25 ohms or less.

C. Make connection to overall grounding system as indicated.

D. Ensure that final resistance of interconnected ground system is 5 ohms, or less. Measure ground resistance in normally dry conditions, and not less than 48 hours after rainfall.

3.3 EQUIPMENT GROUNDING:

A. Ground each piece of electrical equipment by means of a grounding conductor installed in raceway feeding that piece of equipment with copper wire sized in accordance with National Electric Code. Grounding conductors installed in conduit furnished with green, 600-volt insulation.

B. Connect transformer cases and neutrals to grounding system. Connect neutral ground connection at transformer terminal. Provide two separate, independent, diagonally opposite, connections for power transformers so removal of one connection will not impair continuity of other.

C. Connect two separate ground connections from ground grid to ground bus of switchgear assemblies, motor control centers and all outdoor substation equipment. Ensure that each connection for item of equipment is from different section of ground grid.
D. Install a separate grounding conductor from ground system to motors of 100 hp. and larger, in addition to raceway system. Ground motor ground connection to motor frame, independent of mounting bolts or sliding base. Ground motor to nearest point on grounding system, unless otherwise indicated.

E. Connect lightning arresters to ground system by suitable conductors.

F. Connect emergency generator neutral to grounding system by a grounding conductor of size required by National Electrical Code, unless a larger size is indicated. Connect grounding conductor to generator disconnect enclosure and generator neutral on generator side of

disconnect. Ground generator frame with two separate independent connections, so removal of one connection will not impair continuity of other.

G. Ground each street lighting standard by ground rod driven near base of standard, in accordance with requirements of National Electric Safety Code. Connect ground rods to grounding conductor brought with street lighting feeder cable.

H. Ground transformers, lightning arresters, insulators etc., installed on poles, poles and timber structures, or metal structure. Run grounding conductors between poles or structure and ground rods. Protect grounding conductor by molding applied for at least 8 ft. above ground, with both molding and conductor stapled. Install ground rod where indicated and driven until top of rod is 1 ft. below ground. Measure ground resistance of rod and if not 25 ohms or less, drive additional rods to obtain resistance of 25 ohms or less.

I. Where lightning arresters are furnished with electrical equipment and grounding connections are not inherently provided, ensure that suitable separate grounding conductor connects lightning arresters with system ground.

J. Ground wire fences when used to enclose electrical equipment. Unless otherwise indicated, provide minimal grounding by buried outside peripheral ground loop; connections to each corner fence post and nearby ground rod; flexible connections to each gate; and at least two connections to grounding system from approximately opposite positions on fence.

K. Also connect the ground rods to the grounding conductor run with the direct burial cable.

3.4 COMMERCIAL GROUNDING:

A. Telephone:1. Install one No. 2 insulated ground conductor to ground bus in telephone equipment cabinet.
2. Connect one No. 12 insulated ground conductor to all 68 conduits terminating at backboard.

END OF SECTION

SECTION 16500 - LIGHTING

PART 1 GENERAL

1.1 REFERENCES:

A. The following is a list of standards which may be referenced in this section:

1. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
2. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
3. Uniform Building Code (UBC): Section 2329, Earthquake Requirements.
4. Underwriters Laboratories, Inc. (UL):

a. 595, Standard for Safety Marine-Type Electric Lighting Fixtures.
b. 924, Standard for Safety Emergency Lighting and Power Equipment.

1.2 SUBMITTALS:

A. Shop Drawings:

1. Interior Luminaries:

a. Catalog data sheets and pictures.
b. Luminaries finish and metal gauge.
c. Lens material, pattern, and thickness.
d. Candle power distribution curves in two or more planes. e. Candle power chart 0 to 90 degrees.
f. Lumen output chart.
g. Average maximum brightness data in foot lamberts.
h. Coefficients of utilization for zonal cavity calculations. i. Mounting or suspension details.
ii. Ballast type, location and method of fastening and % of THD as indicated in drawings.

2. Exterior Luminaries:

a. Catalog data sheets and pictures.

b. Luminaries finish and metal gauge.c. Lens material, pattern, and thickness.
d. IES lighting classification and isolux diagram. e. Fastening details to wall or pole.
f. Ballast type, location and method of fastening.
g. For light poles, submit wind loading, complete dimensions, and finish.

3. Lamps:

a. Voltages. b. Colors.
c. Approximate life (in hours). d. Approximate initial lumens. e. Lumen maintenance curve.
f Lamp type and base.
g. Copy of lamp order, including individual quantities, for project.

4. Ballasts:

a. Type.
b. Wiring diagram.
c. Nominal watts and input watts. d. Input voltage and power factor.
e. Starting current, line current, and restrike current values. f Sound rating.
g. Temperature rating. h. Efficiency ratings.
i. Low temperature characteristics.
j. Emergency ballasts rating and capacity data.

5. Photo-Time Control:

a. Wiring diagram. b. Contact ratings.

6. Photocells:

a. Voltage, and power consumption. b. Capacity.
c. Contacts and time delay. d. Operating levels.
e. Enclosure type and dimensions. f. Temperature range.1.3 UL COMPLLANCE:

A. Materials manufactured within scope of Underwriters Laboratories shall be
UL Standards listed and have an applied UL listing mark.

B. Assembled fixture, complete with lamps, shall be in accordance with
State of California Title 24 requirements.

PART 2 PRODUCTS

2.1 LUMINARIES:

A. Specific requirements relative to execution of Work of this section are located in the Luminaries Schedule on Drawings.

B. Feed-through type, or separate junction box. C. Ballasts: Two-lamp when possible.
D. Tandem wired for three-lamp, fluorescent fixtures. E. Wire Leads: Minimum 18 AWG.
F. Component Access: Accessible and replaceable without removing luminaire from ceiling.

G. Soffit Installations:

1. UL Labeled: SUITABLE FOR DAMP LOCATIONS.
2. Ballast: Removable, prewired. H. Exterior Installations:
1. UL Labeled: SUITABLE FOR WET LOCATIONS.
2. Ballast: Removable, prewired.
3. When factory-installed photocells are provided, entire assembly shall have UL label.

2.2 LAMPS:

A. Fluorescent:

1. Type Efficiency: Energy.2. Color: Cool white. B. High Intensity Discharge:
1. Type: High pressure sodium.
2. Color: Color corrected. C. Incandescent:
1. Type Efficiency: Standard.
2. Color: Clear.

D. Incandescent Quartz: Clear. E. Tungsten Halogen:
1. Type Efficiency: Energy.
2. Color: Clear. F. Manufacturers:
1. General Electric.
2. Sylvania.
3. North American Phillips.

2.3 BALLASTS:

A. General:

1. Meet requirements for fixture light output, reliable starting, radio interference, total harmonic distortion shall, electromagnetic interference, and dielectric rating.
2. Certified by electrical testing laboratories to conform to Certified
Ballast Manufacturer's specifications. B. Fluorescent:

1. Type: Electronic type with mot more than 10% THD ballast.
2. Sound Rating: Minimum A maximum allowable noise level of 30 decibels measured 2-feet from installed fixture.
3. Automatic resetting, thermo-protector to prevent case temperature from exceeding 110 degrees C in the event of a short circuit.

C. Metal Halide:1. High power factor, normal ambient, 180 degrees C insulation class.
2. Types:

a. Autotransformer with capacitor and ignitor for lamps 150 watts and less.

b. Constant wattage autotransformer with capacitor for lamps above 150 watts.

D. High Pressure Sodium:

1. High power factor, normal ambient, 180 degrees C insulation class, with capacitor and ignitor.
2. Type:

a. Autotransformer for 50-watt lamps.
b. Constant wattage autotransformer for lamps 70 watts and above.

E. Manufacturers:

1. MagneTek Jefferson.
2. Advance Transformer.
3. Universal.

PART 3 EXECUTION

3.1 LUMINARIES:

A. General:

1. Install in accordance with manufacturer's recommendations.
2. Provide proper hangers, pendants, and canopies as necessary for complete installation.
3. Provide additional ceiling bracing, hanger supports, and other structural reinforcements to building required to safely mount.
4. Install plumb and level.

5. Mounting heights shown for wall mounted or pendant mounted luminaires are measured from bottom of luminaries to finished floor or finished grade, whichever is applicable.
6. Install each luminaries outlet box with galvanized stud. B. Pendant Mounted:
1. Provide swivel type hangers and canopies to match luminaries, unless otherwise noted.
2. Space single-stem hangers on continuous-row fluorescent luminaries nominally 48-inches apart.
3. Provide twin-stem hangers on single luminaries. C. Pole Mounted.
1. Provide branch circuit in line fuses in pole base handhole.

D. Swinging Type: Provide, at each support, safety cable capable of supporting four times the vertical load from the structure to the luminaries.

E. Finished Areas

1. Install symmetrically with tile pattern.
2. Locate with centerlines either on centerline of tile or on joint between adjacent tile runs.
3. Install recessed luminaries tight to finished surface such that no spill light
will show between ceilings and sealing rings.
4. Combustible Low Density Cellulose Fiberboard: Provide spacers and mount luminaries l-1/2-inches from ceiling surface, or use fixtures suitable for mounting on low density ceilings.
5. Junction Boxes:

a. Flush and Recessed Luminaries: Locate minimum 1-foot from luminaries.
b. In concealed locations, install junction boxes to be accessible by removing luminaries.

