PROJECT MANUAL
VOLUME 2 of 2

DIVISIONS 02-10, 12, 22, 23, & 26

READING SCHOOL DISTRICT

ART & FCS RENOVATIONS

NOVEMBER 2026

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SECTION 02 09 00 - SUMMARY OF WORK – ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections apply to this Section. Asbestos Abatement – Summary of Work was prepared by Element Environmental Solutions, Inc. (E2S), by a Pennsylvania Licensed Asbestos Project Designer (#0002251), under E2S Project 1042.0158.

1.2 SUMMARY

A. Section Includes:

1. Technical Specifications for:

a. Removal and disposal of asbestos-containing flooring materials in Art Rooms 244, 224A, 245 and 245A at Reading High School to support the renovation project, as detailed below.
b. Reference the Asbestos Abatement Drawings ASB-01 (Second Floor) included with the Bid Documents for abatement scope and locations of work.

1.3 SEPARATE CONTRACTS

A. Renovations to Art Rooms and FCS Rooms at Reading High School (Multiple Primes Summer 2027).

1.4 PERFORMANCE REQUIREMENTS

A. Coordinate abatement activities under the work of this contract with Construction Manager, Environmental Consultant, and the Owner at project meetings prior to the start of construction, as applicable, and within agreed upon timeframes; and throughout the Project.

B. Work shall be performed in accordance with these specifications, including all codes, regulations, and requirements pertaining to the work detailed below in Scope of Work.

1.5 GENERAL REQUIREMENTS

A. Abatement is included in the General Construction Contract (Abatement Contractor to be hired as a Subcontractor), and any Contractor performing asbestos abatement activities must be licensed as an Asbestos Abatement Contractor by the Pennsylvania Department of Labor and Industry (PA DLI) and shall provide documentation prior to starting work.

B. Asbestos Abatement Workers and Supervisors must also be licensed as such by PA DLI and have current licenses on-site at all times. An Asbestos Supervisor must be on site at all times during abatement activities.

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C. Abatement Subcontractor will be responsible for preparing and submitting proper notifications to governing agencies including EPA, DEP, and PA DLI as applicable, in a timely manner sufficient to be able to perform the work without delaying the Project.

D. Abatement Subcontractor will be responsible for means and methods necessary to access and remove asbestos-containing materials and for proper disposal of all materials removed

E. It is the intent for electrical and water service to remain in operation during the abatement portion of the work.

F. All abatement activities, removal procedures, etc. will be performed in strict accordance with the most stringent governing regulations, including but not limited to the following (as applicable):

1. PA DLI – Accreditation and Licensing Acts.
2. EPA's AHERA, NESHAP's and Part 761-765 (Disposal) Regulations.
3. OSHA's Asbestos and Lead in Construction Standards.
4. OSHA's Hazard Communication Standard and HAZWOPR.
5. All other federal, state and local regulations that apply.

G. Asbestos Abatement Subcontractor is responsible for any fees or permits required by the City of Reading, including dumpster and waste container fees, as applicable.

H. Where a conflict arises between Specifications and regulations, the most stringent takes precedence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ASBESTOS ABATEMENT – SCOPE OF WORK

A. Reading High School – Art Rooms

1. Removal and proper disposal of approximately 2,550 square feet (S.F.) of asbestos-containing floor tile and associated mastic (black) located on the Second Floor in Rooms 244, 244A, 245 and 245A.

a. See Drawing No. ASB-01 for representative locations of ACM floor tile & mastic. Quantities are estimated; Contractor to field verify quantities prior to bidding and is responsible for removal and disposal of all ACM floor tile and mastic identified on the Drawing.

B. Asbestos Abatement – Unit Prices/Allowances

1. See Division 1 Specification Sections 01 21 00 – Allowances and 01 22 00 – Unit Prices, and General Contractor Bid Form for allowances and unit prices that are included in the Base Bid for this project, as applicable for abatement.

3.2 CONSTRUCTION SCHEDULE

A. Abatement Subcontractor shall coordinate all abatement, including scheduling and sequencing, with the Owner, Construction Manager and Environmental Consultant. Tentative start date for the abatement work is June 9, 2027, and substantial completion date for the abatement work is June 17, 2027. Refer to Specification Section 01 10 00 – Summary for the overall construction schedule.

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3.3 REMOVAL PROCEDURES – ASBESTOS ABATEMENT

A. Floor Tile and Mastic:

1. Contractor shall perform the removal of asbestos-containing floor tile and associated mastic on concrete under full containment with a 3-stage decontamination chamber in place, under negative pressure, using wet removal methods. Full containment shall consist of 2-layers of 6-mil polyethylene sheeting for critical barriers, 1-layer of 6-mil poly sheeting on walls, and 1-layer of 6-mil poly sheeting on ceiling. Contractor shall erect proper signage to meet OSHA regulated area requirements. Contractor shall remove all floor tile and mastic as indicated on Drawing ASB-01. Mastic on concrete will be removed using HEPA-equipped floor grinders (mechanical methods); edges and hard-to-reach areas shall be removed using grinders, scrapers, or similar methods (no chemical solvents). If power supply sufficient to operate grinding equipment is available, the District will allow Contractor use; however, Contractor is responsible for properly connecting to the power source and providing electric to the actual work area (GFCI required). Contractor shall verify power supply prior to bidding and shall include all necessary costs in Base Bid for power, including supplying generators for sufficient power, if required.
2. Floor tile and mastic included in the abatement scope that is located under casework, cabinets, etc. **is included** in the scope of work for abatement (as applicable). Abatement Subcontractor shall coordinate with the General Contractor for removal of this casework to accommodate full abatement of all flooring within spaces identified in this scope of work. No additional costs will be approved for flooring and mastic in these spaces that is currently located under casework, cabinets, etc. unless located in areas NOT identified on Drawings, or Abatement Subcontractor is off-site, then a Site Mobilization Fee would apply.
3. All ACM shall be disposed of according to regulation for that particular category of material (friable, non-friable category I, etc.) in a landfill that accepts such material. All waste shall be properly packaged and labeled, and manifested, according to regulation for the type of materials.

3.4 CLEARANCE REQUIREMENTS - ASBESTOS

A. Upon completion of the ACM removal and final cleaning, Environmental Consultant (ENV) will perform a visual inspection of each work area. At such time that the work area passes visual inspection, Contractor will encapsulate the work area in accordance with regulation and applicable sections of Division 2 specifications, as applicable. Contractor shall not encapsulate concrete floors. Environmental Consultant will perform final air clearance testing in accordance with AHERA regulations and applicable sections of Division 2 specifications. If clearance test results do not meet clearance criteria, as defined in Section 020915, Contractor is responsible to re-clean at no additional cost to Owner and may be responsible for additional costs related to the additional final clearance sampling and analysis. For this project, clearance sampling will be by TEM analysis, based on the quantities and types of materials abated, and removal procedures used (friable, non-friable) in each given work area.

B. It is the intent for electrical and water service to be made available by the District for Contractor use during the abatement portion of the work; Abatement Subcontractor is responsible for all connections and supplying electric and water to actual work areas, as necessary, to perform the work detailed in these specifications. Abatement Subcontractor is also responsible for verifying whether a sufficient power source is available for operating equipment necessary to perform the work as specified or shall provide the necessary means for power and include all costs in Bid.

3.5 ASBESTOS-CONTAINING MATERIALS

A. The following asbestos containing materials are known or assumed to be present at the worksite based upon the asbestos inspections and previous sampling; if any other materials are found which are suspected of containing asbestos, immediately notify ENV:

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1. 12” x 12” Floor Tile and Mastic (Black) – Various Rooms.
2. Epoxy Flooring (1929 portion).
3. 9” x x 9” Floor Tile and Mastic (Black) – Various Rooms.
4. Sheet Vinyl Flooring and Mastic.
5. Transite Tabletops.

3.6 AIR MONITORING – ASBESTOS

A. Owner will contract with a third party to have asbestos abatement oversight, air monitoring, and final air clearance air quality testing performed for this project. Contractor is to cooperate fully with the Environmental Consultant. For this project, clearance sampling will be by PCM or TEM analysis, based on the quantities and types of materials abated, and removal procedures used (friable, non-friable) in each given work area. **OSHA Personal Air Sampling is the responsibility of the Abatement Subcontractor.**

3.7 OWNER OCCUPANCY

A. The Owner, Owner’s Representative, or Other Contractors will occupy portions of the existing building during the period of abatement. Cooperate fully with Owner, etc. to minimize conflicts and facilitate work. Perform the work so as not to interfere with operations and work being performed by others, in accordance with project schedules and specified procedures and requirements.

B. All abatement work must occur while the school is NOT occupied with students - either off-hours, on weekends, during spring/summer break or other school holidays when the building is open and accessible.

3.8 SUBMITTALS

A. Asbestos Abatement Notification

B. Work Plan and Waste Management Plan

C. Safety Data Sheets (SDS), as applicable

D. Proposed Waste Hauler and Landfill

E. Asbestos Abatement Subcontractor License

F. Asbestos Abatement Worker and Supervisor Licenses

G. Subcontractors (if applicable)

END OF SECTION 02 09 00

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SECTION 02 09 01 – DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.1 DEFINITIONS

A. Definitions in this article are not complete but general to the extent they are not defined elsewhere.

B. Indicated: The term "Indicated" is a cross-reference to graphic representations, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.

C. Directed: Where not otherwise explained, terms such as "directed", "requested", "authorized", "selected", "approved", "required", "accepted", and "permitted" mean "directed by ENGINEER", "requested by "ENGINEER", and similar phrases. However, no such implied meaning will be interpreted to extend ENGINEER responsibility into CONTRACTOR'S responsibility for construction supervision.

D. Approve: Where used in conjunction with ENGINEER response to submittals, requests, applications, inquiries, reports and claims by CONTRACTOR, the meaning of term "approved" will be held to limitations of ENGINEER responsibilities and duties as specified in General and Supplementary Conditions. In no case will "approval" by ENGINEER be interpreted as a release of CONTRACTOR from responsibilities to fulfill requirements of Contract Documents.

E. Project Site: The term "project site" is defined as the space available to CONTRACTOR for performance of the WORK, either exclusively or in conjunction with others performing other work as part of the project. The extent of project site is shown on the drawings and may or may not be identical with the description of land upon which the project is to be built.

F. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing protecting, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.

I. Installer: The term "installer" is defined as the entity (person or firm) engaged by CONTRACTOR, or its subcontractor or sub- subcontractor for performance of a particular unit of work at project site, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.

J. Testing Laboratory: The term "testing laboratory" is an entity engaged to perform specific inspections or tests of the WORK, either at project site or elsewhere; and to report and (if required) interpret results of those inspections or tests.

K. Owner’s Representative is the entity described as the "ENGINEER" in "General Conditions of the CONTRACT for Construction". All references to ARCHITECT or ENGINEER in the contract documents shall in all cases refer to the OWNER'S REPRESENTATIVE. The OWNER'S REPRESENTATIVE will

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represent the OWNER during construction and until final payment is due. The OWNER'S REPRESENTATIVE will advise and consult with the OWNER. The OWNER'S instructions to the CONTRACTOR shall be forwarded through the OWNER'S REPRESENTATIVE.

L. General Superintendent: Is the CONTRACTOR'S representative at the work site. This person is the Competent Person required by OSHA in 29 CFR 1926.

1.2 RELATIVE TO ASBESTOS ABATEMENT

A. Aerosol: A system consisting of particles, solid or liquid, suspended in air.

B. Air Cell: Insulation normally used on pipes and duct work that is comprised of corrugated cardboard which is frequently comprised of asbestos combined with cellulose or refractory binders.

C. Air Monitoring: The process of measuring the fiber content of a specific volume of air.

D. Amended Water: Water to which a surfactant has been added.

E. Asbestos: The asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite. For purposes of determining respiratory and worker protection both the asbestiform and non-asbestiform varieties of the above minerals and any of these materials that have been chemically treated and/or altered shall be considered as asbestos.

F. Asbestos-Containing Material (ACM): Any material containing more than 1 percent by weight (>1%) of asbestos of any type or mixture of types.

G. Asbestos-Containing Waste Material: Any material which is or is suspected of being or any material contaminated with an asbestos-containing material which is to be removed from a work area for disposal.

H. Authorized Visitor: The OWNER, the OWNER'S REPRESENTATIVE, testing lab personnel, the ARCHITECT/ENGINEER or a representative of any federal, state and local regulatory or other agency having authorization over the Project.

I. Barrier: Any surface that seals off the work area to inhibit the movement of fibers.

J. Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches.

K. Ceiling Concentration: The concentration of an airborne substance that shall not be exceeded.

L. Certified Industrial Hygienist (C.I.H.): An industrial hygienist certified by the American Board of Industrial Hygiene.

M. Demolition: The wrecking or taking out of any building component, system, finish or assembly of a facility together with any related handling operations.

N. Disposal Bag: A properly labeled 6 mil thick leak-tight plastic bags used for transporting asbestos waste from work and to disposal site.

O. Encapsulant: A material that surrounds or embeds asbestos fibers in an adhesive matrix, to prevent release of fibers.

P. Bridging encapsulant: An encapsulant that forms a discrete layer on the surface of an in situ asbestos matrix.

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Q. Penetrating encapsulant: An encapsulant that is absorbed by the in situ asbestos matrix without leaving a discrete surface layer.

R. Removal encapsulant: A penetrating encapsulant specifically designed for removal of asbestos-containing materials rather than encapsulation.

S. Encapsulation: Treatment of asbestos-containing materials, with an encapsulant.

T. Enclosure: Abatement of ACM by the construction of an air-tight, impermeable, permanent barrier around asbestos-containing material to control the release of asbestos fibers into the air.

U. Filter: A media component used in respirators to remove solid or liquid particles from the inspired air.

V. Friable Asbestos Material: Material that contains >1% asbestos by weight, and that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

W. Glove-bag: A sack (typically constructed of 6 mil transparent polyethylene or polyvinylchloride plastic) with two inward projecting long-sleeve gloves, which are designed to enclose an object from which an asbestos-containing material is to be removed.

X. HEPA Filter: A High Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97 of asbestos fibers greater than 0.3 microns in length.

Y. HEPA Filter Vacuum Collection Equipment (or vacuum cleaner): High efficiency particulate air filtered vacuum collection equipment with a filter system capable of collecting and retaining asbestos fibers. Filters should be 99.97 efficiency for retaining fibers of 0.3 microns or larger.

Z. High-Efficiency Particulate Air Filter (HEPA): A filter which removes from air 99.97 or more of monodisperse dioctyl phthalate (DOP) particles having a mean particle diameter of 0.3 micrometer.

AA. Negative Pressure Respirator: A respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.

BB. Negative Pressure Ventilation System: A pressure differential and ventilation system.

CC. Personal Monitoring: Sampling of the asbestos fiber concentrations within the breathing zone of an employee.

DD. Protection Factor: The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided by a respirator to the wearer.

EE. Repair: Returning damaged ACM to an undamaged condition to prevent fiber release.

FF. Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres.

GG. Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.

HH. Time Weighted Average (TWA): The average concentration of a contaminant in air during a specific period.

II. Visible Emissions: Any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.

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JJ. Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning utensils which have been dampened with amended water or diluted removal encapsulant and afterwards thoroughly decontaminated or disposed of as asbestos contaminated waste.

KK. Work Area: The area where asbestos related work or removal operations are performed which is defined and/or isolated to prevent the spread of asbestos dust, fibers or debris, and entry by unauthorized personnel. Work area is a Regulated Area as defined by 29 CFR 1926.

1.3 GENERAL APPLICABILITY OF STANDARDS

A. Except to the extent that more explicit or more stringent requirements are written directly into the CONTRACT DOCUMENTS, applicable standards of the construction industry have the same force and effect (and are made a part of contract documents by reference) as if copied directly into CONTRACT DOCUMENTS, or as if published copies were bound herewith.

B. Refer to the other CONTRACT DOCUMENTS for resolution of overlapping and conflicting requirements which result from the application of several different industry standards to the same unit of work.

C. Refer to individual unit of work sections for indications of which specialized codes and standard the CONTRACTOR must keep at the project site, available for reference.

D. References Standards (referenced directly in CONTRACT DOCUMENTS or by governing regulations) have precedence over non-referenced standards which are recognized in industry for applicability to work.

E. Except as otherwise indicated, where compliance with an industry standard is required, comply with the standard in effect as of date of the CONTRACT DOCUMENTS.

1.4 COPIES OF STANDARDS

A. The CONTRACT DOCUMENTS require that each entity performing work be experienced in that part of the WORK being performed.

B. Each entity is also required to be familiar with recognized industry standards applicable to that part of the WORK.

C. Where copies of standards are needed for proper performance of the WORK, the CONTRACTOR is required to obtain such copies directly from the publication source.

D. Although certain copies of standards needed for enforcement of the requirements may be required submittals, the OWNER'S REPRESENTATIVE reserves the right to require the CONTRACTOR to submit additional copies of these standards as necessary for enforcement of the requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 02 09 01

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SECTION 02 09 02 – CODES AND REGULATIONS

PART 1 - GENERAL

1.1 DESCRIPTION OF THE WORK

A. Governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the Specification.

B. Notices and permits which are known to the OWNER and which either must be applied for and received, or which must be given to governmental agencies before start of work.

1.2 CODES AND REGULATIONS

A. Except to the extent that more explicit or more stringent requirements are written directly into the CONTRACT DOCUMENTS, all applicable codes, regulations, and standards have the same force and effect (and are made a part of the CONTRACT DOCUMENTS by reference) as if copied directly into the CONTRACT DOCUMENTS, or as if published copies are bound herewith.

B. The CONTRACTOR shall assume full responsibility and liability for the compliance with all applicable federal, state, and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site.

C. The CONTRACTOR is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable federal, state, and local regulations.

D. The CONTRACTOR shall hold the OWNER and OWNER'S REPRESENTATIVE harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulation on the part of himself, his employees, or his SUBCONTRACTORS.

1.3 FEDERAL REQUIREMENTS

A. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), including but not limited to:

1. Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite; Final Rules Title 29, Part 1910, Section 1001 and Part 1926, Section 58 of the Code of Federal Regulations.
2. Respiratory Protection Title 29, Part 1910, Section 134 of the Code of Federal Regulations.
3. Construction Industry Title 29, Part 1926, of the Code of Federal Regulations
4. Access to Employee Exposure and Medical Records Title 29, Part 1910, Section 20 of the Code of Federal Regulations.
5. Hazard Communications Title 29, Part 1910, Section 1200 of the Code of Federal Regulations.
6. Specifications for Accident Prevention Signs and Tags Title 29, Part 1910, Section 145 of the Code of Federal Regulations.

B. U.S. Department of Transportation Hazardous Substances Title 29, Parts 171 and 172 of the Code of Federal Regulations.

C. U.S. Environmental Protection Agency (EPA) including but not limited to:

1. Asbestos Abatement Projects; Worker Protection Rule Title 40 Part 763, Sub-part G of the Code of Federal Regulations.

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2. Asbestos Hazard Emergency Response Act (AHERA) Regulation Asbestos Containing Materials in Schools Final Rule & Notice Title 40, Part 763, Sub-part E of the Code of Federal Regulations.
3. Training Requirements of (AHERA) Regulation Asbestos Containing Materials in Schools Final Rule & Notice Title 40, Part 763, Sub-part E, Appendix C of the Code of Federal Regulations.
4. National Emission Standard for Hazardous Air Pollutants (NESHAPS) National Emission Standard for Asbestos Title 40, Part 61, Sub-part A, and Sub-part M (Revised Sub-part B) of the Code of Federal Regulations.

1.4 STATE REQUIREMENTS – PENNSYLVANIA

A. Pennsylvania Department of Environmental Protection Notification prior to removal as required.

B. Pennsylvania Department of Labor and Industry Notification prior to removal as required.

1.5 LOCAL REQUIREMENTS

A. Abide by all local requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials.

1.6 STANDARDS

A. ANSI Z9.2-79: Fundamentals Governing the Design and Operations of Local Exhaust Systems Publication.

B. ANSI Z88.2-80: Practices for Respiratory Protection Publication.

C. Simplified Sampling Scheme for Friable Surfacing Materials.

D. Laboratories with Polarized Light Microscopy Capabilities for bulk asbestos identification.

E. Respiratory Protection for the Asbestos Abatement Industry. EPA-560-0PTS-86-001.

F. ASTM E849: Safety and Health Requirements Relating to Occupational Exposure.

1.7 NOTICES

A. U.S. Environmental Protection Agency: Send written notification as required by US EPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) to the regional Asbestos NESHAPS Contact at least 10 days prior to beginning any work on asbestos-containing materials. Send notification to the following address; send copies to ENGINEER and OWNER.

1. REGION 3
   Asbestos NESHAPS Contact
   Air & Waste Management Division USEPA
   841 Chestnut Street
   Philadelphia, PA 19107
   (215) 597-6552

B. Include the following information in the notification sent to the NESHAPs Contract:

1. Name and address of OWNER or operator.
2. Description of the facility being demolished or renovated, including the size, age, and prior use of the facility.
3. Estimate of the approximate amount of friable asbestos material present in the facility in terms of linear feet of pipe, and surface area on other facility components.
4. Location of the facility being demolished or renovated.

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5. Scheduled starting and completion dates of demolition or renovation.
6. Nature of planned demolition or renovation and method(s) to be used.
7. Procedures to be used to comply with the requirements of USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61 Subpart M).
8. Name and location of the waste disposal site where the friable asbestos waste material will be deposited.
9. For facilities being demolished under an order of a state or local governmental agency, issued because the facility is structurally unsound and in danger of imminent collapse, the name, title, and authority of the state or local governmental representative who has ordered the demolition.

1.8 STATE AND LOCAL AGENCIES

A. Send written Notification as required by state and local agencies prior to beginning any work on asbestos-containing materials. Send copies to OWNER and ENGINEER including copies of receipts showing that notification was received by the agencies and the date received.

1.9 PERMITS

A. An annual "Industrial waste hauler permit" specifically for asbestos-containing materials, is required for transporting of waste asbestos-containing materials to a disposal site.

1.10 LICENSES

A. Maintain current licenses as required by applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the work of this CONTRACT.

B. Maintain two (2) copies of applicable federal, state and local regulations above. Post one copy of each at the job site. Keep on file in CONTRACTOR'S office one copy of each.

1.11 SUBMITTALS

A. Before Start of WORK submit the following to the OWNER'S REPRESENTATIVE for review:

1. Notices required by federal, state and local regulations together with proof of timely transmittal to agency requiring the notice.
2. Copies of current valid permits required by state and local regulations.
3. Copies of all state and local licenses and permits necessary to carry out the work of this CONTRACT.
4. Copies of notices required by federal, state, and local agencies together with proof of timely transmittal to the agency.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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SECTION 02 09 03 – ABATEMENT AIR MONITORING

PART 1 - GENERAL

1.1 SECTIONS INCLUDES

A. Air monitoring carried out by the OWNER'S REPRESENTATIVE to verify that the building beyond the WORK AREA and the outside environment remain uncontaminated.

B. Establish airborne fiber levels both inside and outside the WORK AREA as action levels.

C. Action required by the CONTRACTOR if an action level is met or exceeded.

1.2 WORK BY OTHERS

A. Air monitoring required by OSHA is the CONTRACTOR'S responsibility and is not covered in this Section.

1.3 AIR MONITORING

A. The purpose of the air monitoring by the OWNER'S REPRESENTATIVE will be to detect faults in the WORK AREA isolation such as:

1. Contamination of the building outside of the WORK AREA with airborne asbestos fibers.
2. Failure of filtration or rupture in the negative pressure system.
3. Contamination of the exterior of the building with airborne asbestos fibers.

B. Should any of the above occur, the CONTRACTOR shall immediately cease asbestos abatement activities until the fault is corrected. WORK shall not recommence until authorized by the OWNER'S REPRESENTATIVE.

C. The OWNER'S REPRESENTATIVE will monitor airborne fiber counts in the WORK AREA to detect airborne fiber counts which may significantly challenge the ability of the WORK AREA isolation procedures.

D. WORK AREA clearance to determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to an acceptable level, the OWNER'S REPRESENTATIVE will sample and analyze air per Specification Section 02 09 15.

E. The OWNER'S REPRESENTATIVE will be conducting air monitoring throughout the course of the Project.

1.4 STOP ACTION LEVELS

A. Maintain an average airborne count in the WORK AREA of less than 0.5 fibers per cubic centimeter. If the fiber counts rise above this figure for any sample taken, revise work procedures to lower fiber counts.

B. If the Time Weighted Average (TWA) fiber count for any work shift or 8 hour period exceeds 0.5 fibers per cubic centimeter, stop all WORK, leave negative air system in operation and notify OWNER'S REPRESENTATIVE. Do not recommence WORK until subsequent testing indicates acceptable fiber counts.

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C. If airborne fiber counts exceed 1.0 fibers per cubic centimeter for any period of time, cease all WORK until fiber counts fall below 0.5 fibers per cubic centimeter and notify OWNER'S REPRESENTATIVE. Do not recommence WORK until subsequent testing indicates acceptable fiber counts.

D. If any air sample taken outside of the WORK AREA exceeds the base line established below, immediately and automatically stop all WORK. If this reading was taken inside the building but outside the critical barriers immediately erect new critical barriers to isolate the affected area from the balance of the building.

E. Decontaminate the affected area in accordance with Section 020914 Cleaning and Decontamination Procedures. Follow all protective measures as outlined in other sections of this Specification.

F. The CONTRACTOR shall be responsible for costs for all additional air monitoring and clearance testing required due to the contamination.

1.5 FIBERS COUNTED

A. The following procedure will be used to resolve any disputes regarding fiber types when a project has been stopped due to excessive airborne fiber counts. "Airborne Fibers" referred to above include all fibers regardless of composition as counted in the NIOSH 7400 Procedures.

B. If WORK has stopped due to high airborne fiber counts, the CONTRACTOR may request that air samples be secured by the OWNER's REPRESENTATIVE for analysis by Transmission Electron Microscopy. "Airborne Fibers" counted in samples analyzed by Transmission Electron Microscopy shall be only asbestos fibers, but of any diameter and length.

C. If Transmission Electron Microscopy is used to arrive at the basis for determining "Airborne Fiber" counts in accordance with the above paragraph, and if the average of airborne asbestos fibers in all samples taken exceeds 0.5 fibers per cubic centimeter, or if anyone sample exceeds 1.0 fibers per cubic centimeter, then the cost of such analysis will be borne by the CONTRACTOR, at no additional cost to the OWNER.

D. Transmission Electron Microscopy will be performed using the analysis method set forth in the AHERA regulation 40 CFR Part 763 Appendix A.

1.6 AIR SAMPLE

A. The number and volume of air samples taken by the OWNER'S REPRESENTATIVE will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical method used.

B. Samples will be collected on 25 mm cassettes with 50 mm extension cowls.

1. PCM: 0.8 micrometer mixed cellulose ester.
2. TEM: 0.45 micrometer polycarbonate.

1.7 BACKGROUND SAMPLES

A. The OWNER'S REPRESENTATIVE may collect air samples to establish a baseline prior to the start of WORK:

1.

Location	Number	Method	Rate (L/M)	Minimum Volume (L)
Each Work Area	1	PCM	1-3	200

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1.8 PROJECT SAMPLES

A. The OWNER'S REPRESENTATIVE may collect the following project samples on a daily basis during the WORK:

1.

Location	Number	Method	Rate (L/M)	Minimum Volume (L)
Each Work Area	1	PCM	1-3	200
Outside Each Work Area	2	PCM	1-3	200
Clean Room	1	PCM	1-3	200
Negative Air Exhaust	1	PCM	1-3	200

B. The OWNER'S REPRESENTATIVE may collect additional samples as needed.

1.9 LABORATORY TESTING

A. The services of a testing laboratory will be employed by the OWNER to perform laboratory analysis of the air samples. A technician will be at the job site, and samples will be sent daily so that verbal reports on air samples can be obtained within 24 hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ADDITIONAL TESTING

A. The CONTRACTOR may conduct his own air monitoring and laboratory testing. If he elects to do this, the cost of such air monitoring and laboratory testing shall be included in the Contract Sum.