6. Wiring and Conduit:

a. Provide wiring of temperature rating required by luminaries. b. Provide flexible steel conduit.

7. Provide plaster frames when required by ceiling construction.
8. Independent Supports:

a. Provide each recessed fluorescent luminaries with two safety chains or two No. 12 soft-annealed galvanized steel wires of length needed to secure luminaire to building structure independent of ceiling structure.b. Tensile strength of chain or wire, and method of fastening to structure shall be adequate to support weight of luminaries.
c. Fasten chain or wire to each end of luminaries.

F. Unfinished Areas: Locate luminaries to avoid either conflict with other building systems or blockage of luminaries light output.

1. Fixture Suspension: Provide 3/8 inch threaded steel hanger rods.

Scissor type hangers not permitted.
2. Attachment to Steel Beams: Provide flanged beam clips and straight or angled hangers.

3.2 LAMPS:

A. Provide in each fixture, the number and type for which the fixture is designed, unless otherwise noted.

3.3 BALLASTS:

A. Install in accordance with manufacturer's recommendations.

B. Utilize all ballast mounting holes to fasten securely within luminaries. C. Replace noisy or defective ballasts.
3.4 LIGHTING CONTROL:

A. Outdoor Luminaries: Photocells switch lights ON at dusk and OFF at dawn.

3.5 CLEANING FOLLOWING CONSTRUCTION:

A. Remove all labels and other markings, except UL listing mark. B. Wipe luminaries inside and out to remove construction dust.
C. Clean luminaries plastic lenses with antistatic cleaners only.

D. Touch up all painted surfaces of luminaries and poles with matching paint ordered fom manufacturer.

E. Replace all defective lamps at time of Substantial Completion.

END OF SECTION

SECTION 16510 - BUILDING LIGHTING, INTERIOR

PART 1 GENERAL

1.1 DESCRIPTION:

This section includes the furnishings, installation of and connection of the interior lighting.

1.2 RELATED WORK:

A. Section 16050, ELECTRICAL WORK - GENERAL.

B. Section 16127, CABLES, LOW VOLTAGE 600 VOLTS AND BELOW. C. Section 16450, GROUNDING.

1.3 SUBMITTALS:

In accordance with section 16050 ELECTRICAL WORK - GENERAL, furnish the following:

A. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting, material, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, lenses, louvers, lamps, and controls.
3. When catalog data and/or shop drawings for fluorescent fixtures are submitted for approval, photometric data from an independent testing laboratory shall be included with the submittal, indicating average brightness and efficiency of the fixture, as specified in specification or as shown on the drawings. Coefficient of utilization data will not be considered a suitable substitute.

B. Samples: C. Manuals:

1. Complete operating and maintenance manuals shall be provided, including technical data sheets, and information for ordering replacement parts. Deliver four copies of the above data to the ResidentEngineer prior to final inspection. D. Certifications:

Prior to final inspection, deliver to the Resident Engineer four copies of the following certifications:

1. Certification that the equipment has been properly installed, adjusted, and tested.

1.4 APPLICABLE PUBLICATIONS:

The following specifications and standards, except as hereinafter modified, are incorporated herein by reference and form a part of this specification to the extent indicated by the references thereto. Except where a specific date is given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of Invitation for Bids shall be applicable. In text such specifications and standards are referred to by basic designation only.

A. Federal Specifications (Fed. Spec.):

• W-F-412E.....Fixtures, Lighting, Incandescent Lamp Industrial
• W-F-1662A.....Fixture, Lighting Fluorescent, Alternating Current
(Recessed and Surface Ceiling)

B. American National Standards Institute (ANSI):

• C-81.....Electric Lamp Bases and Holders
• C-82.....Lamp Ballasts

C. Certified Ballast Manufacturers Association (CBM):

• Requirements for Ballast Certification. D. National Fire Protection Association (NFPA):
• No. 70.....National Electrical Code (NEC) E. Underwriters Laboratories, Inc. (UL):
• No. 57.....Electric Lighting Fixtures
• No. 496.....Edison-Base Lampholders
• No.542.....Lampholders, Starters, and Starter Holders for
Fluorescent Lamps
PART 2 PRODUCTS

2.1 LIGHTING FIXTURES:

A. Shall conform to the detail drawings, NEC Article 410 and UL-57. B. Sheet Metal:
1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
4. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

D. Lamp Sockets:

1. Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542 and ANSI C-81. Contacts for recessed double contact lampholders and for slimline lampholders shall be silver plated. Lampholders for bi-pin lamps, with the exception of those for "U" type lamps, shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.
2. Incandescent: Shall have porcelain enclosures and conform to the applicable requirements of UL 496.
3. High Intensity Discharge (H.I.D.): Shall have porcelain enclosures and conform to the applicable requirements of ANSI C-81.

E. Recessed incandescent fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

F. Fluorescent fixtures with louvers or light transmitting panels shall have hinges, latches and safety catches to facilitate safe, convenient cleaning andrelamping. Vaportight fixtures shall have pressure clamping devices in lieu of the latches.

G. Mechanical Safety: Lighting Fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by screws, chains, captive hinges or fasteners such that they cannot be accidently dislodged during normal operation or routine maintenance.

H. Metal Finishes:

1. The manufacturer shall apply his standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
3. Exterior finishes shall be as shown on the drawings.

I. Ballasts for Fluorescent Fixtures: Lamp types F32T8 and F32/U shall be operated by electronic high-frequency type ballasts. All other applications shall utilize the standard electromagnetic core and coil type. Exception: For special applications, lamp types F40T12 and

F40/U shall be operated from core-and-coil ballasts where specifically required on the contract drawings as "core-and-coil".

1. High-Frequency electronic ballasts (for operation of F32T8 and F32/U lamps):

a. Ballasts shall operate the lamps at a frequency between 20 and 40 KHz from an input frequency of 60Hz.
b. The lamps shall include the F32T8 energy saving types. c. Ballast package:

1) Size: The ballast case shall be sized to be physically inter- changeable with standard core and core ballasts and suitable for standard mounting in new or existing lighting fixtures.
2) Case marking: Mark the ballast to indicate the required supply voltage, frequency, RMS current, current surge during starting, input watts, and power factor at the design center voltage, open circuit voltage, crest factor and efficacy.d. Performance:

1) Light output:

a) At the design voltage, the light output shall be at least equal to that obtained by a core-and-coil ballasted system meeting ANSI and CBM standards. The comparison test shall be measured in the same fixture at 25 degrees C (plus or minus one degree) ambient room temperature.
b) Tests shall be made in fixtures designed only for the number of lamps being tested.
c) For other applications (higher ambient, etc.) the tests should be operated with equivalent lamp wall temperatures plus or minus 4 degrees C.

2) Efficacy: The efficacy of the high-frequency, electronically ballasted system shall be at least 15 percent greater than the equivalent CBM core-and-coil ballasted system (see "Light output" above).
3) Starting: The ballast shall be capable of starting F40-T12, 40 watt lamps at an ambient temperature of 50 degree F or more for an input voltage of plus or minus 10 percent about the center design voltage. The ballast shall never be started in the instant start mode at any temperature.
4) Operation:

a) The ballast shall safely and reliably operate in a room ambient temperature from 50 degree F to 105 degree F.
b) The light output shall not vary by more than plus or minus 15 percent for a plus or minus 10 percent variation of the input voltage about the center design voltage.
c) The ballast shall operate the lamps in a manner that will not adversely curtail the normal life of the lamp.

5) Surge withstands capability: The ballast shall be able to with-stand a single input surge of 6,000 volts from a 50 ohm 50 KHz damped sinewave source.
6) Flicker: The flicker shall be less than 5 percent.
7) Noise: The audible noise levels should be equivalent to the Class A rating of CBM certified ballasts.
8) Electromagnetic interference (EMI): The EMI, conductedand radiated, shall meet the Federal Communication
Commission's Part 18 Subsection H.
9) Rated life: The ballast shall have a rated life of 10 years or 30,000 hours (based on a 10 hour day).
10) Lamp type: The two lamp ballast shall safely operate two F32T8 lamps, or two F32/U lamps. The single lamp ballast shall safely operate one F32T8 lamp or one F32/U lamp.
11) Power factor: Not less than 90 percent. e. Reliability:
1) Labels: Ballasts must be labeled or listed by UL or ETL.
2) Submit, simultaneously with shop drawings, a certified test report by an independent testing laboratory showing that the electronic ballasts meet or exceed all the performance requirements in this specification.