3.2 PERSONAL MONITORING

A. The CONTRACTOR shall perform air monitoring as required to meet OSHA Requirements for maintenance of Time Weighted Average (TWA) fiber counts for types of respiratory protection provided. OWNER'S REPRESENTATIVE will not be performing air monitoring to meet these OSHA requirements.

END OF SECTION 02 09 03

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SECTION 02 09 04 – DIFFERENTIAL PRESSURE AND AIR CIRCULATION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Establishing, operating and maintaining a differential pressure ventilation system.

1.2 SUBMITTALS

A. Number of HEPA filtered fan units required and the calculations necessary to determine the number of machines.

B. Description of projected air flow within work area and methods required to provide adequate air flow in all portions of the WORK AREA.

C. Manufacturer’s product data on the HEPA filtered fan units to be used.

D. Location of the machines in the work space.

E. Method of supplying adequate power to the machines and designation of building electrical panel(s) which will be supplying the power

F. Description of work practices to ensure that airborne fibers travel downstream from workers.

1.3 QUALITY ASSURANCE

A. Monitor pressure differential across Decontamination Unit with a differential pressure meter equipped with a strip chart recorder.

B. Meter shall be equipped with a warning buzzer which will sound if pressure differential drops below 0.02" of water.

PART 2 - PRODUCTS

2.1 HEPA FILTERED FAN UNITS

A. Cabinet shall be factory sealed to prevent asbestos-containing dust from being released during use, transport, or maintenance. Access to and replacement of all air filters shall be from intake end.

B. Rate capacity of fan according to usable air-moving capacity under actual operating conditions.

C. The final filter shall be the HEPA type. The filter media (folded into closely pleated panels) must be completely sealed on all edges with a structurally rigid frame.

D. A continuous rubber gasket shall be located between the filter and the filter housing to form a tight seal.

E. Testing shall be in accordance with Military Standard Number 282 and Army Instruction Manual 136-300-175A.

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F. Each filter shall bear a UL586 label to indicate ability to perform under specified conditions.

G. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.

H. Two stages of pre-filters, which protect the final filter by removing the larger particles, are required to prolong the operating life of the HEPA filter.

I. Each unit shall be equipped with a Magnahelic gauge or manometer to measure the pressure drop across filters and indicate when filters have become loaded and need to be changed. A table indicating the usable air-handling capacity for various static pressure readings on the Magnahelic gauge shall be affixed near the gauge for reference, or the Magnahelic reading indicating at what point the filters should be changed, noting Cubic Feet per Minute (CFM) air delivery at that point.

J. Provide units equipped with an elapsed time meter to show the total accumulated hours of operation.

K. The unit shall have an electrical (or mechanical) lockout to prevent fan from operating without a HEPA filter. Units shall be equipped with automatic shutdown system to stop fan in the event of a major rupture in the HEPA filter or blocked air discharge.

L. Warning lights are required to indicate normal operation, too high a pressure drop across the filters (i.e., filter overloading), and too low of a pressure drop (i.e., major rupture in HEPA filter or obstructed discharge.

M. Electrical components shall be approved by the National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL).

N. Each unit shall be equipped with overload protection sized for the equipment. The motor, fan, fan housing, and cabinet shall be grounded.

2.2 ACCEPTABLE MANUFACTURERS

A. Aerospace America, Inc. “Aero-Clean 2000”
900 Truman Parkway
P.O. Box 189
Bay City, Michigan 48707

B. Asbestos Control Technology, Inc. “Micro-Trap”
P.O. Boc 183
Maple Shade, NJ 08052

C. Control Resource Systems, Inc. “Hog 2000”
670 Mariner Drive
Michigan City, Indiana 46360

D. Global Consumer Services, Inc. “Red Baron”
1721 N. Highland Avenue
Los Angeles, CA 90028

E. Trim-Dim Filter Corporation “ACCU-2M”
1431 Wast Lake Street
Chicago, Illinois 60607

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PART 3 - EXECUTION

3.1 PRESSURE DIFFERENTIAL

A. Provide a fully operational differential pressure and air circulation system within the WORK AREA maintaining continuously a pressure differential across WORK AREA enclosures.

B. Demonstrate to the OWNER'S REPRESENTATIVE the pressure differential by use of a pressure differential meter or a manometer, before disturbance of any asbestos containing materials.

C. Continuously monitor and record the pressure differential between the WORK AREA and the building outside of the WORK AREA with a monitoring device incorporating a strip chart recorder.

3.2 PREPARATION OF THE WORK AREA

A. Provide fully operational HEPA filtered fan units supplying a minimum of one air change every 15 minutes.

B. Add one (1) additional unit as a backup in case of equipment failure or machine shutdown for filter changing.

C. Locate exhaust unit(s) so that makeup air enters WORK AREA primarily through decontamination facilities and traverses WORK AREA as much as possible.

D. Place end of unit or its exhaust duct through an opening in the plastic barrier or wall covering. The plastic around the unit or duct shall then be sealed with tape.

E. Vent to outside of building, unless authorized in writing by the OWNER'S REPRESENTATIVE.

F. Provide supplemental inlets where required for proper air flow through the work space in location approved by the OWNER'S REPRESENTATIVE by making openings in the plastic sheeting that allow air from outside the building into the WORK AREA.

G. Locate auxiliary makeup air inlets as far as possible from the exhaust unit(s), off the floor (preferably near the ceiling), and away from barriers that separate the WORK AREA from occupied clean areas.

H. Cover with flaps to reseal automatically if the negative pressure system should shut down for any reason. Spray flap and around opening with spray adhesive so that flap seals if it closes.

3.3 START UP THE PRESSURE DIFFERENTIAL AND AIR CIRCULATING SYSTEM

A. Each unit shall be serviced by a dedicated circuit with overload device tied into an existing building electrical panel which has sufficient spare capacity to accommodate the load of all negative pressure units connected.

B. Before any asbestos-containing material is wetted or removed, and after the WORK AREA has been prepared, the decontamination facility set up, and the HEPA filtered fan unit(s) installed, start the unit(s) (one at a time) to demonstrate the system

C. Proper operation of the system will exhibit the following:

1. Plastic barriers and sheeting move slightly in toward WORK AREA.
2. Curtain of decontamination units move slightly in toward WORK AREA
3. There is a noticeable movement of air through the decontamination unit
4. Use smoke tubes to demonstrate a positive motion of air.

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5. Use a differential pressure meter or manometer to demonstrate a pressure difference of at least 0.02 inches of water across every barrier separating the WORK AREA from the balance of the building or outside.

D. Modify the system as necessary to successfully demonstrate the above.

3.4 USE OF SYSTEM DURING ABATEMENT OPERATIONS

A. Start HEPA filtered fan units before beginning work.

B. After abatement work has begun, run units continuously to maintain a constant negative pressure until decontamination of the WORK AREA is complete.

C. Do not turn off units at the end of the work shift or when abatement operations temporarily stop.

D. Do not shut down system during encapsulating procedures, unless authorized by the OWNER'S REPRESENTATIVE in writing.

E. Start abatement work at a location farthest from the exhaust units and proceed toward them.

F. If an electric power failure occurs, immediately stop all abatement work and do not resume until power is restored and exhaust units are operating again.

G. At completion of abatement work, allow exhaust units to run as specified, to remove airborne fibers that may have been generated during abatement work and cleanup and to purge the WORK AREA with clean makeup air.

3.5 DISMANTLING THE SYSTEM

A. When a final inspection and the results of final air tests indicate that the area has met the WORK AREA clearance criteria of Section 020915, the exhaust units may be removed from the WORK AREA.

B. Before removal from the WORK AREA, remove and properly dispose of pre-filter, and seal intake to the machine with 6 mil polyethylene to prevent environmental contamination from the filters. The machine shall be cleaned and wrapped with 6 mil polyethylene prior to removing from the WORK AREA.

END OF SECTION 02 09 04

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SECTION 02 09 05 – TEMPORARY ENCLOSURES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Contingency Plans.

B. Strippable Coatings: Product data, MSDS.

C. Spray Cement: Product data, MSDS.

D. Sheet Plastic: Product data, MSDS.

E. Signs: Samples.

PART 2 - PRODUCTS

2.1 POLYETHYLENE SHEET

A. A single polyethylene film in the largest sheet size possible to minimize seams, 6.0 mils thick, clear, frosted, or black as indicated.

B. Provide flame resistant polyethylene film for all work to be done where hot pipes or equipment are present or where there is a potential for fire, that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-Resistant Textiles and Films.

2.2 SPRAY PLASTIC

A. Spray plastic which is formulated to adhere to surfaces and peel off cleanly at the completion of the WORK may be used if approved.

B. Damages to finish caused by application or removal of the spray plastic must be repaired and refinished to the satisfaction of the OWNER at no additional cost to the OWNER.

2.3 DUCT TAPE

A. Provide duct tape in 2" or 3" widths as required, with an adhesive which is formulated to tenaciously stick to sheet polyethylene.

B. Damages to finish caused by application or removal of the spray plastic must be repaired and refinished to the satisfaction of the OWNER at no additional cost to the OWNER.

2.4 SPRAY CEMENT

A. Provide spray adhesive which is specifically formulated to stick tenaciously to sheet polyethylene.

B. Damages to finish caused by application or removal of the spray plastic must be repaired and refinished to the satisfaction of the OWNER at no additional cost to the OWNER.

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PART 3 - EXECUTION

3.1 GENERAL

A. A "WORK AREA" is considered contaminated during the WORK and must be isolated from the balance of the building and decontaminated at the completion of the asbestos-control work.

B. Completely isolate the WORK AREA from other parts of the building so as to prevent asbestos-containing dust or debris from passing beyond the isolated area.

C. Should the area beyond the WORK AREA(s) become contaminated with asbestos- containing dust or debris as a consequence of the WORK, those areas shall be isolated and cleaned in accordance with the procedures indicated for WORK AREAS at no additional cost to OWNER.

D. Place all tools, scaffolding, staging, etc. necessary for the WORK in the area to be isolated prior to erection of the plastic sheeting temporary enclosures.

E. Remove all removable furniture, equipment and supplies that are designated as non- contaminated.

F. Clean all immovable or attached furniture, equipment and fixtures and completely cover with two (2) layers of polyethylene sheeting, at least 6 mil in thickness, securely taped in place with duct tape. Such furniture and equipment shall be considered outside the WORK AREA unless covering plastic or seal is breeched.

G. Disable Ventilating Systems or any other system bringing air into or out of the WORK AREA.

H. Lockout power to WORK AREA by switching off all breakers serving power or lighting circuits in WORK AREA.

I. Lockout power to circuits running through WORK AREA wherever possible by switching off all breakers or removing fuses serving these circuits.

J. Install inspection windows in locations shown on the plans or as directed by the OWNER'S REPRESENTATIVE. Each inspection window is to have a 24" x 24" viewing area fabricated from 1/4" acrylic or polycarbonate sheet.

3.2 EMERGENCY EXIT

A. Arrange exit door so that it is secure from outside the WORK AREA but permits egress from the WORK AREA.

B. Mark outline of door on primary and critical barriers with luminescent paint at least 1" wide. Hang a razor knife on a string beside outline. Paint words "EMERGENCY EXIT" inside outline with luminescent paint in letters at least one foot high and 2" wide.

C. Utilize existing emergency lighting signs.

3.3 CONTROL ACCESS

A. Isolate the WORK AREA to prevent entry by building occupants into WORK AREA or surrounding controlled areas.

B. Submit to OWNER'S REPRESENTATIVE a list of doors and other openings that must be secured to isolate WORK AREA. Include on list notation if door or opening is in an indicated exit route.

C. After receiving written authorization from the OWNER'S REPRESENTATIVE lock all doors into WORK AREA, or, if doors cannot be locked, chain shut. Cover any signs that direct emergency exiting, either outside or inside of WORK AREA, to locked doors.

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D. Do not obstruct doors required for emergency exits from WORK AREA or from building.

E. Construct partitions or closures across any opening into WORK AREA. Partitions are to be a minimum of 8 feet high.

F. Modify elevator controls to prevent elevators from stopping at doors in WORK AREA(s). This WORK is to be performed by a qualified elevator technician.

G. Replace passage sets on doors required for exiting from WORK AREA with temporary locksets for duration of the project. Use entry type locksets that are key lockable from one side and always operable from inside. After meeting release criteria set forth in Section 01714 WORK AREA Clearance reinstall original passage sets and adjust for proper operation.

H. Arrange WORK AREA so that the only access into WORK AREA is through lockable doors to personnel and equipment decontamination units. If necessary, install temporary doors with entrance type locksets that are key lockable from the outside and always unlocked and operable from the inside. Do not use dead bolts or padlocks.

I. Where the WORK AREA is immediately adjacent to or within view of occupied areas, provide a visual barrier of opaque polyethylene sheeting at least 6 mil in thickness so that the work procedures are not visible to building occupants. The visual barrier is in addition to critical primary and secondary barriers. Where this visual barrier would block natural light, substitute frosted or woven rip-stop sheet plastic in locations approved by the OWNER'S REPRESENTATIVE.

J. Provide Warning Signs at each locked door leading to WORK AREA reading as follows:

KEEP OUT

CONSTRUCTION

WORK AREA

PROTECTIVE CLOTHING REQUIRED
BEYOND THIS POINT

K. Immediately inside door and outside critical barriers post an approximately 20 inch by 14 inch manufactured caution sign displaying the following legend with letter sizes and styles of a visibility required by 29 CFR 1926:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

RESPIRATORS AND PROTECTIVE CLOTHING ARE
REQUIRED IN THIS AREA

Provide spacing between respective lines at least equal height of the respective upper line.

3.4 ALTERNATE METHODS OF ENCLOSURE

A. Alternate methods of containing the WORK AREA may be substituted to the OWNER'S REPRESENTATIVE for approval in accordance with procedures set forth in Section 020912 Materials and Equipment - Asbestos Abatement.

B. Do not proceed with any such method(s) without prior written approval of the OWNER'S REPRESENTATIVE.

C. Use of strippable coatings must be submitted in accordance with this Section.

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3.5 RESPIRATORY AND WORKER PROTECTION

A. Before proceeding beyond this point in providing Temporary Enclosures:

1. Provide Worker Protection per Specification Section 02 09 08.
2. Provide Respiratory Protection per Specification Section 02 09 10.
3. Provide Decontamination Units per Specification Section 02 09 11.

3.6 CRITICAL BARRIERS

A. Completely separate the WORK AREA from other portions of the building, and the outside by closing all openings with two separate sheet plastic barriers each at least 6 mil in thickness.

B. Sealing cracks leading out of WORK AREA with duct tape.

C. Individually seal all ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, convectors and speakers, and other openings into the WORK AREA with polyethylene sheeting at least 6 mil in thickness, taped securely in place with duct tape.

D. Maintain seal until all work including Project Decontamination is completed.

E. Take care in sealing of lighting fixtures to avoid melting or burning of sheeting.

F. Provide sheet plastic barriers at least 6 mil in thickness as required to seal openings completely from the WORK AREA into adjacent areas. Seal the perimeter of all sheet plastic barriers with duct tape or spray cement.

G. Mechanically support sheet plastic independently of duct tape or spray cement seals so that seals do not support the weight of the plastic, if the tape/glue comes loose.

H. Provide pressure differential and air circulation system per Specification Section 02 09 04.

I. Clean housings and ducts of all overspray materials prior to erection of a Critical Barrier that will restrict access.

3.7 PREPARE AREA

A. If fixed scaffolding is to be used to provide access HEPA vacuum and wet clean area prior to scaffolding installation.

B. Remove all electrical and mechanical items, such as lighting fixtures, clocks, diffusers, registers, escutcheon plates, etc. which cover any part of the surface to be worked on with the WORK.

C. Remove all general construction items such as cabinets, casework, door and window trim, moldings, ceilings, trim, etc., which cover the surface of the WORK as required to prevent interference with the WORK.

D. Clean, decontaminate and reinstall all such materials, upon completion of all removal work with materials, finishes, and workmanship to match existing installations before start of work.

E. Clean all contaminated furniture, equipment and or supplies with a HEPA filtered vacuum cleaner or by wet cleaning, as specified in Section 020914 Cleaning and Decontamination Procedures, prior to being moved or covered.

F. All equipment furniture, etc. is to be deemed contaminated unless specifically declared as uncontaminated on the drawings or in writing by the OWNER'S REPRESENTATIVE.

G. Clean all surfaces in WORK AREA with a HEPA filtered vacuum or by wet wiping prior to the installation of primary barrier.

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3.8 PRIMARY BARRIER

A. Protect building and other surfaces in the WORK AREA from damage from water and high humidity or from contamination from asbestos-containing debris, slurry or high airborne fiber levels by covering with a primary barrier as described below:

1. Cover shelving, clocks, light fixtures and other equipment with one (1) layer of 6 mil sheet plastic
2. Cover fabric, paper, cork wall coverings or unpainted gypsum board with one layer of 6 mil sheet plastic
3. Tape over any cracks that are larger than 1/16”.
4. Tape over electrical outlets, switches, door locks, etc
5. Cover wood paneling in WORK AREA with one layer of 6 mil sheet plastic
6. Cover carpeting with three (3) layers of polyethylene sheeting at least 6 mil in thickness. Place corrugated cardboard sheets between the top and middle layers of polyethylene
7. Cover windows with one (1) layer of 6 mil sheet plastic
8. If requested by the OWNER'S REPRESENTATIVE, cover windows with one (1) layer of black 6 mil plastic.

B. Cover floor of WORK AREA with two (2) individual layers of clear polyethylene sheeting, each at least 6 mil in thickness, turned up walls at least 12 inches. Form a sharp right angle bend at junction of floor and wall so that there is no radius which could be stepped on causing the wall attachment to be pulled loose. Both spray-glue and duct tape all seams in floor covering. Locate seams in top layer six feet from, or at right angles, to, seams in bottom layer. Install sheeting so that top layer can be removed independently of bottom layer.

C. Cover carpeting with three (3) layers of polyethylene sheeting at least 6 mil in thickness. Place corrugated cardboard sheets between the top and middle layers of polyethylene.

D. Cover sheet plastic in areas where scaffolding is to be used with a single layer of 1/2" COX plywood or 1/4" tempered hardboard. Wrap edges and corners of each sheet with duct tape. At completion of abatement work wrap plywood or hardboard with two (2) layers of 6 mil polyethylene and move to next WORK AREA or dispose of as an asbestos-contaminated waste material.

E. Cover all walls in WORK AREA including "Critical Barrier" sheet plastic barriers with one layer of polyethylene sheeting, at least 6 mil in thickness, mechanically supported and sealed with duct tape or spray-glue in the same manner as "Critical Barrier" plastic barriers. Tape all joints including the joining with the floor covering with duct tape.

F. Cover walls, floor and ceiling of elevator with two (2) layers of 6 mil polyethylene. Arrange entry to WORK AREA so that elevator door is in positively pressurized space outside the clean room of the decontamination unit.

G. Do not cover stairs or ramps with unsecured sheet plastic, where stairs or ramps are covered with plastic, provide 3/4" exterior grade plywood treads securely held in place, over plastic. Do not cover rungs or rails with any type of protective materials.

H. Remove and replace plastic sheeting which has been damaged by removal operations or where seal has failed allowing water to seep between layers. Remove affected sheeting and wipe down entire area. Install new sheet plastic only when area is completely dry.

3.9 ISOLATION AREA

A. Maintain isolation areas between the WORK AREA and adjacent building area:

1. In locations shown on the plans.
2. In unoccupied rooms located between WORK AREA and adjacent occupied portions of the building.
3. In locations where separation between WORK AREA and occupied portions of the building is formed by sheet plastic and/or temporary barriers.
4. Floor below WORK AREA.

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5. Form isolation area by controlling access to the space in the same manner as a WORK AREA. Physically isolate the space from the WORK AREA and adjacent areas.
6. Accomplish physical location by:

    a. Installing critical barriers in unoccupied space.
    b. Erecting a second Critical Barrier a minimum of 3'-0" away from WORK AREA.

3.10 STOP WORK

A. If the critical or primary barrier falls or is breached in any manner stop work immediately. Do not start work until authorized in writing by the OWNER'S REPRESENTATIVE.

3.11 EXTENSION OF WORK AREA

A. If the Critical Barrier is breached in any manner that could allow the passage of asbestos debris or airborne fibers, then add affected area to the WORK AREA, enclose it as required by this Section of the specification and decontaminate it as described in Section 020913 Project Decontamination.

3.12 SECONDARY BARRIER

A. Secondary layer of plastic as a drop cloth to protect the primary layer from debris generated by the asbestos abatement work is specified in the appropriate work sections.

3.13 EXTERIOR ENCLOSURES

A. Construct exterior enclosures as necessary to completely enclose the WORK. Fabricate from reinforced polyethylene sheeting and 2" x 4" wood framework. Attach to existing building components or brace as necessary for lateral stability. Construct walls to meet all state and local regulations for construction of temporary buildings. Construct to resist a wind, slope ceiling to permit drainage of rain water. Exterior enclosures shall be completely separate from other required barriers or protective layers.

END OF SECTION 02 09 05

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SECTION 02 09 06 – REGULATED AREAS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation of Regulated Area for work.

1.2 SUBMITTALS

A. HEPA Filtered Vacuum Cleaners: Submit product data.

B. Signs: Submit samples of each type of sign to be used.

C. Warning Tape: Submit samples.

PART 2 - EQUIPMENT

2.1 HEPA FILTERED VACUUM CLEANERS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the WORK include, but are not limited to, the following:

1.	Nilfisk of America Inc. 225 Great Valley Parkway Malvern, PA 19355	HEPA Filtered Vacuums
2.	Clayton Associates, Inc. P.O. Box 589 30 Southard Avenue Farmingdale, NJ 07727	ACE Model HEPA Vacuum
3.	Hako Minuteman 111 South Route 53 Addison, IL 60101	Hako Minuteman HEPA Vacuums
4.	Vactagon Pneumatic Systems, Inc. 18 Homestead Place Bergenfield, NJ 07621	Vaculoader HEPA Vacuum
5.	Pullman-Hold (White) Corporation P.O. Box 277 Fultonville, NY 12072	HEPA Filtered Vacuums

2.2 PLASTIC SHEET

A. A single polyethylene film in the largest sheet size possible to minimize seams, 6.0 mil thick as indicated, clear, frosted, or black as indicated.

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PART 3 - EXECUTION

3.1 SECURING WORK AREA

A. Secure WORK AREA from access by occupants, staff or users of the building. Accomplish this where possible, by locking doors, windows, or other means of access to the area, or by constructing temporary wood stud and plywood barriers.

3.2 DEMARCATION OF REGULATED AREA

A. Demarcate each Regulated Area with a sheet plastic drop sheet as described below

B. Post warning signs in both English and Spanish that carry the following legends:

1. First Sign:

a. Provide warning signs at each locked door leading to the controlled area reading as follows:

1) Legend	Notation
KEEP OUT	3-inch Block

2. Second Sign:

a. Immediately inside the locked door and outside the controlled area post an approximately 20 inch by 14 inch manufactured caution sign displaying the following legend with letter sizes and styles of a visibility required by 29 CFR 1926:

1) Legend:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

C. Where the controlled area is in a large area such as on part of a boiler room or open office area, delineate area with 3 inch wide polyethylene ribbon with the printed warning, "CAUTION ASBESTOS REMOVAL". Install this ribbon at between 3 and 4 feet above the floor.

3.3 SCHEDULING

A. Work may be carried out during normal working hours in those areas which can be completely secured by lockable doors from access by building occupants and staff, and which have HVAC equipment that can be shut down and locked off.

B. Otherwise, work is to be carried out after building occupants and cleaning staff have left.

3.4 GENERAL PROCEDURES

A. Setup and management of the controlled area is to be under the supervision of an OSHA Competent Person as defined in CFR 1926.1101 Asbestos Construction Standard.

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B. Before start of work comply with requirement for worker protection in Section 020908, and respiratory protection in Specification Section 02 09 10.

C. Do not allow eating, drinking, smoking, chewing tobacco or gum, or apply cosmetics in the Regulated Area.

D. Shut down any air handling equipment bringing air into or out of the Regulated Area.

E. Clean any existing dust or debris from the floor and walls, and other surface in the immediate location of the WORK prior to commencing work by damp-mopping or by use of a High Efficiency Particulate Air (HEPA) filtered vacuum.

F. Cover floor in vicinity of WORK AREA and six (6) feet beyond, with 6 mil polyethylene drop sheet. Where WORK is adjacent to wall, extend drop sheet up wall and secure at ceiling with duct tape. This drop sheet demarcates the boundary of the Regulated Area.

G. Seal all openings, supply and exhaust vents, and convectors within ten (10) feet of the WORK AREA with 6 mil polyethylene sheeting secured and completely sealed with duct tape.

H. Perform the WORK per the appropriate specification section while on plastic drop sheet.

I. Immediately remove any asbestos-containing debris which collects on the drop sheet either by using a HEPA vacuum or by spraying with amended water or removal encapsulant, collecting with wet paper towels, placing in a disposal bag while still wet, and cleaning surface of plastic sheet with wet paper towels.

J. Complete the following at completion of work in an area before stepping off drop sheet:

1. While standing on plastic sheet thoroughly HEPA vacuum ladder and any tools used and pass to worker standing off sheet.
2. Worker standing off the sheet HEPA vacuum thoroughly the worker standing on the sheet.
3. Worker on the sheet thoroughly HEPA vacuum all surfaces of the plastic sheet, bags, and any other items on the sheet including his own feet.

K. If moving to the next WORK AREA in the same secure area: Worker on the drop sheet is to don clean foot covers, placing each foot, in turn, off the sheet as the foot cover is put on. Remove clean foot covers at the next WORK AREA while standing on the sheet. Dispose of the used foot covers along with the plastic sheet at completion of work in that area. Do not reuse foot covers to move off the sheet.

L. If work day is complete or if next WORK AREA is in another secured area: all workers remove paper suits turning them inside out while doing so. The person on the sheet step with each foot off the sheet as the foot covers are removed.

M. Fold sheet and all its contents toward the center.

N. Place the sheet in a properly labeled disposal bag.

O. Neck down the bag and collapse it with the HEPA vacuum.

P. Twist the bag shut, bend over and seal with duct tape by wrapping around bag neck at least 3 times.

Q. Clean all surfaces of the WORK AREA by use of a HEPA filter vacuum until no visible residue remains.

END OF SECTION 02 09 06

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SECTION 02 09 07 – ENTRY INTO CONTROLLED AREAS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Entry into the space above a suspended ceiling where there is exposed friable asbestos- containing fireproofing, visible asbestos-containing debris, or other friable asbestos- containing surfacing material when the ceiling tiles in an area no greater than 6 feet by 12 feet are to be removed.

B. Entry through sealed access (access door, hatchway, locked door) into an area with friable asbestos-containing surfacing materials or visible debris.

C. Use procedures of this section only where historic airborne fiber data demonstrate that airborne fiber counts in the breathing zone of those performing the WORK can be continuously maintained at less than 0.1 fibers per cubic centimeters and airborne fiber counts in the WORK AREA can be continuously maintained at less than 0.01 fibers per cubic centimeter.

1.2 SUBMITTALS

A. Evidence of the ability to perform work of this section while maintaining an airborne fiber count below 0.1 fibers per cubic centimeter in the breathing zone of the individual performing the WORK.

B. Evidence of the ability to perform work of this section while maintaining an airborne fiber count below 0.01 fibers per cubic centimeter in the WORK AREA.