2. Core and coil ballasts (for lamps other than F32T8 and F32/U or where shown on drawings as "core and coil".):

a. Shall be rapid starting type.
b. Shall be UL Class P with automatic-resetting, internal, thermal protection.
c. Shall conform to ETL-CBM label requirements.
d. Power factors shall be not less than 90 percent. Capacitors in ballasts shall not contain PCB (Polychlorinated Biphenyl) fluids or other fluids recognized as hazardous when discharged into the environment.
e. Sound ratings shall be A, except for ballast sized which are not available with A ratings, as standard products from any manufacturer. Ballasts which are not available with A ratings shall have the quietest ratings available.
f. Where core and coil ballasts are specified or detailed in lieu of the normally required high-frequency electronic types, two lamp ballasts shall be energy-saving type, UL listed to operate F40T12 rapid start lamps for both the standard 40 watt lamps and the reduced wattage (approximately 35 watts) energy-saving lamps. Lamp output shall be within 5 percent of nominal rating. When operating energy-saving lamps, the input watts to the ballast shall not exceed 78 watts at 120 V.A.C. or 79 watts at 277 V.A.C. Energy-saving type ballasts should not be used in ambient temperatures below manufacturer's recommendations.

3. Ballasts for lighting fixtures controlled by dimming devices shall conform to the recommendations of the manufacturer of the associateddimming devices to assure satisfactory operation of the lighting systems, and shall be the product of one manufacturer.
4. All ballasts serving straight or "U" type lamps, nominal three feet (socket to socket) or longer in tube length, shall be mounted by four non-turning studs (or captive bolts) equipped

with lockwashers and nuts or locking type nuts, or by four thread cutting (TC) sheet metal screws which are firmly secured against the fixture body (or wireway) to maximize dissipation of heat and minimize noise. Exception: high frequency electronic ballast may be mounted at a minimum of two points, one at each end of unit.
5. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.
6. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
7. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.

J. Ballasts for High Intensity Discharge Fixtures:

1. Shall have individual overcurrent protection sized in accordance with the manufacturer's recommendations.
2. Shall have integral thermal protection where the fixture is recessed in an interior ceiling.
3. Shall be the constant wattage, high power factor type or the reactor high power factor type. Capacitors shall not contain PCB (Polychlorinated Biphenyl) fluids or other fluids recognized as hazardous when discharged into the environment.
4. Shall have not less than B sound ratings for interior fixtures, when available. Ballasts which are not available with B ratings shall be of the next standard rating.

K. Provide all lighting fixtures with a specific means for grounding their metallic wireways and housings to an equipment grounding conductor.

L. Lighting Transmitting Components for Fluorescent Fixtures:1. Shall be 100 percent virgin acrylic plastic or water white, annealed, crystal glass.
2. Flat lens panels shall have not less than 1/8-inch of average thickness.
The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.
3. Unless otherwise specified lenses and diffusers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.

M. Lighting Fixtures in Hazardous Areas: Fixtures shall be suitable for installation in flammable atmospheres (Class and Group) as defined in the NEC.

2.2 OCCUPANT SENSOR LIGHTING CONTROL SYSTEMS:

A. General: An active or passive sensor shall be utilized to control the "On-Off" actuation of fluorescent or incandescent lighting loads. It shall provide control of an isolated set of contacts on exposure to a perceived change in environmental conditions indicating the presence or absence of one or more persons. It shall maintain the contacts closed in the presence of continued changes (due to human presence) at similar intensity and rate. It shall open the contacts at a nominal time after the changes cease.

B. Passive Sensor System: Sensor(s) shall react to changes of radiated infrared energy, indicating the activity of one or more human bodies in the area covered:

1. Range of detection: The sensor(s) shall provide effective coverage of a room, sensing the presence of one or more people in the room in order to turn the lights on. The ceiling mounted sensor's area of coverage shall be approximately a 14 foot diameter circle at six feet away. Provide sufficient units to give full coverage as measured 30" above the floor. A field-of-view adjustment feature shall be provided to allow orientation to various room operating conditions.
2. Sensor placement: Locate the sensor(s) in accordance with the manufacturer's recommendations to maximize energy savings by avoiding nuisance activation due to sudden temperature or air flow changes. Locate the units within 6 feet horizontally of work stations or major points of activity, including the center of room entrance doors.

C. Active Sensor System: Sensor(s) shall react to reflective changes to generated ultrasonic radiation (crystal controlled, 24 to 42 KHz), indicating the activity of one or more persons in the area covered.

1. Range of detection: On ceilings below twelve feet in height, a singledirection sensor shall cover approximately a 30' by 30' area; a two directional unit a 60' by 30' area; and a two-way corridor unit a total distance of 90 feet. The sensors shall be equipped with a concealed but accessible sensitivity control to tune the unit to specific room conditions.
2. Sensor placement: Locate the sensor(s) in accordance with the manufacturer's recommendations to maximize energy savings by avoiding nuisance activation due to predictable non-human motion activities. Give particular attention to work station or major areas of activity and the coverage of room entrance doors.

D. Timing/Function: Shall not be user adjustable. Lighting shall remain on with one or more persons within the covered area. The system shall be factory set to maintain lights on for a minimum of 8 minutes and not longer than 12 minutes after the area of coverage is vacated. For testing purposes, there shall be a means to change the per-set time delay to 30 seconds or less.

E. Control Unit: The system shall have a switching relay(s) capable of switching the fluorescent or incandescent loads as required. Contacts shall be rated at a minimum of 15 Amps at voltages to 277, with expected cycles of operation in excess of 100K. Power derived from a current limiting 24 volt transformer shall power the system and the unit must be packaged for installation on a standard 4" x 4" NEMA box enclosure. The unit shall be wired through a conventional wall switch to provide an over-ride system "Off" and active "Off-On" functioning.

F. Field Wiring: The wiring between the control unit and sensor(s) shall be 3 conductor #22 gauge PVC jacketed.

2.3 REMOTE CONTROL SWITCHING FOR INDOOR LIGHTING SYSTEMS:

A. Shall be rated for continuous-duty service.

B. Electric contacts shall be precious metal surface.

C. Magnetic contactors and relays shall be electrically-operated and mechanically-held.

D. Characteristics of the components and the total resistances of the circuits throughout the systems shall be such that the systems will operate satisfactorily in every respect while the branch circuit power supply voltage to each system is within a 105-130 volt range at 60 Hz.
E. Wall switches shall be the momentary contact type suitable for mounting in a single gang outlet box space and compatible with the standard design wall plates as specified.F. Where shown on the drawings incorporate the components in panelboards behind separate doors and mount them on sound absorbing materials.

G. Install circuit breaker or fuse protection for the control circuits.

H. Low voltage remote control system shall be DC type operating at not greater than 30 volts, and meeting requirements for Class 2 circuits in Chapter 725 of the NEC.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, and as shown on the drawings.

B. Align, mount and level the lighting fixtures uniformly.

C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Resident Engineer.

D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.

E. Patient bed lighting fixtures shall be attached to studs in the walls. F. Lighting Fixture Supports:
1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
4. Hardware for recessed fluorescent fixtures:

a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceilingsystem.
b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.

5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:

a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than
1/4-inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
b. In addition to being secured to any required outlet box, fixtures shall be bolted to a plaster ceiling at four points spaced near the corners of each fixture. Pre-positioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

6. Hardware for recessed lighting fixtures:

a. All fixtures mounting devices connecting fixtures to the ceiling system or building structure shall have a capacity for a horizontal force of 100 percent of the fixture weight and a vertical force of
400 percent of the fixture weight.
b. Mounting devices shall clamp the fixture to the ceiling system structure (main grid runners or fixture framing cross runners) at four points in such a manner as to resist spreading of these supporting members. Each support point device shall utilize a screw or approved hardware to "lock" the fixture housing to the ceiling system, restraining the fixture from movement in any direction relative to the ceiling. The screw (size No. 10 minimum) or approved hardware shall pass through the ceiling member (T-bar, channel or spline), or it may extend over the inside of the flange of the channel (or spline) which faces away from the fixture, in a manner which prevents any fixture movement.
c. In addition to the above the following are required for fixtures exceeding 20 pounds in weight. Note: Ceiling types are defined in ASTM Standard C635-69.
1) Where fixtures mounted in "Intermediate" and "Heavy Duty" ceilings weigh between 20 pounds and 56 pounds provide two 12 gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
2) Where fixtures weigh over 56 pounds they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.

d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

7. Surface mounted lighting fixtures:

a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 1/4-20 - secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 56 pounds shall be supported directly from the building structure.
b. Where ceiling cross runners are installed for support of lighting fixtures they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
c. Fixtures less than 15 pounds in weight and occupying less than two square feet of ceiling area may, (when designed for the purpose) be supported directly from the outlet box when all the following conditions are met.

1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.

2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
3) The outlet box is supported vertically from the building structure.

d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.

8. Single or double pendent-mounted lighting fixtures:a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.

9. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and secured by approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.

G. Completely lamp each new lighting fixture installed and each existing lighting fixture reinstalled in accordance with following requirements:

1. Fluorescent Lamps:

a. Except as indicated below, standard lamps shall be F40T12 rapid start, energy saving type (approx. 34 watts) having a color temperature between 3500 degrees Kelvin and 4100 degrees Kelvin, a color rendering index (CRI) not less than 69 and an initial lumen output not less than 2900. Type F40 "U" tube lamps shall have the same color temperature and CRI limits as the above.