C. Include the following data for each procedure required by the WORK:

1. Date of measurements.
2. Operations monitored.
3. Sampling and analytical methods used and evidence of their accuracy.
4. Number duration, and results of samples taken.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REGULATED AREA

A. Prior to beginning work in this area establish a Regulated Area as described in Section 020906 Regulated Areas.

3.2 ACCESS THROUGH SUSPENDED CEILINGS

A. Follow worker protection procedures including disposable coveralls and respirators required by Section 020908, and Specification Section 020910.

B. Follow local area protection procedures of Section 020906. Spread layer of 6 mil polyethylene sheet on floor 6 feet further in extent than the size of the ceiling opening.

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C. HEPA vacuum around edges of all panels to be removed.

D. While holding nozzle of HEPA vacuum in vicinity slowly lift one edge of center ceiling panel. Immediately HEPA vacuum space at lifted edge. Lift entire panel straight up and HEPA vacuum all four sides.

E. Place panel on top of adjacent ceiling.

F. Place intake duct to HEPA Filtered Fan Unit per Section 020904 in space above ceiling and fasten in place. Operate machine continuously while ceiling is open.

G. Climb to a position which permits access to the top of the ceiling adjacent to the removed panel.

H. Working in the space above the ceiling, HEPA vacuum both sides of the ceiling panel first removed and hand it down into a 6 mil polyethylene bag for storage.

I. Remove loose material hanging from the friable asbestos-containing material with the suction from the HEPA vacuum.

J. Pass wand of operating HEPA vacuum through air between asbestos-containing material and top of ceiling.

K. HEPA vacuum the tops of all ceiling panels which are in reach.

L. Carefully HEPA vacuum the crack between the suspension system and ceiling panels from the top for all ceiling panels within reach.

M. Remove ceiling panels as required while constantly HEPA vacuuming all four edges of panel and suspension system.

N. Working in space above ceiling HEPA vacuum both sides on each panel removed and hand each down into a 6 mil polyethylene bag which is labeled as set forth is Specification Section 02 09 18.

O. Maintain HEPA vacuum in operation with nozzle above ceiling and exhaust at floor for the entire time that the ceiling is open and work is being done above the ceiling.

P. When above-ceiling work is complete replace ceiling panels.

Q. HEPA vacuum worker's head, arm, and shoulders before climbing down from ceiling.

R. HEPA vacuum ladder while climbing down.

S. While standing on plastic sheet thoroughly HEPA vacuum ladder and pass it to person standing off sheet.

3.3 ENTRY INTO CONTROLLED AREAS

A. Use same procedure as above except that ceiling tiles do not need to be removed.

B. If access is through a wall hatch or door, duct tape floor sheet to wall or threshold.

C. If access is into large area such as crawl tunnel, comply with worker protection requirements but use HEPA vacuum only for work procedures in the area.

3.4 PERSONNEL DECONTAMINATION

A. At the end all work change to a clean disposable coverall and leaving respirator in place proceed to a remote shower and decontaminate as required by Section 020908 Worker Protection - Asbestos Abatement.

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END OF SECTION 02 09 07

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SECTION 02 09 08 – WORKER PROTECTION – ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes the equipment and procedures required for protecting workers against asbestos contamination and other workplace hazards except for respiratory protection.

1.2 WORKER TRAINING

A. Train all workers in accordance with 29 CFR 1926 in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures.

B. AHERA accredited or equivalent Abatement Workers as required by the AHERA regulation 40 CFR 763 Appendix C to Subpart E, April, 30, 1987.

C. State and local certification as required by regulations.

1.3 MEDICAL EXAMINATIONS

A. Provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8 hour time weighted average.

B. In the absence of specific airborne filter data provide medical examination for all workers who will enter the WORK AREA for any reason.

C. Examination shall as a minimum meet OSHA requirements as set forth in 29 CFR 1926.

D. In addition, provide an evaluation of the individuals ability to work in environments capable of producing heat stress in the worker.

1.4 SUBMITTALS

A. Submit a course outline of the worker training course. Include date and time course was given, name and title of teacher, attendance sheet listing all attendees of the course.

B. Report from Medical Examination conducted within last 12 months as part of compliance with OSHA medical surveillance requirements for each worker who is to enter the WORK AREA.

C. Submit notarized certification signed by an officer of the abatement contracting firm and notarized that exposure measurements, medical surveillance, and worker training records are being kept in conformance with 29 CFR 1926.

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PART 2 - EQUIPMENT

2.1 PROTECTIVE CLOTHING

A. Provide disposable full-body coveralls and disposable head covers, and require that they be worn by all workers in the WORK AREA.

B. Provide work boots with non-skid soles, and where required by OSHA, foot protection for all workers. Dispose of boots as asbestos contaminated waste at the end of the work. Disposable foot covers may be provided in lieu of disposing of work shoes where permitted by site conditions.

C. Provide head protection (hard hats) as required by OSHA for all workers, and provide spares for use by others. Label hats with same warning labels as used on disposal bags. Thoroughly clean, decontaminate and bag hats before removing them from WORK AREA at the end of the WORK.

D. Provide eye protection (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury.

E. Provide work gloves to all workers and require that they be worn at all times in the WORK AREA. Do not remove gloves from WORK AREA. Dispose of as asbestos contaminated waste at the end of the WORK.

2.2 ADDITONAL PROTECTIVE EQUIPMENT

A. Respirators, disposable coveralls, head covers, and footwear covers shall be provided by the CONTRACTOR for the OWNER, OWNER'S REPRESENTATIVE, and other authorized representatives who may inspect the job site.

B. Provide two (2) respirators, six (6) complete coveralls and, six (6) respirator filter changes per day.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the WORK.

B. The following procedures are minimums to be adhered to regardless of fiber count in the WORK AREA.

C. Each time WORK AREA is entered remove all street clothes in the Changing Room of the Personnel Decontamination Unit and put on new disposable coverall, new head cover, and a clean respirator.

D. Proceed through shower room to equipment room and put on work boots.

3.2 DECONTAMINATION PROCEDURES

A. Require all workers to adhere to the following applicable personal decontamination procedures whenever they leave the WORK AREA as a minimum:

1. Type C Supplied Air or Powered Air-Purifying Respirators:

a. When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the equipment room, and dispose of as contaminated waste
b. Still wearing respirators, proceed to showers. Showering is mandatory, unless noted otherwise.

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c. Thoroughly wet body including hair and face. If using a Powered Air-Purifying Respirator (PAPR) hold blower unit above head to keep canisters dry.
d. With respirator still in place thoroughly wash body, hair, respirator face piece, and all parts of the respirator except the blower unit and battery pack on a PAPR.
e. Pay particular attention to seal between face and respirator and under straps.
f. Take a deep breath, hold it and/or exhale slowly, completely wet hair, face, and respirator. While still holding breath, remove respirator and hold it away from face before starting to breath.
g. Carefully wash face-piece of respirator inside and out.
h. If using PAPR; shut down in the following sequence, first cap inlets to filter cartridges, then turn off blower unit. Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Shower as above.
i. Rinse shower room walls and floor prior to exit.
j. Proceed from shower to Changing Room and change into street clothes or into new disposable work items.

2. Air Purifying-Negative Pressure Respirators:

a. When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the equipment room, and dispose of as contaminated waste.
b. Still wearing respirators, proceed to showers. Showering is mandatory, unless noted otherwise.
c. Thoroughly wet body from neck down.
d. Wet hair as thoroughly as possible without wetting the respirator filter if using an air purifying type respirator.
e. Take a deep breath, hold it and/or exhale slowly, complete wetting of hair, thoroughly wetting face, respiratory and filter (air purifying respirator). While still holding breath, remove respirator and hold it away from face before starting to breathe.
f. Dispose of wet filters from air purifying respirator.
g. Carefully wash face-piece of respirator inside and out. Shower completely with soap and water.
h. Rinse thoroughly.
i. Rinse shower room walls and floor prior to exit.
j. Proceed from shower to Changing Room and change into street clothes or into new disposable work items.

3.3 WITHIN WORK AREA

A. Require that workers NOT eat, drink, smoke, chew gum or tobacco in the WORK AREA. To eat, chew, drink or smoke, workers shall following the procedure described above, then dress in street clothes before entering the non-work areas of the building.

END OF SECTION 02 09 08

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CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT

PROJECT NAME _____DATE _____

PROJECT ADDRESS _____

CONTRACTOR'S NAME _____

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's CONTRACT with the OWNER for the above project requires that: You be supplied with the proper respirator and be trained in its use. You be trained in safe work practices and in the use of the equipment found on the job. You receive a medical examination. These things are to have been done at no cost to you. By signing this certification you are assuring the OWNER that your employer has met these obligations to you.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators, and informed of the type respirator to be used on the above referenced project. I have a copy of the written respiratory protection manual issued by my employer. I have been equipped at no cost with the respirator to be used on the above project.

TRAINING COURSE: I have been trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. The topics covered in the course included the following:

Physical characteristics of asbestos
Health hazards associated with asbestos
Respiratory protection
Use of protective equipment
Negative air systems
Work practices including hands on or on-job training
Personal decontamination procedures
Air monitoring, personal and area

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray.

Signature _____

Printed Name_____

Social Security Number _____ _

Witness _____

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SECTION 02 09 09 – WORKER PROTECTION – REPAIR AND MAINTENANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment and procedures for protecting workers against asbestos contamination and other workplace hazards.

B. This section applies only where the airborne fiber counts as measured in accordance with 29 CFR 1926 are below 0.1 fibers per cubic centimeter for an 8 hour Time Weighted Average (TWA).

1.2 WORKER TRAINING

A. Workers are to be accredited as Abatement Workers as required by the AHERA regulation 40 CFR 763 Appendix C to Subpart E, April 30, 1987 or equivalent.

B. Workers are to be trained, certified and accredited as required by state or local code or regulation.

C. Workers are to be trained in accordance with 29 CFR 1926 in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures.

D. Workers are to be trained in the purpose, proper use, fitting, instructions, and limitations of respirators as required by 29 CFR 1910.134.

1.3 MEDICAL EXAMINATIONS

A. Provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8 hour Time Weighted Average.

B. In the absence of specific airborne fiber data provide medical examination for all workers who will enter the WORK AREA for any reason.

C. Examination shall as a minimum meet OSHA requirements as set forth in 29 CFR 1926.

D. In addition, provide an evaluation of the individuals ability to work in environments capable of producing heat stress in the worker.

1.4 SUBMITTALS

A. Copies of certificates from an EPA-approved AHERA Abatement Workers Course for each worker as evidence that each asbestos abatement worker is accredited as required by the AHERA Regulation 40 CFR 763 Appendix C to Subpart E, April 30, 1987.

B. Evidence that all workers have been trained, certified and accredited as required by state or local code or regulation.

C. Airborne asbestos fiber count data from an independent air monitoring firm to verify that work procedures will result in an airborne fiber level as measured in accordance with 29 CFR 1926 below 0.1 fibers per cubic centimeter as an 8 hour Time Weighted Average (TWA).

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D. A course outline of the worker training course. Include date and time course was given, name and title of teacher, attendance sheet listing all attendees of the course.

E. Report from Medical Examination conducted within last 12 months as part of compliance with OSHA medical surveillance requirements for each worker who is to enter the WORK AREA.

F. Certification signed by an officer of the abatement contracting firm and notarized that exposure measurements, medical surveillance, and worker training records are being kept in conformance with 29 CFR 1926.

PART 2 - EQUIPMENT

2.1 PREOTECTIVE CLOTHING

A. Disposable full-body coveralls and disposable head covers, and required that they be worn by all workers in the WORK AREA.

B. Insulated jacket, pants, gloves, and hat. Require that cold weather gear be removed in Equipment Room of Personnel Decontamination Unit. Dispose of cold weather gear as asbestos waste at completion of all work.

C. Disposable latex boot covers with non-skid soles, and where required, OSHA approved foot protectives, for all workers. Boot covers shall not be worn out of the WORK AREA or off the sheet plastic drop layer for any reason. Boot covers may be decontaminated, bagged and carried from one WORK AREA to another.

D. Head protectives (hard hats) as required by OSHA for all workers. Label hats with same warning labels as used on disposal bags. Require hard hats to be worn at all times that work is in progress that may potentially cause head injury.

E. Eye protectives (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury.

F. Work gloves to all workers and require that they be worn at all times in the WORK AREA.

PART 3 - EXECUTION

3.1 GENERAL

A. Work and Decontamination procedures involve a minimum of one person in the WORK AREA on the plastic sheet and one off the sheet.

B. The person on the sheet carries out the WORK and never leaves the sheet until the WORK is complete and dry decontamination procedures are completed.

C. The person off the sheet supplies materials to and accepts material from the on-sheet person.

D. Off sheet person never enters the WORK AREA.

E. Do not eat, drink, smoke, chew gum or tobacco, or apply cosmetics in the WORK AREA. To eat, drink, chew, or smoke, workers shall follow the procedures described below and leave the WORK AREA.

F. Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the WORK.

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3.2 AIR MONITORING

A. Collect a personal air sample on the on-sheet person at 2 liters per minute for the entire time that work is being carried out.

B. Collect one area sample of 1,200 liters in each secure area at completion of the work at a pumping rate of 10-12 liters per minute. Transmit samples to testing laboratory for analysis.

3.3 RESPIRATORS

A. Instruct and train each worker in proper respirator use and require that each worker always wear a respirator, properly fitted on the face, in the WORK AREA.

3.4 COVERALLS

A. Put on new disposable coveralls, new head covers, new footwear covers over street clothes, and put on a clean respirator.

B. Wear disposable, full-body coveralls and disposable head and footwear covers in the WORK AREA.

3.5 ADDITIONAL PROTECTIVE EQUIPMENT

A. At the work site maintain 2 complete sets of protective equipment including respirators, disposable coveralls, head covers, and footwear covers for use by the OWNER'S REPRESENTATIVE or the OWNER.

3.6 DECONTAMINATION PROCEDURES

A. Each person HEPA vacuum thoroughly the other person. Use brush attachment on the HEPA vacuum.

B. While still wearing respirator each person remove their paper suit, turning it inside out while removing it. Roll up suit and pack in hood.