1) In utility areas (Mechanical, Telephone and Electrical Service rooms and closets), maintenance closets and non-medical storage spaces, utilize F40T12 energy saving (approx. 34 watt) light-white lamps.
2) In areas with ambient temperatures below 60 degrees use the 40 watt version of the standard lamp above.
3) Over the beds in Intensive Care, Coronary Care, Recovery, Life Support, and Observation and Treatment areas; Electromyographic, Autopsy (Necropsy), Surgery, and certain dental rooms (Examination, Oral Hygiene, Oral Surgery, Recovery, Labs, Treatment, and X-Ray) use color corrected lamps having a CIE color rendering index of 90 or above and a corolated color temperature between 5000 degrees Kelvin and 6000 degrees Kelvin.
4) Other areas as indicated on the drawings.

2. Incandescent lamps shall be the general service, inside frosted type rated
125 volts except where otherwise shown on the drawings.
3. High Intensity Discharge Lamps:

a. Mercury vapor lamps shall be ANSI type "DX". Lamps in open orlouvered fixtures mounted less than 15 feet above the finished floor (or grade) shall be of the safety type in which the arc will automatically extinguish if the outer glass envelope becomes broken.
b. Multi-vapor lamps shall be as defined on the detail drawings.
c. High pressure sodium lamps shall be as defined on the detail drawings.

H. Contractor shall coordinate between the electrical and ceiling trades to ascertain approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.

END OF SECTION

SECTION 16721 - FIRE ALARM SPECIFICATION

PART 1 GENERAL

A. General Requirements:

1. The requirements of the Contractor Documents, including the General and Supplementary General Condition and Division 1 - General Requirements shall apply to the work of this section.
2. At the time of bid, all exceptions taken to these specifications, all variances from these, Specification and al substitutions of operating capacities or equipment called for in these Specifications shall be listed in writing and forwarded to the Engineer. Any such exception, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment.

B. Scope:

1. The work covered by this Section of the Specification shall include all labor, equipment, materials and services and to furnish and install a complete fire alarm. It shall be complete with all necessary hardware, software and memory. It shall be possible to permanently modify the software on site by using the integral programmer. The system shall consist of, but not be limited to, the following:

a. Fire alarm control panel Addressable. b. Remote annunciator Addressable.
c. Manual fire alarm stations Addressable. d. Smoke detectors Addressable.
e. Duct Smoke detectors Addressable. f. Heat detectors Addressable.
g. Alarm Horn/Strobe. C. Applicable Codes and Standards:
1. All equipment shall be U.L. listed for it's intended use.
2. NFPA Standards 72.
3. The National Electric Code NFPA 70.
4. All other local codes and authorities having jurisdiction.

16721-1D. Related Documents:

1. Secure permits and approvals prior to installation.
2. Prior to commencement and after completion of work, notify authorities having jurisdiction.
3. Submit letter of approval for installation before requesting before requesting acceptance of system.

E. Related Work:

1. The contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the fire alarm system shall include, but not be limited to:

a. Duct smoke detectors shall be furnished, wired and connected by the electrical contractor. The HVAC contractor shall furnish necessary duct opening to install the duct smoke detectors.
b. Air handling and smoke exhaust system fan control circuits and status contacts to be furnished by the HVAC control equipment.
c. Wire and Cables shall be provided by fire electrical contractor. F. Submittals:
1. Provide list of all types of equipment and components provided.
2. Provide description of operation of the system, similar to that provided in Part 2 of this Section of the Specifications, to include any and all exceptions, variances or substitutions listed at the time of bid. Any such exceptions, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment.
3. Provide manufacturer's printed product data, catalog cuts a description of any special installation procedures.
4. Provide samples of various items when requested.
5. Provide shop drawings as follows:

a. Drawings of the alarm control panel.
b. Single line riser diagram showing all equipment and type, number and size of all conductors.

G. Warranty:

1. Manufacturer shall guarantee the system equipment for a period of one (1) year from date of final acceptance of the system.2. The contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.
3. The contractor shall warranty all materials, equipment, wiring, devices, installation and workmanship, including service labor for one (1) year from date of acceptance.
4. The supplier and/or contractor shall have sufficient stock of spare parts of devices on hand and have a fully equipped service organization, base in Puerto Rico, capable of guaranteeing response time within (6) hours of service and/or emergency calls. The service shall be available (24) hours or day a week, and (365) days a year for the complete installed system.
5. Upon completion of the installation of sound system equipment, the electrical contractor shall provide to the architect a signed written statement, substantially in form as follows: "The undersigned, having been engaged as the Electrical Contractor on the project confirms that the sound system equipment was installed in accordance with the wiring diagrams, instructions and directions provided to us by the manufacturer."

H. Products:

1. Operation of any alarm initiating device shall automatically:

a. Sound all alarm signals throughout the buildings at the continuous evacuation rate.
b. Turn on all strobe lights throughout the buildings. c. Turn on system's red common alarm LED.
d. Turn on the red zone active LED for the circuit of alarm at the fire alarm control panel.
e. Start the reset/alarm silence disable timer to guarantee that alarm signals will sound for a minimum period of 3 minutes.
f. Start the alarm signal silence timer to turn the signals off after a minimum period of 30 minutes.
g. Operate the alarm relay contact (to initiate the transmission of an alarm indication to a central station agency via leased telephone lines. Selection of a central station agency, it's equipment, is fees and fees for leased telephone lines are the responsibility of the owner or his representative).
h. Visually annunciate on the remote annunciator panel, the activated alarm initiating circuit. The visual indication shall remain on until the alarm condition is reset to normal.2. Activation of a sprinkler supervisory device shall automatically:

a. Sound an audible signal at the fire alarm control panel at 120 SPM.
The audible signal shall be capable of being silenced during the off- normal condition.
b. Fast flash the yellow common trouble LED. Silencing the panel's audible shall turn this LED on steady.
c. Fast flash the yellow zone active LED for the activated circuit.
d. Operate a relay/city tie contact to initiate the transmission of a supervisory indication to the central station agency.
e. Sound an audible signal at the remote annunciator panel. The audible signal may abe silenced during the off-normal condition.
f. Restoral of initiating device contacts shall turn on the zone LED
steady and resound the common trouble signal at 120 SPM.

3. The fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the fire alarm control panel. Any opens or grounds on system wiring and shorts across indicating circuit wiring shall automatically.

a. Sound and audible signal at the fire alarm control panel at 20 SPM.
The audible shall be capable of being silenced during the trouble condition.
b. Slow flash a zone trouble LED at 20 SPM to indicate the source of the wire trouble. The visual indication shall remain on until the trouble condition is repaired.
c. Sound an audible signal at the remote annunciator panel. The audible signal may be silenced during the trouble condition.

d. Visually annunciate a general trouble condition, on the remote annunciator panel.

4. Subsequent alarms, supervisory signals, or trouble activations shall repeat their respective response sequence.

I. Materials:

1. Fire Alarm control panel:

a. The control panel enclosure shall be UL listed, surface or semi-flush mounted, and provide equipment mounting facility for installation of IRC-3 full footprint and 1/2 footprint modules and mounting studs on the enclosure back plane for installation of system modules. The CAB3 and CAB6 series enclosures shall incorporate an removableback plate feature to provide mounting studs for modules to facilitate pre-wiring and testing prior to the installation of electronics equipment in the enclosure. The enclosure shall be painted white (red), and shall be provided with a lexan veiwing window and keylock. The enclosure backbox shall be provided with electrical knockouts and mounting holes. A ground strap shall be provided form the back box to the front door assembly to provided RFI/EMI protection. A security tamper switch shall be provided for security applications. Ventilation holes shall be provided on the front door.