C. Place suits in a disposal bag.

D. Evacuate air from the bag with HEPA vacuum.

E. Twist the bag shut, bend over and seal with duct tape by wrapping around bag neck at least 3 times.

F. Each person HEPA vacuum area of respirator seal to face on the other person.

G. Remove respirator and, HEPA vacuum face at respirator seal and all surfaces of the respirator. HEPA vacuum any parts of hair or head covered by respiratory straps.

H. If using PAPR: shut down in the following sequence, first cap inlets to filter cartridges, then turn off blower unit (this sequence will help keep debris which has collected on the inlet side of filter from dislodging and contaminating the outside of the unit). Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Be extremely cautious of getting water in battery pack as this will short out and destroy battery.

I. Wash respirator face-piece inside and outside.

J. At completion of above, thoroughly wash face and hands with soap and water.

END OF SECTION 02 09 09

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SECTION 02 09 10 – RESPIRATORY PROTECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Use respiratory protection appropriate for the fiber level encountered in the work place or as required for other toxic or oxygen-deficient situations encountered.

1.2 STANDARDS

A. Where there is a conflict in requirements set forth in these regulations and standards, meet the more stringent requirement.

B. OSHA - U.S. Department of Labor Occupational Safety and Health Administration, Safety and Health Standards 29 CFR 1910, Section 1001 and Section 1910.134. 29 CFR 1926.

C. CGA - Compressed Gas Association, Inc., New York, Pamphlet G-7, "Compressed Air for Human Respiration", and Specification G-7.1 "Commodity Specification for Air".

D. CSA - Canadian Standard Association, Rexdal, Ontario, Standard Z180.1-1978, "Compressed Breathing Air".

E. ANSI - American National Standard Practices for Respiratory Protection, ANSI Z88.2-1980.

F. NIOSH - National Institute for Occupational Safety and Health.

G. MSHA - Mine Safety and Health Administration.

1.3 SUBMITTALS

A. Manufacturer's product information for each component used, including NIOSH and MSHA Certifications for each component in an assembly and/or for entire assembly.

B. When a Type "C" supplied air respiratory system is required by the work, submit drawing showing assembly of components into a complete supplied air respiratory system. Include diagram showing location of compressor, filter banks, backup air supply tanks, hose line connections in work area(s), routing of air lines to work area(s) from compressor.

C. Level of respiratory protection intended for each operation required by the Project.

D. Airborne asbestos fiber count data from an independent air monitoring firm to substantiate selection of respiratory protection proposed.

1.4 AIR QUALITY FOR SUPPLIED AIR RESPIRATORY SYSTEMS

A. Provide air used for breathing in Type "C" supplied air respiratory systems that meets or exceeds standards set for C.G.A. type 1 (Gaseous Air) Grade D.

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PART 2 - EQUIPMENT

2.1 AIR PURIFYING RESPIRATORS

A. Half face or full face type respirators.

B. Equip full face respirators with a nose cup or other anti-fogging device.

C. HEPA type filters labeled with NIOSH and MSHA Certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980).

D. A chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH/MSHA Certification.

2.2 SUPPLIED AIR RESPIRATOR SYSTEMS

A. Provide equipment capable of producing air of the quality and volume required by the above reference standards applied to the job site conditions and crew size.

B. Full face piece and hose by same manufacturer that has been certified by NIOSH/MSHA as an approved Type "C" respirator assembly operating in pressure demand mode with a positive pressure.

C. In atmospheres which contain sufficient oxygen (greater than or equal to 19.5 oxygen) provide a pressure- demand full face piece supplied air respirator equipped with an emergency back-up HEPA filter.

D. In atmospheres which are oxygen deficient (less than 19.5 oxygen) provide a pressure- demand full face piece supplied air respirator incorporating an auxiliary self-contained breathing apparatus (SCBA) which automatically maintains an uninterrupted air supply in pressure demand mode with a positive pressure face piece.

E. Provide a reservoir of compressed air located outside the work area which will automatically maintain a continuous uninterruptable source of air automatically available to each connected face piece and hose assembly in the event of compressor shutdown, contamination of air delivered by compressor, power loss or other failure. Provide sufficient capacity in the back-up air supply to allow a minimum escape time of one-half hour times the number of connections available to the WORK AREA.

F. Provide a warning device that will operate independently of the building's power supply. Locate so that alarm is clearly audible above the noise level produced by equipment and work procedures in use, in all parts of the work area and at the compressor. Connect alarm to warn of:

1. Compressor shut down or other fault requiring use of backup air supply.
2. Carbon Monoxide (CO) levels in excess of 5 PPM/V.

G. Interconnect monitors, alarms and compressor so that compressor is automatically shut down and the alarms sounded if any of the following occur:

1. Carbon Monoxide (CO) concentrations exceed 5 PPM/V in the air line between the filter bank and backup air supply.
2. Compressor temperature exceeds normal operating range.

H. Provide a compressor driven by an electric motor. Ensure that electrical supply available at the work site is adequate to energize motor.

I. Locate compressor outside of building in location that will not impede access to the building, and that will not cause a nuisance by virtue of noise or fumes to occupied portions of the building.

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J. Locate air intake remotely from any source of automobile exhaust or any exhaust from motors, or buildings.

K. Provide an after-cooler at entry to filter system which is capable of reducing temperatures to outside ambient air temperatures.

L. Configure system to permit the recharging of 1/2 hour 2260 PSI SCBA cylinders.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with ANSI Z88.2 - 1980 "Practices for Respiratory Protection" and OSHA 29 CFR 1910 and 1926.

B. Require that respiratory protection be used at all times that there is any possibility of disturbance of asbestos-containing materials whether intentional or accidental.

C. Require that a respirator be worn by anyone in a work area at all times, regardless of activity.

3.2 FIT TESTING

A. Provide initial fitting of respiratory protection during a respiratory protection course of training set up and administered by a Certified Industrial Hygienist.

B. Fit types of respirator to be actually worn by each individual.

C. Allow an individual to use only those respirators for which he has been trained and fitted.

D. On a Weekly Basis, check the fit of each worker's respirator by having irritant smoke blown onto the respirator from a smoke tube.

E. Each time an air-purifying respirator is put on, it must be checked for fit with a positive and negative pressure fit test in accordance with the manufacturer's instructions or ANSI Z88.2 (1980).

F. All fit testing shall be done in accordance with Appendix C of 29 CFR 1926.58.

3.3 TYPE OF RESPIRATORY PROTECTION REQUIRED

A. Respiratory protection which supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below the permissible exposure limit (PEL) is the minimum level of protection allowed.

3.4 PERMISSIBLE EXPOSURE LIMIT (PEL)

A. 8-Hour Time Weighted Average (TWA) of asbestos fibers to which any worker may be exposed shall not exceed 0.10 fibers/cubic centimeters.

B. Fibers are defined as all fibers regardless of composition as counted in the NIOSH 7400 procedure, or asbestos fibers of any size as counted using either a scanning or transmission electron microscope.

3.5 RESPIRATORY PROTECTION FACTORS (Courtesy of OSHA Publication 3352-02 2009)

A. Table I: Assigned Protection Factors:

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Table I: Assigned Protection Factors[5]					
Type of Respirator[1,2]	Quarter mask	Half-mask	Full face-piece	Helmet/Hood	Loose-fitting face-piece
1. Air-purifying Respirator	5	10[3]	50	-	-
2. Powered Air-purifying Respirator (PAPR)	-	50	1,000	25/1,000[4]	25
3. Supplied-air Respirator (SAR) or Airline Respirator					
* Demand mode	-	10	50	-	-
* Continuous flow mode	-	50	1,000	25/1,000[4]	25
* Pressure-demand or other positive-pressure mode	-	50	1,000	-	-
4. Self-contained Breathing Apparatus (SCBA)					
* Demand mode	-	10	50	50	-
* Pressure demand or other positive-pressure mode (e.g., open/closed circuit)	-	-	10,000	10,000	-

1. Notes:

   a. [1] Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.
   b. [2] The assigned protection factors in Table I are only effective when the employer implements a continuing, effective respirator program as required by this section (29 CFR 1910.134), including training, fit testing, maintenance, and use requirements.
   c. [3] This APF category includes filtering face-pieces, and half masks with elastomeric face-pieces.
   d. [4] The employer must have evidence provided by the respirator manufacturer that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000. This level of performance can best be demonstrated by performing a WPF or SWPF study or equivalent testing. Absent such testing, all other PAPRs and SARs with helmets/hoods are to be treated as loose-fitting face-piece respirators, and receive an APF of 25.
   e. [5] These APFs do not apply to respirators used solely for escape. For escape respirators used in association with specific substances covered by 29 CFR 1910 subpart Z, employers must refer to the appropriate substance-specific standards in that subpart. Escape respirators for other IDLH atmospheres are specified by 29 CFR 1910.134(d)(2)(ii).

3.6 NEGATIVE PRESSURE RESPIRATORS (HALF OR FULL-FACE MASK)

A. Supply a sufficient quantity of respirator filters approved for asbestos, so that workers can change filters during the work day.

B. Require that respirators be wet-rinsed, and filters discarded, each time a worker leaves the WORK AREA.

C. Store respirators and filters at the job site in the changing room and protect totally from exposure to asbestos prior to their use.

3.7 POWERED AIR PURIFYING (HALF OR FULL-FACE MASK)

A. Supply a sufficient quantity of high efficiency respirator filters approved for asbestos so that workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement.

B. Require that HEPA elements in filter cartridges be protected from wetting during showering.

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C. Require entire exterior housing of respirator including blower unit, filter cartridges, hoses, battery pack, face mask, belt, and cords to be washed each time a worker leaves the WORK AREA.

D. Caution should be used to avoid shorting battery pack during washing. Provide an extra battery pack for each respirator so that one can be charging while one is in use.

3.8 TYPE “C” RESPIRATOR

A. Continuously monitor the air system operation including compressor operation, filter system operation, backup air capacity and all warning and monitoring devices at all times that system is in operation.

B. Assign an individual trained, by manufacturer of the equipment in use or by a Certified Industrial Hygienist, in the operation and maintenance of the system to provide this monitoring.

3.9 RESPIRATORY PROTECTION PROGRAM

A. Submit a Respiratory Protection Program, indicating type of respiratory protection proposed for each portion of the WORK.

END OF SECTION 02 09 10

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SECTION 02 09 11 – DECONTAMINATION UNITS

PART 1 - GENERAL

1.1 SECTIONS INCLUDES

A. Personnel and equipment decontamination facilities.

B. Personnel Decontamination Unit is the only means of ingress and egress for the work area.

C. Materials exit the work area through the Equipment Decontamination Unit.

PART 2 - PRODUCTS

2.1 PLASTIC SHEET AND ACCESSORIES

A. Polyethylene Sheet: A single polyethylene film in the largest sheet size possible to minimize seams, 6.0 mils thick, as indicated, clear, frosted, or black as indicated.

B. Where plastic sheet is the only separation between the work area and building exterior, provide translucent, nylon reinforced, laminated, flame resistant, polyethylene sheeting that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mils thick as indicated, clear, frosted or black as indicated.

C. Duct tape in 2" or 3" widths as indicated, with an adhesive which is formulated to stick tenaciously to sheet polyethylene.

D. Spray adhesive which is specifically formulated to stick tenaciously to sheet polyethylene.

2.2 SHOWER

A. One piece waterproof shower pan, with rigid, impervious, waterproof walls. Structurally support as necessary for stability.

B. Factory made shower head producing a spray of water which can be adjusted for spray size and intensity. Arrange so that control of water temperature, flow rate, and shut off is from inside shower.

C. Cascaded filter units on drain lines from showers with disposable filter elements as indicated below:

1. Primary Filter – Pass particles 20 microns and smaller.
2. Secondary Filter –t Pass particles 5 microns and smaller.

D. Heavy bronze angle type hose bib with wheel handle, vacuum breaker, and 3/4" National Standard male hose outlet.

2.3 SUMP PUMP

A. Provide totally submersible waterproof sump pump with integral float switch and proper size for application. Provide unit capable of pumping debris, sand, plaster or other materials washed off during decontamination procedures without damage to mechanism of pump.

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PART 3 - EXECUTION

3.1 PERSONNEL DECONTAMINATION UNIT

A. A serial arrangement of connected rooms or spaces, Changing Room, Drying Room, Shower Room, Equipment Room, that all persons pass through for entry into and exiting from the work area for any purpose.

B. Provide temporary lighting within decontamination units as necessary to reach a lighting level of 100 foot candles.

3.2 CHANGING ROOM

A. Physically and visually separated from the rest of the building for the purpose of changing into protective clothing.

B. Construct using polyethylene sheeting, at least 6 mil in thickness, to provide an airtight seal between the Changing Room and the rest of the building.

C. Locate so that access to WORK AREA from Changing Room is through Shower Room.

D. Separate Changing Room from the building by a two sheet polyethylene flapped doorway.

E. Do not allow asbestos contaminated items to enter this room. Require workers to enter this room either from outside the area dressed in street clothes, or naked from the showers.

F. An existing room may be utilized as the Changing Room if it is suitably located and approved by OWNER'S REPRESENTATIVE. Protect all surfaces of room with sheet plastic as set forth in Section 020905 Temporary Enclosures.

G. Maintain changing room dry and clean at all times. Do not allow overflow water from shower to wet floor in changing room.

H. Damp wipe all surfaces twice after each shift change with a disinfectant solution.

I. Provide a continuously adequate supply of disposable bath towels.

J. Provide posted information for all emergency phone numbers and procedures.

K. Provide 1 storage locker per employee.

3.3 DRYING ROOM

A. A place for workers to dry after showering.

B. Arrange so floor drains to shower room.

C. Separate from the rest of the building with airtight walls of 6 mil polyethylene sheeting.

D. Separate from change room with a sheet plastic flapped doorway.

3.4 SHOWER ROOM

A. A completely water tight operational shower to be used for transit by cleanly dressed workers heading for the WORK AREA from the Changing Room, or for showering by workers headed out of the WORK AREA after undressing in the Equipment Room.

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B. Separate this room from the rest of the building with air tight walls fabricated of 6 mil polyethylene sheeting.

C. Separate this room from the Changing and Equipment Rooms with air tight walls fabricated of 6 mil polyethylene sheeting.