1) The Control Panel shall be an Intelligent Response Controller (RC-3) type CM1 polling master. The Panel shall be capable of being housed in any of the following cabinets: CAB2, CAB3, CAB3F or CAB6F. The Polling Master controller shall be capable of supporting up to 576 supervised inputs and outputs. The controller shall have an 80 character Liquid Crystal Display (LCD) that offers (2) 40 character lines. The controller shall differentiate between long term drift above the prealarm threshold (maintenance alert, indicative of the need for cleaning) and a fast rise above the prealarm threshold (indicative of a smoldering fire). The Maintenance Alert shall be annunciated as an alert on the LCD only and shall not be confused as a Trouble or an Alarm. The unit shall contain a real time clock, tactile feel keypad (16keys), with 19 functions, (2) buttons for scrolling data on the LDC, (4) front panel switches for Reset, Alarm, and Trouble Silence, and Drill/All Call and (5) LED's for Controller shall occupy (1) space in the above listed cabinets and control up to (28) additional slave CM2 (s).
2) During the normal state, the NORMAL LED (green) shall flash, the first line of the LCD shall display the time in (HH:MM:SS) as well as the number of active points ("AP") and the number of disabled points ("DP") in the system. When the control panel goes into the alarm condition the (green) NORMAL LED extinguished and the (red) ALARM Led shall light, the buzzer pulsates and LCD indicates the time, the number of messages waiting, the type of alarm, the alarm zone or device number, and the time the ALARM occurred. The second line is dedicated to the user specified message. To acknowledge the alarm, the operator shall press the NEXT/ACK button, and the buzzer will silence providing there isn't an additional alarm waiting. if there are additional alarms waiting the operator shall acknowledge all pendingalarms before the buzzer will silence. To silence audible devices the operator shall press the ALARM SILENCE

button, a new alarm shall cause the audible devices to resound. To reset the network the operator shall press the RESET button. During the TROUBLE condition, the amber TROUBLE LED shall light, the NORMAL LED shall go out, and the BUZZER shall pulsate. The display shall indicate "SUPERV. OPEN. and the zone or device number. The operator shall silence the BUZZER by acknowledging all messages and pressing the TROUBLE SILENCE button. During the SUPERVISORY condition the amber SUPERVISORY LED shall light, the NORMAL LED shall silence the BUZZER by acknowledging all messages and pressing the TROUBLE SILENCE button. The controller shall support any two (2), of the following traditional or intelligent option cards simultaneously in any combination: ZB8-2 Style B & Y circuits; ZB8-5 - Style B & Y circuits; ZB8-8 - Style B & Y circuit; ZA4-2 - Style D & Y circuits; ZA4-2 - Style D & Z circuits; ZAS-1-Analog/Addressable -
96 modules & 96 sensors and/or up to (12) RZB-12-6; ZBO-
8- Relay option card; ZR8-2 Relay option card - Dual 4 into 1 unput select.
3) The controller shall support and control any combination up to (28) additional control modules type CM2, IRC-1, Audio Control Panel (2/6 channel), serial annunciator and switches (RASP) OR (SAN) series, over RS-232. Fiber Optics or 20 ma Loop as required. Each controller shall contain a RS-232 printer/programming port for programming locally via an IBM PC or down loading through modems from a remote PC. When operational each controller shall support a printer through the RS-232 sport and be capable of message routing. The controller shall support up to 2 Intelligent loop card (ZAS-1), each card support (96) intelligent sensors and (96) intelligent modules. Each sensor shall respond to a panel poll for information with an analog representation of measured fire related phenomena (smoke density, particles of combustion, temperature). Such response proves end to end sensor response including the operation of the sensor electronics. Systems which only monitor the presence of a conventional detector in an addressable base shall not be acceptable.

b. The Polling Master shall have be following additional features without any changes in hardware or firmware:
1) Logic Statements
2) Timer Controls
3) Sequences
4) Actions
5) Weekday/Holiday Schedules
6) Guard Patrols
7) Analog Value Reporting of all analog sensors and traditional zones
8) Maintenance Reporting By Intelligent Sensor.
9) Sensivity Setting Changed by time (Day/Night Mode)
10) Alarm Verification by point or zone (0 to 60 seconds)
11) Print a history of Sensors activating the verification cycle.
12) On demand system condition printouts (status).
13) Up to 99 priorities for any event driven relay/output.
14) Enabling and Disabling of any system device or function.
15) Ground Fault Detection on all System devices and inputs.

16) Three Types of One Man Test
17) Normal and Silent One Main Test.
18) Field Programmable One Man Test.

2. The Manual Station Addressable Edwards Model 278SPO conventional Manual Stations systems only. DIP switch selection of "address" codes assign unique identification to each Manual Station so that the system control panel can automatically identify the exact Manual Station location. A factory set type code is used on this analog device, so that the system can immediately identify the type of initiating device associated with a give address.

a. Manual Station Monitor Module (mm) are in constant two-way communication with the control panel and are polled every 4 seconds. When polled by the control panel the (MM) responds by transmitting its type (Manual Station), its location (Address) and its present condition and status. Thus the control panel is able to decide when a fire condition exists and an display the type of device reporting the fire and its precise location. It can also monitor any subsequent spread of the fire from data received from other devices and sensors.

3. The Model 551F Addressable Heat Detector unique dual thermistor sensor will monitor the ambient temperature from 0 cºcto 60ºC and gives a fast response to rapid increases in temperature.a. The 551F Detector are simple to install, service and maintain. The Detector is mounted on an addressable base Edwards Model B501F. Using a specially designed tool, maintenance personnel can remove and replace the plug-in sensors without using a ladder. These sensors incorporate a built-in type identification so the system can identify the type of detector. The 551F also has a built-in magnetic reed switch for local testing.

4. The Model 1551F Addressable Ionization Smoke Detector unique unipolar chamber responds quickly and uniformly to the broadest range of fires and can withstand wind gusts up to 12 meters-per second without outputting an alarm level signal. Because of the unipolar chamber, the 1551F is approximately two times more responsive than most ionization sensors.

a. The 1551F Detectors are simple to install, service and maintain. The
1551F Detector is mounted on an addressable base Edwards Model B501F. Using a specially designed tool, maintenance personnel can remove and replace the plug-in detectors without using a ladder. These sensors incorporate a built-in type identification so the system can identify the type of sensor. The 1551F also has a built-in magnetic reed switch for local testing.
b. The 155AF Plug-in series of detectors are designed to commercial standards and appearance.

5. The DH4001 Duct Smoke Detector Addressable Housing accepts optional accessory modules to provide low cost, custom duct detector configurations to meet specific job needs.
6. Duct Detector Air Sampling Tube- One air sampling inlet tube must be ordered for each duct smoke detector housing. The inlet tube can be easily cut to any length and must span the

entire width of the air duct. Tubes longer than 36" (900mm) must be supported at both ends. Tubes are available from
8" (200mm) to 120" (3.06m). Refer to Ordering Information for available lengths.
7. EST Deluxe Horn/Strobe combination signalling appliances are designed for use with compatible control equipment associate with life safety and communications systems.

a. These high quality EST Horn/Strobes are part of a full line of attractive similarly styled fire alarm Audible/Visual signals. The housing/bezel is finished in "Fire Red" or Beige and is made form durable, fire retardant high impact Lexan. These supervised appliances come with wire lead terminals type connections and are available in two flash intensity levels.
J. Acceptable Manufacturers:

1. The catalog numbers used are those of Edwards Systems Technology (EST), Farmington, CT< and constitute the type and quality of equipment to be furnished.
2. If equipment of another manufacturer is to be submitted for approval as equal, the contractor shall, at the time of bid, list all exceptions taken to these Specifications, all variances from these Specification and all substitutions of operating capabilities or equipment called for in these Specifications and forward said list to the Engineer. Any such exceptions, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment. Final determination of compliance with these Specification shall rest with the Engineer, who, at his description, may require proof of performance.

K. Execution:

1. Installation:

a. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagram. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the local Fire Department, and shall be installed in rigid, threaded conduit throughout.
b. All penetration of floor slabs and fire walls shall be fire stopped in accordance with all local fire codes.
c. End of Line Resistors: Shall be furnished as required for mounting as directed by the manufacturer.
d. All wiring shall be color coded throughout, to National Electrical
Code Standards.
e. The system shall be arranged to receive power from one three wire
120 Vac, 15A supply. All low voltage operation shall be provided from the fire alarm control panel.

f. Field Quality Control: The system shall be installed and fully tested under the supervision of a trained manufacturer's representative. The system shall be demonstrated to perform all of the functions specified.2. Test:

a. Reports of any field testing during installation shall be forwarded the
Engineer.
b. Each individual system operation on a circuit by basis shall be tested for its complete operation. The procedure for testing the entire fire alarm system shall be set forth with the consent of the code enforcement official, the Engineer and the manufacturer.

3. Documentation and Training:

a. The contractor shall compile and provide to the owners three (3) complete manuals on the complete system to include operating and maintenance instruction, catalog cuts of all equipment and components, as-built wiring diagrams and a manufacturer's suggested spare parts list.
b. In addition to the above manuals, the contractor shall provide the services of the manufacturer's trained representative for a period of four (4) hours to instruct the owner's designated personnel on the operation and maintenance of the entire system.

L. Experience and Qualifications:

1. The manufacturer of equipment shall have 10 years experience manufacturing similar equipment to that specified. He shall submit names, addresses and telephone numbers of ten similar protects successfully completed.
2. Installing contractor shall have 10 years experience and shall be authorized distributor of the equipment manufacturer. He shall summit similar information to that listed in item one.
3. All technicians on the project shall have a minimum of 2 years experience on similar equipment and shall be factory certified on the specific equipment being installed.

END OF SECTION

SECTION 16741 - TELEPHONE

PART 1 RELATED DOCUMENTS

1.1 DESCRIPTION:

A. The general provisions of the Contract, including General and Special Conditions, apply to the work specified in this section. Other sections of this specification, as they related to work to be performed under this section, are also applicable as if included under this section.

PART 2 DESCRIPTION OF WORK

A. Supply and install a complete raceway system including cable trays, conduit, boxes and cabinets, as well as underground conduit to telephone connection point as indicated on drawings and in accordance with the recommendations of the Puerto Rico Telephone Company.

PART 3 MATERIALS

A. Minimum size of telephone wall outlets shall consist of 4" square by 1½" deep box with K.O. to fit conduit and equipped with one gang raised cover of the required height to bring the outlet flush with the finished wall surface. Plates shall be of the type specified in the drawings. When key system outlets are specified they shall consist of a 4-11/16" square by 2-1/3" deep box with 1¼" K.O. to fit conduit and equipped with one gang raised cover of the required height to bring the outlet flush with the finished wall surface.

B. Standard galvanized steel two piece telephone cabinets with separate flush for surface trim (as needed) shall be used. Provided with single or double hinged door. Lack and 34" plywood backing. Indicated dimensions on drawings are interior. The larger dimension indicates the height. Cabinets will be placed at
48" (center of cabinet) above finished floor.

C. Where telephone closets are specified, the Contractor shall be responsible for providing the 3/4" plywood backing with the dimensions specified on thedrawings. The plywood backing shall be securely fastened to the wall.

D. Conduit as indicated on drawings will be of type and size indicated, with protection as called for on the drawings.

PART 4 CONDUIT AND FISHWIRE

A. Minimum size of telephone conduit to be 3/4" B. Radius of conduit bends shall be as follows:

SIZE OF CONDUIT	MINIMUM RADIUS
3/4"	10"
1" to 1-12"	12"
2"	18"
3"	36"
4"	40"

C. All conduits shall be provided with a No. 14 fishwire, except that No.12 copper fishwire shall be provided in runs from cabinet to cabinet, from cabinet to closet, from closet to closet, or from main closet or main cabinet to service pole or easement.

D. Provide all conduit material needed for street crossing (2-4" PVC SCH-40) and carport crossing were required, also to provide and install all service conduit (3'-4
PVC SCH.40) from the telephone outlet in the house to the nearest telephone right of way.

E. Mark the termination of the street crossing and service conduit with 2" x 4" plank.

PART 5 COORDINATION AND APPROVAL

A. The contractor shall coordinate with Outside Plant Engineering at Hato Rey, telephone 751-5781 for the supervision of the installation of the conduits.

B. The contractor shall submit to the ARPE Regional Office certified letter of work completion, from the P.R.C.A. Engineering Division, and shall Grant Deed forTelephone Right of Way in favor of Puerto Rico Communications Authority prior the approval of final inscription plans.

C. Contractor shall obtain approval and/or acceptance of system from the Puerto
Rico Telephone Company correcting any defects noted by them.

D. The Puerto Rico Communications Authority shall not accept the telephone installation and shall not give service to the project until the grand deed right of way is legalized and the installation is approved.

END OF SECTION

SECTION 16900 - ELECTRICAL CONTROLS AND MISCELLANEOUS ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 DESCRIPTION:

A. Furnish, install and connect the electrical control equipment and miscellaneous electrical equipment, including such instruments and devices as are indicated and specified. Enclosures for electrical equipment shall be as indicated.

B. Where type of enclosure is not indicated, furnish the equipment with a NEMA Type 12 enclosure.

C. Furnish and install all steel channels necessary for mounting of electrical equipment.

1.2 RELATED WORK:

A. Conduit, wiring, and connections for equipment and devices; Section 15806.

B. Control equipment, relays, control wiring, conduit, and connections for control of heating, ventilating and air-conditioning; Section 15806.

1.3 REFERENCE STANDARDS:

A. UL: Underwriters' Laboratories, Inc., 33 Pfingsten Road, Northbrook, Illinois

B. NEMA: National Electrical Manufacturers Association, 2101 L Street, Northwest, Washington, D.C.

C. FM: Factory Mutual Engineering Corporation, Factory Mutual System, 1151 Boston/Providence Turnpike, Norwood, Massachusetts.

PART 2 PRODUCTS

2.1 MANUFACTURERS OF MISCELLANEOUS EQUIPMENT:

A. General Electric CompanyB. Westinghouse Company

C. Square D Company

D. Russell & Stoll, Livingston, NJ E. Acceptable equivalent.
2.2 STEEL CHANNEL MANUFACTURERS:

A. Unistrut Corp., Wayne, MI

B. Power-Strut Division, Van Huffel Tube Corp., Warren, OH C. T.J. Cope, Division of Cyprus Mines Corp., Collegeville, PA D. Acceptable equivalent.
2.3 EXPLOSION PROOF/WATERTIGHT PUSHBUTTON STATION MANUFACTURERS:

A. Crouse Hinds Company, Syracuse, NY B. Pyle-National Company, Chicago, IL C. Russell & Stoll, Livingston, NJ
2.4 SWITCHES:

A. Furnish HAND-OFF-AUTO switches, safety switches, tumbler switches and other accessory devices as necessary for the control of motors and other electrical equipment or devices.

1. Furnish heavy duty type, safety switches, with external operating handles, 3 PST, rated 600 volt, 60 Hertz with ampere rating as indicated, and having provisions for padlocking.

2. Furnish fuses for safety switches as indicated.

2.5 CONDUIT AND WIRING:

A. Furnish conduit and wiring necessary to make connections between intruments panels, consoles, cabinets and external equipment and devices.

2.6 PUSHBUTTON STATIONS:

A. Furnish pushbutton stations designed for heavy-duty service and with momentary or maintaining contacts as indicated or as necessary for starting and stopping motor.
B. At pushbutton stations furnish nameplates with white letters on black background. C. Furnish safety lockout station with position indication located near motor to prevent application of current. Where pumps are located on lower levels than driving motors, furnish safety lockout station near each pump or other item of equipment.

D. Rate explosion-proof pushbutton stations for the Group, Division and Class as indicated.
E. Galvanized cast-iron enclosures for NEMA Type 4 watertight pushbutton stations. F. Furnish fiberglass reinforced polyester enclosures for pushbutton stations and pushbutton external surfaces located in highly corrosive area. Also furnish

pushbutton external surface with external neoprene boot over fiber glass reinforced polyester enclosure. Furnish gaskets with stainless steel screws, to prevent entry of chemicals.

2.7 MANUAL MOTOR STARTERS:

A. Furnish manual motor starters where indicated and for 120-volt, 60-Hertz fractional horsepower motors that do not have built-in thermal overload devices.

B. Furnish each manual motor starter with overload heater or heaters of suitable capacity for motor-running over-current protection for motor it controls. Furnish manual starters as single or 2 pole, as necessary, and with toggle mechanisms indicating OFF and ON positions. Where indicated, furnish manual starters with built-in HAND-OFF-AUTO switches. Furnish enclosures as indicated.

C. Manual starters within sight of motors, as defined by N.E.C.

2.8 COMBINATION STARTERS:

A. Unless otherwise indicated, furnish each combination starter with motor circuit protector and full-voltage magnetic starter. Furnish motor circuit protectors and starters as specified under Motor Control Centers.

B. Furnish control transformer with current limiting primary fuses.
. Furnish indicating lights of the transformer type, heavy duty, and oiltight unit rated at 120 volts.

D. Furnish heavy duty, oiltight type pushbuttons to provide momentary contacts or contacts as necessary for starting and stopping the motor.

2.9 CIRCUIT BREAKERS:

A. Furnish manually operated circuit breakers, ambient-compensated, providing thermal magnetic inverse time-limit overload and instantaneous short circuit protection. Furnish overload protection on all poles; trip settings as indicated.

B. Furnish breakers that are rated 208 volt alternating current; 3 PST or 2 PST, have 100-amp. or larger frames, and have an interrupting capacity of not less than 10,0000 rms symmetrical amperes at 208 volts.

C. Furnish time-current characteristics curves for each size of circuit breaker furnished.

E. Furnish circuit breakers housed in NEMA type 1 enclosure indicated, having external operating handles with provisions for padlocking.

F. Furnish circuit breakers manufactured by General Electric Company, Square D Company, Westinghouse Electric Corp., or acceptable equivalent.

2.10 ELECTRIC CLOCKS:

A. Furnish electric clock operating on 120-volt, 60 Hertz at each clock outlet. Unless otherwise indicated, furnish each clock with white circular dial with sweep-second hand and black-enameled numerals and hands. Size of clocks as indicated.

B. Enclose each clock in a satin aluminum finish, metal case for surface mounting.

2.11 CONTROL PANELS:

A. Furnish control panels for A/C and other equipment, as indicated in mechanical drawings. Enclosure that dimensions, construction and mounting of equipment is as indicated.

B. Furnish panels constructed of at least 3/32 gage steel and provided with terminal blocks for connection of all external wiring.

C. Furnish pushbuttons, indicator lights and switches of heavy duty, oil tight types.
Furnish relays of industrial types, with 120-volt, 60-Hertz operating coils, and contacts rated for intended service.

D. Furnish nameplates for each panel and each device on panel. Nameplates of laminated plastic material, at least 3/32 in. thick, and with white letters on a black background.

PART 3 EXECUTION

3.1 WIRING OF MISCELLANEOUS DEVICES:

A. Make all electrical connections required for recording and indicating instruments, and miscellaneous devices and provide electrical supplies to metering, instrumentation, control, and alarm systems.