D. Provide splash-proof entrances to Changing and Equipment Rooms with 2 doors.

E. Arrange so that water from showering does not splash into the Changing or Equipment Rooms.

F. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance.

G. Pump waste water to drain and provide 20 micron and 5 micron waste water filters in line to drain. Change filters daily or more often if necessary.

3.5 EQUIPMENT ROOM

A. Work equipment, footwear and additional contaminated work clothing to be left here. This is a change and transit area for workers.

B. Separate this room from the WORK AREA by a 6 mil polyethylene flap doorway.

C. Separate this room from the rest of the building with air tight walls fabricated of two separate layers of 6 mil polyethylene.

D. Separate this room from the Shower Room with airtight walls fabricated of two separate layers of 6 mil polyethylene.

3.6 WORK AREA

A. Separate WORK AREA from the Equipment Room by polyethylene sheeting barriers.

B. If the airborne asbestos level in the WORK AREA is expected to be high, add an intermediate cleaning space between the Equipment room and the WORK AREA.

C. Damp wipe clean all surfaces after each shift change.

D. Repair and replace damaged floor sections as required.

3.7 CONSTRUCTION OF DECONTAMINATION UNIT

A. Construct air tight walls and ceiling using polyethylene sheeting, at least 6 mil in thickness. Attach to existing building components or a temporary framework.

B. Use 2 layers (minimum) of 6 mil, polyethylene sheeting to cover floors in the Equipment, Shower (underneath shower pan), and Changing Rooms.

C. Provide an additional layer in the Equipment Room for every shift Change expected.

D. Roll one (1) layer of plastic from Equipment Room into WORK AREA after each shift change. Provide a minimum of two (2) layers of plastic at all times. Use only clear plastic to cover floors.

E. Fabricate doors from overlapping sheets with openings a minimum of three feet (3') wide. Configure so that sheeting overlaps adjacent surfaces. Weight sheets at bottoms as required so that they quickly close after being released. Put arrows on sheets to indicate direction of overlap and/or travel.

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F. If the decontamination area is located within an area containing friable asbestos on overhead ceilings, ducts, piping, etc., provide the area with a minimum 1/2 inch plywood "ceiling" with polyethylene sheeting, at least 6 mil in thickness covering the top of the "ceiling".

G. Visual barriers of opaque polyethylene sheeting at least 6 mil in thickness so that work privacy is maintained and work procedures are not visible to building occupants.

H. Where the area adjacent to the decontamination area is accessible to the public, construct a solid barrier on the public side of the sheeting to protect the sheeting. Construct barrier with wood or metal studs covered with minimum 1/2 inch plywood. Where the solid barrier is provided, sheeting need not be opaque.

I. Provide subpanel at Changing Room to accommodate all removal equipment. Power subpanel directly from a building electrical panel. Connect all electrical branch circuits in decontamination unit and particularly any pumps in shower room to a ground-fault circuit protection device.

3.8 DECONTAMINATION SEQUENCE

A. Before leaving the WORK AREA, remove all gross contamination and debris from overalls and feet.

B. The worker than proceeds to the Equipment Room and removes all clothing except respiratory protection equipment.

C. Extra work clothing may be stored in contaminated end of the Equipment Room.

D. Disposable coveralls are placed in a bag for disposal with other material.

E. Decontamination procedures found in Section 020908 shall be followed by all individuals leaving the WORK AREA.

F. After showering, the worker moves to the Changing Room and dresses in either new coveralls for another entry or street clothes if leaving.

3.9 EQUIPMENT DECONTAMINATION UNITS

A. A serial arrangement of rooms, Clean Room, Holding Room, Wash Room constructed with 6 mil polyethylene sheeting, supported as necessary for removal of equipment and material from WORK AREA, not personnel.

B. Provide an enclosed shower unit located in WORK AREA just outside Wash Room as an equipment, bag and container cleaning station.

C. Provide Wash Room for cleaning of bagged or containerized asbestos-containing waste materials passed from the WORK AREA after being wiped clean can be passed to the Holding Room. Separate this room from the work area by a single flap of 6 mil polyethylene sheeting.

D. Provide Holding Room as a drop location for bagged asbestos-containing materials passed from the Wash Room located so that bagged materials cannot be passed from the Wash Room through the Holding Room to the Clean Room. Separate this room from the adjacent rooms by double flaps fabricated from 6 mil polyethylene.

E. Provide Clean Room to isolate the Holding Room from the building exterior. Separate this room from the exterior by a single flap of 6 mil polyethylene sheeting.

3.10 E QUIPMENT DECONTAMINATION SEQUENCE

A. At wash-down station, thoroughly wet-clean contaminated equipment or sealed polyethylene bags and pass into Wash Room.

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B. When passing equipment or containers into the Wash Room, close all doorways of the Equipment Decontamination Unit, other than the doorway between the Wash-down Station and the Wash Room.

C. Wet-clean the bags and/or equipment.

D. Pass items into Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room.

E. Workers from the building exterior enter Holding Area and remove decontaminated equipment and/or containers for disposal.

F. Require these workers to wear full protective clothing and appropriate respiratory protection.

G. At no time is a worker from an uncontaminated area to enter the enclosure when a removal worker is inside.

3.11 CLEANING OF DECONTAMINATION UNITS

A. Clean debris and residue from inside of Decontamination Units on a daily basis.

B. Damp wipe or hose down all surfaces after each shift change.

C. If the Changing Room of the Personnel Decontamination Unit becomes contaminated with asbestos-containing debris, abandon the entire decontamination unit and erect a new decontamination unit. Use the former Changing Room as an inner section of the new Equipment Room.

3.12 SIGNS

A. Post an approximately 20 inch by 14 inch manufactured caution sign at each entrance to the WORK AREA as required by 29 CFR 1926.

B. Post an approximately 10 inch by 14 inch manufactured sign at each entrance to each WORK AREA displaying the following legend:

1. Legend:

a. No Food, Beverages or Tobacco Permitted.
b. All Persons Shall Don Protective Clothing (Coverings) Before Entering the WORK AREA.
c. All Persons Shall Shower Immediately After Leaving WORK AREA and Before Entering the Changing Area.

END OF SECTION 02 09 11

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SECTION 02 09 12 – MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Administration and procedural requirements governing the CONTRACTOR'S selection of products.

B. Administration procedures for handling requests for substitutions made after award of the CONTRACT.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products in accordance with the manufacturers' recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.

B. Schedule delivery to minimize long-term storage at the site and overcrowding of construction spaces.

C. 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.

D. Deliver products to the site in the manufacturers' original sealed containers or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

E. Inspect products upon delivery to ensure compliance with the CONTRACT DOCUMENTS, and to ensure that products are undamaged and properly protected.

F. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

G. Store heavy materials away from the project structure in a manner that will not endanger the supporting construction.

H. Store products subject to damage by the elements above ground, under cover in a Weather-tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturers' instructions.

1.3 PROCEDURES

A. Requests for changes in the products, materials, equipment and methods of construction required by the CONTRACT DOCUMENTS are considered requests for "substitutions", and are subject to the requirements specified herein. Following are not considered as substitutions:

1. Revisions to the CONTRACT DOCUMENTS, where requested by the OWNER, or OWNER'S REPRESENTATIVE are considered as "changes" not substitutions.
2. Specified CONTRACTOR options on products and construction methods included in the CONTRACT DOCUMENTS are not subject to the requirements for substitutions as herein specified.
3. Except as otherwise provided in the CONTRACT DOCUMENTS, the CONTRACTOR's determination of and compliance with governing regulations and orders as issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders.

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1.4 QUALITY ASSURANCE

A. To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.

B. Compatibility of products is a basis requirements of product selection.

C. When the CONTRACTOR is given the option of selecting between two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also CONTRACTOR options.

1.5 SUBMITTALS

A. Submit 3 copies of each request for substitution. In each request identify the product or fabrication or installation method to be replaced by the substitution; include related specification section and drawing numbers, and complete documentation showing compliance with the requirements for substitutions.

B. Within one week of receipt of the CONTRACTOR'S request for substitution, the OWNER'S REPRESENTATIVE will request additional information or documentation as may be needed for evaluation of the request.

C. Within 2 weeks of receipt of the request, or within one week of receipt of the requested additional information or documentation, whichever is later, the OWNER'S REPRESENTATIVE will notify the CONTRACTOR of either the acceptance or rejection of the proposed substitution.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT COMPLIANCE

A. Requirements for individual products are indicated in the CONTRACT DOCUMENTS; compliance with these requirements is in itself a contract requirement.

B. Where some particular product or device is specified by brand name or manufacturer it is to be considered a standard.

C. If approved equal, items of other manufacturer than those mentioned may be used, unless specifically noted otherwise for purposes of standardization.

D. Any substitution must receive the written approval of the OWNER'S REPRESENTATIVE.

2.2 SUBSTITUTIONS

A. The CONTRACTOR'S request for a substitution will be received and considered when extensive revisions to the CONTRACT DOCUMENTS are not required, and one or more of the following conditions are met.

B. Request is directly related to an "or equal" clause or similar language in the Contract Documents.

C. Specified product or method cannot be provided within the CONTRACT time. However, the request will not be considered if the product or method cannot be provided as a result of the CONTRACTOR'S failure to pursue the work promptly or to coordinate the various activities properly.

D. Specified product or method cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

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E. Substantial advantage is offered the OWNER, in terms of cost, time, energy conservation or other considerations of merit, after deducting of offsetting responsibilities the OWNER may be required to bear.

F. Specified product or method cannot be provided in a manner which is compatible with other materials of the work, and where the CONTRACTOR certifies that the substitution will overcome the incompatibility.

G. Specified product or method cannot be properly coordinated with other materials in the work, and where the CONTRACTOR certifies that the proposed substitution can be properly coordinated.

H. Specified product or method cannot receive a warranty as required by the contract documents and where the CONTRACTOR certifies that the proposed substitution includes the required warranty.

2.3 GENERAL PRODUCT REQUIREMENTS

A. Provide products that comply with the requirements of the CONTRACT DOCUMENTS that are undamaged and, unless otherwise indicated, unused at the time of installation.

B. Provide products that are complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

C. Where they are available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

D. Where, because of the nature of its application, the OWNER is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard, domestically produced products for which the manufacturer has published assurances that the products and its parts are likely to be available to the OWNER at a later date.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Except as otherwise indicated in individual sections of these specifications, comply with the manufacturers' instructions and recommendations for installation of the products in the applications indicated.

B. Anchor each product securely in place, accurately located and aligned with other work.

C. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at time of acceptance.

END OF SECTION 02 09 01

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SECTION 02 09 13 – PROJECT DECONTAMINATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cleaning of the primary barrier plastic prior to its removal.

B. Cleaning of the room surfaces to remove any new or existing contamination.

C. Operation of the pressure differential and air circulation system is used to remove airborne fibers.

1.2 SUBMITTALS

A. Evidence of suitability and compatibility of encapsulants with proposed finish materials.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. WORK of this section includes the decontamination of air in the WORK AREA which has been, or may have been contaminated by the elevated airborne asbestos fiber levels generated during abatement activities.

B. Cleaning, decontamination, and removal of temporary facilities installed prior to abatement work.

C. Cleaning, and decontamination of all surfaces (ceiling, walls, floor) of the WORK AREA, and all furniture or equipment in the WORK AREA.

3.2 PRIMARY BARRIER CLEANING

A. Carry out a first cleaning of all surfaces of the WORK AREA including items of remaining sheeting, tools, scaffolding and/or staging by use of damp-cleaning and mopping, and a High Efficiency Particulate Air (HEPA) filtered vacuum. (Note: A HEPA vacuum will fail if used with wet material.)

B. Do not perform dry dusting or dry sweeping.

C. Use each surface of a cleaning cloth one time only and then dispose of as contaminated waste.

D. Continue this cleaning until there is no visible debris from removed materials or residue on plastic sheeting or other surfaces.

E. Remove all Filters in Air Handling System(s) and dispose of as asbestos containing waste in accordance with requirements of Specification Section 02 09 18.

F. Wait 24 hours to allow the HEPA filtered fan units to clean air and remove airborne asbestos fibers. Use oscillating fans as necessary to assure circulation of air in all parts of WORK AREAS during this period.

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G. Maintain pressure differential and air circulation system in operation until WORK AREA passes air clearance testing.

H. Have OWNER'S REPRESENTATIVE visually inspect the WORK AREA to review initial cleaning efforts.

I. As soon as the work area passes OWNER'S REPRESENTATIVE'S inspection, spray the primary barriers with encapsulant and remove all primary barrier sheeting, leaving only the critical barriers, decontamination units and pressure differential and air circulation system.

3.3 FINAL CLEANING

A. Carry out a final cleaning of all surfaces in the WORK AREA in the same manner as the first cleaning immediately after removal of primary barrier. This cleaning is being applied to existing room surfaces and critical barriers.

B. At the completion of cleaning of all surfaces except carpeting, HEPA vacuum carpeting designated to remain in WORK AREAS. Use a passive (non-power brush type) floor attachment with rubber floor seals and adjustable above-floor height.

C. Completely clean carpeting in one direction with each pass of the floor attachment overlapping the previous pass by one-half the attachment width. At the completion of one such cleaning, vacuum clean in the same manner in a direction at right angles to the initial cleaning.

D. Wait 24 hours to allow HEPA filtered fan units to clean air and remove airborne asbestos fibers. Use oscillating fans as necessary to assure circulation of air in all parts of work areas during this period. Maintain pressure differential and air circulation system in operation until work area passes air clearance testing.

3.4 VISUAL INSPECTION

A. After 24 Hours the OWNER'S REPRESENTATIVE will perform a complete visual inspection of the entire WORK AREA including: decontamination unit, all plastic sheeting, seals over ventilation openings, doorways, windows, and other openings; look for debris from any sources, residue on surfaces, dust or other matter.

B. If any such debris, residue, dust or other matter is found repeat final cleaning and continue decontamination procedure from that point.