B. Connect HAND-OFF-AUTO switches, safety switches, tumbler switches, and other accessory devices as indicated or necessary for control of motors and other electrical equipment or devices.

C. Install conduit and wiring and make all necessary electrical connections between all instrument panels, consoles, cabinets, and external equipment and devices. Panels, cabinets, etc., are indicated.

3.2 WIRING OF EQUIPMENT FURNISHED UNDER OTHER SECTIONS:

A. As specified under Electrical Work General, install conduit, wiring, and connections for equipment and devices furnished under other Sections of specifica- tions, and as indicated.

B. Refer to heating, ventilating, and air-conditioning specifications and drawings for locations of air-handling units, duct heaters, air-conditioning units, damper motors, ventilating and exhaust fans, and other equipment requiring 480-volt and 208-volt supply; provide supply to equipment.

C. Where indicated on drawings, install manual and magnetic starting equipment for heating and ventilating equipment.

D. Unless otherwise indicated on drawings, all control equipment, relays, control wiring, conduit, and connections necessary for control of heating, ventilating, and air-conditioning systems provided under Section 15806. Refer to mechanical specifications and drawings for locations of pressure-operated control switches, float switches, butterfly valves, solenoid-operated valves, sump pumps, metering instruments, control panels, alarm actuating contacts, indicating lamps, limit switches, and other devices requiring wiring or interconnections with equipment supplied under electrical Sections of these specifications.

END OF SECTION

SECTION 16950 - ELECTRICAL TESTING

PART 1 GENERAL

1.1 REFERENCES:

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI):

a. C2, National Electrical Safety Code.

2. Institute of Electrical and Electronics Engineers (IEEE):

a. 43, Recommended Practice for Testing Insulating Resistance of
Rotating Machinery.
b. 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
c. 95, Recommended Practice for Insulation Testing of Large AC Rotating Machinery with High Direct Voltage.
d. 118, Standard Test Code for Resistance Measurement.
e. 400, Guide for Making High-Direct-Voltage Tests on Power
Cable Systems in the Field.

3. National Electrical Manufacturers Association (NEMA):

a. AB 4, Guideline for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications.
b. PB 2, Deadfront Distribution Switchboards.
c. WC 7, Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
d. WC 8, Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

4. International Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
5. National Fire Protection Association (NFPA):

a. 70, National Electrical Code (NEC).b. 70E, Standard for Electrical Safety Requirements for Employee

Workplaces.

1.2 SUBMITTALS:

A. Administrative Submittals: Submit 30 days prior to performing inspections or tests:

1. Schedule for performing inspection and tests.
2. List of references to be used for each test.
3. Sample copy of equipment and materials inspection form(s).
4. Sample copy of individual device test form.
5. Sample copy of individual system test form.

B. Quality Control Submittals: Submit within 30 days after completion of test:

1. Test or inspection reports and certificates for each electrical item tested. C. Contract Closeout Submittals:
1. Operation and Maintenance Data:

a. After test or inspection reports and certificates have been reviewed by ENGINEER and returned, insert a copy of each in operation and maintenance manual.

1.3 QUALITY ASSURANCE:

A. Testing Firm Qualifications:

1. Corporately and financially independent organization functioning as an unbiased testing authority.
2. Professionally independent of manufacturers, suppliers, and installers, of electrical equipment and systems being tested.
3. Employer of engineers and technicians regularly engaged in testing and inspecting of electrical equipment, installations, and systems.
4. Supervising engineer accredited as Certified Electrical Test Technologist by National Institute for Certification of Engineering Technologists (NICET), or International Electrical Testing Association and having a minimum of 5 years testing experience on similar projects.
5. Technicians certified by NICET or NETA.
6. Assistants and apprentices assigned to project at ratio not to exceed two certified to one noncertified assistant or apprentice.
7. Registered Professional Engineer to provide comprehensive project report outlining services performed, results of such services, recommendations, actions taken, and opinions.8. In compliance with OSHA Title 29, Part 1907 criteria for accreditation of testing laboratories

B. Test equipment shall have an operating accuracy equal to, or greater than, requirements established by NETA ATS.

C. Test instrument calibration shall be in accordance with NETA ATS.

1.4 SEQUENCING AND SCHEDULING:

A. Perform inspection and electrical tests after equipment has been installed. B. Perform tests with apparatus de-energized whenever feasible.
C. Inspection and electrical tests on energized equipment are to be:

1. Scheduled with ENGINEER prior to de-energization.
2. Minimized to avoid extended period of interruption to the operating plant equipment.

D. Notify ENGINEER at least 24 hours prior to performing tests on energized electrical equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GENERAL:

A. Tests and inspection shall establish that:

1. Electrical equipment is operational within industry and manufacturer's tolerances.
2. Installation operates properly.
3. Equipment is suitable for energization.
4. Installation conforms to requirements of Contract Documents and
NFPA 70, NFPA 70E, and ANSI C2.

B. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.

C. Adjust mechanisms and moving parts for free mechanical movement.

D. Adjust adjustable relays and sensors to correspond to operating conditions, or as recommended by manufacturer.E. Verify nameplate data for conformance to Contract Documents. F. Realign equipment not properly aligned and correct unlevelness.

G. Properly anchor electrical equipment found to be inadequately anchored.

H. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench to manufacturer's recommendations, or as otherwise specified.

I. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.

J. Provide proper lubrication of applicable moving parts.

K. Inform ENGINEER of working clearances not in accordance with NFPA 70. L. Investigate and repair or replace:
1. Electrical items that fail tests.
2. Active components not operating in accordance with manufacturer's instructions.
3. Damaged electrical equipment. M. Electrical Enclosures:
1. Remove foreign material and moisture from enclosure interior.
2. Vacuum and wipe clean enclosure interior.
3. Remove corrosion found on metal surfaces.
4. Repair or replace, as determined by ENGINEER, door and panel sections having dented surfaces.
5. Repair or replace, as determined by ENGINEER, poor fitting doors and panel sections.
6. Repair or replace improperly operating latching, locking, or interlocking devices.
7. Replace missing or damaged hardware.
8. Finish:

a. Provide matching paint and touch up scratches and mars.
b. If required due to extensive damage, as determined by
ENGINEER, refinish the entire assembly.

N. Replace fuses and circuit breakers that do not conform to size and type required by the Contract Documents.

3.2 DRY TYPE TRANSFORMERS:A. Visual and Mechanical Inspection:

1. Physical and insulator damage.
2. Proper winding connections.
3. Bolt torque level in accordance with NETA ATS, Table 10.1, unless otherwise specified by manufacturer.
4. Defective wiring.
5. Proper operation of fans, indicators, and auxiliary devices.
6. Removal of shipping brackets, fixtures, or bracing.
7. Free and properly installed resilient mounts.
8. Cleanliness and improper blockage of ventilation passages.

9. Verify that tap-changer is set at correct ratio for rated output voltage under normal operating conditions.
10. Verify proper secondary voltage phase-to-phase and phase-to-ground after energization and prior to loading.

B. Electrical Tests:

1. Insulation Resistance Tests:

a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 7.2.3 for each:

1) Winding-to-winding.
2) Winding-to-ground.

b. 10-minute test duration with resistances tabulated at 30 seconds,
1 minute, and 10 minutes.
c. Results temperature corrected in accordance with NETA ATS, Table 7.2.4.
d. Temperature corrected insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
e. Insulation resistance test results to compare within 1 percent of adjacent windings.

2. Perform tests and adjustments for fans, controls, and alarm functions as suggested by manufacturer.

3.3 LOW VOLTAGE CABLES, 600 VOLTS MAXIMUM:

A. Visual and Mechanical Inspection:

1. Inspect Each Individual Exposed Power Cable No. 6 and Larger For:

a. Physical damage.
b. Proper connections in accordance with single-line diagram.c. Cable bends not in conformance with manufacturer's minimum allowable bending radius where applicable.
d. Color coding conformance with specifications. e. Proper circuit identification.

2. Mechanical Connections For:

a. Proper lug type for conductor material. b. Proper lug installation.
c. Bolt torque level in accordance with NETA ATS, Table 10.1, unless otherwise specified by manufacturer.

3. Shielded Instrumentation Cables For:

a. Proper shield grounding. b. Proper terminations.
c. Proper circuit identification.

4. Control Cables For:

a. Proper termination.
b. Proper circuit identification.

5. Cables Terminated Through Window Type CTs: Verify that neutrals and grounds are terminated for correct operation of protective devices.

B. Electrical Tests for Conductors No. 4 and Larger:

1. Insulation Resistance Tests:

a. Utilize 1,000-volt dc megohmmeter for 600-volt insulated conductors and 500-volt dc megohmmeter for 300-volt insulated conductors.
b. Test each conductor with respect to ground and to adjacent
conductors per IEEE 118 procedures for 1 minute.
c. Evaluate ohmic values by comparison with conductors of same length and type.
d. Investigate values less than 50 megohms.

2. Continuity test by ohmmeter method to ensure proper cable connections.

3.4 SAFETY SWITCHES, 600 VOLTS MAXIMUM:

A. Visual and Mechanical Inspection:

1. Proper blade pressure and alignment.2. Proper operation of switch operating handle.
3. Adequate mechanical support for each fuse.
4. Proper contact-to-contact tightness between fuse clip and fuse.
5. Cable connection bolt torque level in accordance with NETA ATS, Table 10.1.
6. Proper phase barrier material and installation.
7. Verify that fuse sizes and types correspond to one-line diagram. B. Electrical Tests:
1. Insulation Resistance Tests:

a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 10.2.
b. Phase-to-phase and phase-to-ground for 1 minute on each pole.
c. Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.

2. Contact Resistance Tests:

a. Contact resistance in microhms across each switch blade and fuse holder.
b. Investigate deviation of 50 percent or more from adjacent poles or similar switches.

3.5 MOLDED AND INSULATED CASE CIRCUIT BREAKERS:

A. General: Inspection and testing limited to circuit breakers rated 150 amperes and larger and to motor circuit protector breakers rated amperes and larger.

B. Visual and Mechanical Inspection:

1. Proper mounting.
2. Proper conductor size.
3. Feeder designation according to nameplate and one-line diagram.
4. Cracked casings.
5. Connection bolt torque level in accordance with NETA ATS, Table 10.1.
6. Operate breaker to verify smooth operation.
7. Compare frame size and trip setting with circuit breaker schedules or one-line diagram.
8. Verify that terminals are suitable for 75 degrees C rated insulated conductors.

C. Electrical Tests:1. Insulation Resistance Tests:
a. Utilize 1,000-volt dc megohmmeter for 480- and 600-volt circuit breakers and 500-volt dc megohmmeter for 240-volt circuit breakers.
b. Pole-to-pole and pole-to-ground with breaker contacts opened for
1 minute
c. Pole-to-pole and pole-to-ground with breaker contacts closed for
1 minute.
d. Test values to comply with NETA ATS, Table 10.2.

2. Contact Resistance Tests:

a. Contact resistance in microhms across each pole.
b. Investigate deviation of 50 percent or more from adjacent poles and similar breakers.

3. Primary Current Injection Test to Verify:

a. Long-time minimum pickup and delay. b. Short-time pickup and delay.
c. Ground fault pickup and delay.
d. Instantaneous pickup by run-up or pulse method.
e. Trip characteristics of adjustable trip breakers shall be within manufacturer's published time-current characteristic tolerance band, including adjustment factors.
f. Trip times shall be within limits established by NEMA AB 4, Table 5-3.
g. Instantaneous pickup value shall be within values established by
NEMA AB 4, Table 5-4.

3.6 GROUNDING SYSTEMS:

A. Visual and Mechanical Inspection:

1. Equipment and circuit grounds in panelboards assemblies for proper connection and tightness.
2. Ground bus connections in assemblies for proper termination and tightness.
3. Effective transformer core and equipment grounding.
4. Accessible connections to grounding electrodes for proper fit and tightness.
5. Accessible exothermic-weld grounding connections to verify that molds were fully filled and proper bonding was obtained.

B. Electrical Tests:1. Fall-Of-Potential Test:
a. In accordance with IEEE 81, Section 8.2.1.5 for measurement of main ground system's resistance.
b. Main ground electrode system resistance to ground to be no greater than 5 ohms.

2. Two-Point Direct Method Test:

a. In accordance with IEEE 81, Section 8.2.1.1 for measurement of ground resistance between main ground system, equipment frames, and system neutral and derived neutral points.
b. Equipment ground resistance shall not exceed main ground system resistance by 0.25 0.50 ohm.

END OF SECTION

SECTION 16999 - FIELD ACCEPTANCE TESTS

PART 1 GENERAL

1.1 DESCRIPTION:

A. After electrical installation is complete, make tests to demonstrate that entire system is in proper working order and in accordance with drawings and specifications. Make no tests less than those outlined hereafter, unless requested in writing and approved by Engineer. Tests are in addition to, and no substitution for, tests of individual items at manufacturer's plant. Make insulation and ground resistance tests before operating tests. Determine proper rotation of motors before permanent connections are made.

B. Pay all costs for tests including expenses incident to retests occasioned by defects and failures of equipment to meet specifications.

1. Replace wiring and equipment found defective, or failing to meet specified requirements, without charge, unless written acceptance for repair is given by Engineer.
2. Furnish three copies of all test results to Engineer.
3. Unless otherwise specified, Owner will supply electric current necessary for tests.

1.2 REFERENCE STANDARDS:

A. NEMA: National Electrical Manufacturers Association, 2101 L Street, Northwest, Washington D.C.

B. IEEE: Institute of Electrical and Electronic Engineers, 345 East 47th Street, New York, NY.

PART 2 PRODUCTS

2.1 TESTING EQUIPMENT:

A. Calibration:

1. Furnish suitable electrical instruments including voltmeters, ammeters, wattmeters, tachometers and all other equipment necessary to perform tests specified. Furnish certified copies of calibration curves of these instruments which have been calibrated for specific tests.
2. Make necessary openings in circuits for testing instruments and place and connect all instruments, equipment, and devices, necessary for the tests. Upon completion of tests, remove instruments and instrument connections and restore all circuits to permanent condition.
3. Other Sections of specifications require services of one or more manufacturer's representatives, to ensure that equipment supplied has been installed properly and adjusted to proper working order. Advise representative of all applicable tests in this Section, so that work will be coordinated, and tests combined where feasible.

2.2 TESTING:

A. Coordination

1. Coordinate activities, and cooperate with others on project, to ensure that systems are energized when required, loads applied, and other requirements of Section are carried out on timely, coordinated basis.
2. Conduct tests in presence of Engineer. Notify Engineer seven calendar days or more in advance when any test to be performed, and do not start tests without Engineer's permission.

B. Preparation

1. Make up no high and/or medium-voltage connections at service entrance, transformers, substations, motors, medium voltage motor control centers, switchgear and generator permanently until correct phase rotation of all equipment is determined. Install and insulate these connections temporarily, if necessary, while determining proper rotation. Make permanent connections after proper rotation has been established and subsequent to completion of insulation resistance and dielectric tests.

PART 3 EXECUTION

3.1 INSULATION RESISTANCE TESTS OF CIRCUITS, 600 VOLTS AND BELOW:

A. Do not subject conductors rated 600 volts and below to high potential dielectric tests. Test each complete feeder and branch circuit of 600 volts or below with everything but power supply and power-consuming equipment, connected thereto, and have an insulation resistance between conductors and between each conductorand ground of not less than 1,000,000 ohms, unless otherwise accepted by
Engineer.

B. Determine insulation resistance values with all switchboards, panelboards, fuseholders, switches, receptacles, and overcurrent devices in place.

C. Use megohmmeter having output of at least 500 volts to determine insulation resistance value for 600 volt rated conductors, and a 2400 volt megohmmeter for 5 kv and 15 kv rated conductors.

D. List each circuit and measured resistance as test data.

E. Maintain record of all insulation resistance values. Identify conductor, or equipment, date that value was taken and resistance value. Arrange information in suitable neat tabular form and turn to Engineer in triplicate.

3.2 INSULATION RESISTANCE TESTS FOR MOTORS:

A. After installation, test windings of all 3-phase motors with megohmmeter in accordance with, and meeting requirements of, IEEE Standard No. 43.

3.3 DIELECTRIC TESTS OF CONDUCTORS RATED 2400 VOLTS AND ABOVE:

A. After all high and/or medium-voltage conductors are installed, and before connecting and putting into service, subject to dielectric tests. Perform direct current, high-potential tests from phase to phase and from phase to ground. Make tests as specified in latest edition of the applicable IPCEA-NEMA Standard.

B. Complete and enclose splices in conductor system being tested within all pull, junction, or splice boxes before test is started, and complete all potheads and switchgear terminations. Disconnect potential transformers and all power consuming equipment or devices from circuit, if any are present.

3.4 GROUND RESISTANCE:

A. Test each ground rod in accordance with IEEE Std. 142, and submit tabulation of results to Engineer. Include identification of electrode, date of reading and ground resistance value in results.

B. Test each entire grounding system for continuity of connections and for resistance. Ensure that ground resistance of conduits, equipment cases, and supporting frames does not vary appreciably from that of system as whole and does not exceed 5
Ohms.

3.5 OPERATING TESTS:

A. Operate each motor and associated equipment, as nearly as possible, under normal operating conditions for as long as feasible and for length of time sufficient to demonstrate correct alignment, temperature rise, speed, and satisfactory operation. Load motors to full capacity, or as near as possible.

B. Operate switches, circuit breakers and control devices to show correct and satisfactory operation.

C. Associated equipment includes instruments, meters, relays, circuit breakers, switches, and other devices in substations, switchgear, motor control centers, panelboards, control and instrumentation panels, etc., related to motor being tested.

D. Where tests of any of above-referenced equipment included in other Sections of specifications, coordinate testing, as directed by Engineer, to avoid duplication and conflict between tests.

E. Perform above tests in addition to, and not in substitution for required manufacturer's factory tests of individual items.

END OF SECTION