3.5 FINAL AIR SAMPLING

A. After the WORK AREA is found to be visually clean by OWNER'S REPRESENTATIVE, air samples will be taken and analyzed in accordance with the procedure for Phase Contrast Microscopy (PCM) or Transmission Electron Microscopy (TEM) set forth in Specification Section 02 09 15.

B. If Release Criteria are not met, repeat Final Cleaning and continue decontamination procedure from that point.

C. If Release Criteria are met, proceed with completion of the WORK.

3.6 COMPLETION OF ABATEMENT WORK

A. Shutdown and remove the Pressure Differential and Air Circulation System. Seal HEPA filtered fan units with 6 mil polyethylene sheet and duct tape to form a tight seal at intake end before being moved from WORK AREA.

B. Remove all critical barriers and critical barrier sheeting.

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C. Remove decontamination units.

D. Remove all equipment, materials, debris from the work site.

E. Dispose of all asbestos containing waste material as specified in Section 020918 and provide receipts and chain of custody forms documenting proper disposal.

F. Re-inspect all surfaces and finishes and re-clean as needed to remove all signs of stains, water marks, duct tape residue, smudges, smears and other visible marks. All interior finishes and surfaces shall be left in a condition suitable for application of wax or polish by the OWNER. Glass surfaces shall be left sparkling clean.

G. Repair or replace all interior finishes damaged during the course of asbestos abatement work.

H. Fulfill Project Close Requirements.

END OF SECTION 02 09 13

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SECTION 02 09 14 – CLEANING AND DECONTAMINATION PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cleaning and decontamination of areas specified.

B. Removal and disposal of visible debris.

C. Decontamination of carpeting in the area of the debris and in a 3 foot radius beyond any visible debris.

D. Removal, cleaning and re-shelving of books within the above area.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Complete the following before start of work of this Section:

1. Specification Section 02 09 06 “Regulated Areas.”
2. Specification Section 02 09 09 “Worker Protection - Repair and Maintenance.”
3. Specification Section 02 09 10 “Respiratory Protection.”

3.2 WET CLEANING

A. Accomplish wet cleaning during decontamination with paper towels or disposable rags and amended water. Wipe surface once and refold to a fresh face of cloth until all available faces have been used then dispose of paper towel or rag.

3.3 REMOVAL OF ASBESTOS-CONTAINING DEBRIS

A. Cleanup of amassed debris which has fallen from an architectural finish, fireproofing, or thermal insulation on pipes, boilers and other thermal equipment.

B. Shut down all ventilation into room.

C. Seal entry to WORK AREA with 6 mil polyethylene. Slit polyethylene for entry. Install a flap to cover the slit automatically; tape slit closed after entry.

D. Start HEPA vacuum before entering the area. Use the HEPA vacuum to clean a path at least 6 feet wide from the entry point of the WORK AREA to the site of the fallen material. Remove all small debris with the HEPA vacuum.

E. HEPA vacuum surfaces of all pieces too large to be removed by the suction of the HEPA vacuum. Pick up such pieces, wet with amended water and place in the bottom of a 6 mil polyethylene disposal bag conforming to the requirements of Specification Section 02 09 18.

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F. Remove all remaining visible debris with HEPA vacuum. HEPA vacuum an area 3 feet beyond the location in which any visible debris was found.

G. Place a 6 mil polyethylene drop cloth in accordance with Section 020906, Regulated Area, immediately on top of the HEPA vacuumed area before performing any repair work on site from which fallout occurred.

H. HEPA vacuum the site from which material fell removing all loose material which can be removed by the vacuum's suction.

I. Repair or remove remaining material.

J. HEPA vacuum ladder and/or any tools used and pass out of the WORK AREA.

K. HEPA vacuum all surfaces in the room starting at the top of wall and working downward to the floor. Then start at corner of floor farthest from WORK AREA entrance and work towards entrance.

L. HEPA vacuum the floor using a floor attachment with rubber floor seals and adjustable floor to attachment height. Adjust the height so that the rubber seals just touch the floor if carpeted and are within 1/16" of hard surface floors. Vacuum the floor in parallel passes with each pass overlapping the previous by one-half the width of the floor attachment. At the completion of one cleaning vacuum the floor a second time at right angles to the first.

M. Secure area from occupancy until air monitoring results per Specification Section 02 09 15 WORK AREA Clearance indicate that area has met the requirements for re-occupancy.

3.4 CLEANING AND DECONTAMINATING OBJECTS

A. Perform all work of decontaminating objects wherever possible on a plastic drop sheet installed in conformance with Specification Section 02 09 06.

B. HEPA vacuum all surfaces of object and immediate area before moving the object. Pick-up object, if possible, and HEPA vacuum all surfaces.

C. Hand to off-sheet worker who will wet-clean object, if possible, and place in storage location.

D. Decontaminate area where object was located by HEPA vacuuming twice, in perpendicular directions. Wet clean if necessary to remove any debris.

E. Return object to its original location.

3.5 DECOMTAMINATION OF ROOMS

A. Shut down all ventilation into space.

B. Seal entry to WORK AREA with 6 mil polyethylene. Slit polyethylene for entry. Install a flap to cover the slit automatically; tape slit closed after entry.

C. Install Differential Pressure and Air Circulation System in accordance with Specification Section 02 09 04.

D. HEPA vacuum all surfaces in the room starting at the ceiling, then top of wall and working downward to the floor.

E. HEPA vacuum the floor using a floor attachment with rubber floor seals and adjustable floor to attachment height. Adjust the height so that the rubber seals just touch the floor if carpeted and are within 1/16" of hard surface floors. Vacuum the floor in parallel passes with each pass overlapping the previous one by one half the width of the floor attachment. At the completion of one cleaning, vacuum the floor a second time at right angles to the first.

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F. Operate HEPA filtered fan unit in space for 24 hours minimum.

G. At completion of Decontamination WORK workers decontaminate in accordance with Specification Section 02 09 09 “Worker Protection - Repair and Maintenance.”

H. Secure area from occupancy until air monitoring results per Specification Section 02 09 15 WORK AREA Clearance indicate area has met the requirements for re-occupancy.

END OF SECTION 02 09 14

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SECTION 02 09 15 – WORK AREA CLEARANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes work performed by the OWNER'S REPRESENTATIVE to measure post-abatement fiber levels.

1.2 CONTRACTOR RELEASE CRITERIA

A. The WORK is Complete when the WORK AREA is visually clean and airborne fiber levels have been reduced to the level specified in items 1.6 and 1.7 of this Section.

1.3 AIR MONITORING

A. To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the OWNER'S REPRESENTATIVE will secure samples and analyze them according to the following procedures.

B. Fibers Counted: "Fibers" referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400, or asbestos fibers of any size as counted using a Transmission Electron Microscope.

1.4 AGGRESSIVE SAMPLING

A. Before sampling pumps are started the exhaust from forced air equipment (such as a leaf blower with at least 1 horsepower electric motor) will be swept against all walls, ceilings, floors, ledges and other surfaces in the room. This procedure will be continued for 5 minutes per 10,000 cubic feet of WORK AREA volume.

B. One 20 inch diameter fan per 10,000 cubic feet of room volume will be mounted in a central location, directed toward ceiling and operated at low speed for the entire period of sample collection.

C. Air samples will be collected in areas subject to normal air circulation away from room corners, obstructed locations, and sites near windows, doors of vents.

D. After air sampling pumps have been shut off, fans will be shut off.

1.5 SCHEDULE OF AIR SAMPLES

A. The number and volume of air samples taken and analytical methods used by the OWNER'S REPRESENTATIVE will be in accordance with one of the following schedules in compliance with federal regulations. Sample volumes given may vary depending upon the analytical instruments used.

1.6 PHASE CONTRAST MICROSCOPY (PCM)

A. For projects where PCM sampling applies as per regulation, in each homogenous WORK AREA after completion of all cleaning work, a minimum of 7 samples will be collected and analyzed as follows:

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Location	Number	Method	Rate (L/M)	Minimum Volume (L)
Each Work Area	5	PCM	10-15	1,200
Work Area Blank	1	PCM	N/A	N/A
Laboratory Blank	1	PCM	N/A	N/A

B. Fibers on each filter will be counted and measured using the NIOSH Method 7400 procedures.

C. One work area sample may be split and both halves analyzed separately for duplicate analysis.

D. Decontamination of the work site is complete when every WORK AREA sample is equal to or below the applicable Acceptance Level. If any sample is above the Acceptance Level, then the decontamination is incomplete and re-cleaning is required.

1.7 TRANSMISSION ELECTRON MICROSCOPY (TEM)

A. For projects where TEM sampling applies as per regulation, in each homogenous WORK AREA after completion of all cleaning work, a minimum of 13 samples will be collected and analyzed as follows:

Location	Number	Method	Rate (L/M)	Minimum Volume (L)
Each Work Area	5	TEM	10-15	1,200
Outside Work Area	5	TEM	10-15	1,200
Work Area Blank	1	TEM	N/A	N/A
Outside Blank	1	TEM	N/A	N/A
Laboratory Blank	1	TEM	N/A	N/A

B. Analysis of the five (5) inside the WORK AREA samples will be performed using the method set forth in the AHERA Regulation 40 CFR Part 763 Appendix A.

C. Asbestos structures referred to in this Section include asbestos fibers, bundles, clusters or matrices, as defined by method of analysis.

D. Release Criteria: Decontamination of the work site is complete if either of the following two sets of conditions is met:

1. WORK AREA Samples are below filter background levels.
2. All WORK AREA sample volumes are greater than 1,199 liters for a 25 mm sampling cassette. The average concentration of asbestos on the five WORK AREA Samples does not exceed the filter background level of 70 structures per square millimeter of filter area.
3. WORK AREA Samples are not statistically different from samples from outside WORK AREA.
4. All sample volumes except for blanks are greater than 1199 liters for a 25 mm sampling cassette.
5. The average asbestos concentration of the three blanks is below the filter background level of 70 structures per square millimeter of filter area. Average asbestos concentrations in WORK AREA Samples are not statistically different from samples from outside WORK AREA, as determined by the Z-test calculation found in 40 CFR Part 763, Subpart E, Appendix A (Z is less than or equal to 1.65).

E. If these conditions are not met then the decontamination is incomplete and the cleaning procedures of Section 020913 shall be repeated.

F. If the arithmetic mean (average) asbestos concentration on the blank filters exceeds 70 structures per square millimeter of filter area the analysis will cease and new samples will be collected.

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1.8 FAILED CLEARANCE TESTS

A. If the release criteria are not met and the area must be re-cleaned and re-tested the CONTRACTOR will be responsible for all costs associated with re-cleaning and re-testing, including labor and laboratory costs.

1.9 PHASE CONTRACT MICROSCOPY

A. The services of a testing laboratory, accredited by AI.H.A. or E.P.A., will be employed by the OWNER to perform laboratory analysis of the air samples.

B. Air samples will be obtained and be sent for PCM analysis daily, so that verbal reports on air samples can be obtained within 24 hours.

C. A complete record, certified by the testing laboratory, of all air monitoring tests and results will be furnished to the OWNER.

1.10 TRANSMISSION ELECTRON MICROSCOPY

A. The services of a testing laboratory will be employed by the OWNER to perform laboratory analysis of the air samples.

B. Verbal results will be available during the 2nd working day after taking the sample.

C. A complete record, certified by the testing laboratory, of all Transmission Electron Microscopy results will be furnished to the OWNER.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 02 09 15

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SECTION 02 09 16 – ABATEMENT PROCEDURES – MINOR

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of friable asbestos containing materials with less than full containment.

B. Glovebag removals.

C. Mini-enclosures.

1.2 SUBMITTALS

A. Surfactant: Product data, use instructions and recommendations from manufacturer of surfactant intended for use. Include data substantiating that material complies with requirements.

B. Removal Encapsulant product data, use instructions and recommendations from manufacturer of removal encapsulant intended for use. Include data substantiating that material complies with requirements.

C. NESHAPS Certification: certification from manufacturer of surfactant or removal encapsulant that, the material, if used in accordance with manufacturer's instructions, will wet asbestos-containing materials to which it is applied as required by the National Emission Standard for Hazardous Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M).

D. Material Safety Data Sheet: Material Safety Data Sheet, or equivalent, in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for each surfactant and encapsulating material proposed for use. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.

E. Historical Airborne Fiber Data: Submit airborne asbestos fiber count data from an independent air monitoring firm to demonstrate the ability to perform work of this section while maintaining an airborne fiber count below 0.1 fibers per cubic centimeter in the breathing zone of the individual performing the work.

F. Spray Cement: Product description including major components and solvents. Manufacturer's installation instructions. Indicate portions applicable to the Project.

G. Sheet Plastic: For fire retardant plastic submit test reports on NFPA 701 test.

H. Glovebags: Product data.

I. Signs: Samples.

J. Mini-enclosures: Provide shop drawings of mini-enclosure arrangement to be used.

1.3 QUALITY ASSURANCE

A. Air monitoring will be conducted during the course of the minor removals to monitor potential fiber release.

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B. If any sample analyzed exceeds 0.1 fibers/cc the regulated area must be sealed off, decontaminated and cleared in accordance with applicable sections of this Specification.

C. WORK AREA clearance tests when required must also meet the release criteria described in Specification Section 02 09 15.

PART 2 - PRODUCTS

2.1 POLYETHELENE FILM SHEETING

A. Polyethylene film sheeting in the largest sheet size possible to minimize seams, 6.0 mil thick, clear, frosted, or black as indicated.

B. Flame resistant polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mil thick, clear, frosted or black as indicated.

C. Where plastic sheet constitutes the only barrier between the WORK AREA and the building exterior, provide translucent, nylon reinforced or woven polyethylene, laminated, flame resistant, polyethylene sheeting that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mil thick, frosted or black as indicated.

2.2 MISCELLANEOUS MATERIALS

A. Duct tape in 2" or 3" widths as indicated, with an adhesive which is formulated to stick tenaciously to sheet polyethylene.

B. Spray adhesive which is specifically formulated to stick tenaciously to sheet polyethylene.

C. Provide water to which a surfactant has been added. Use a mixture of surfactant and water which results in wetting of the asbestos-containing material and retardation of fiber release during disturbance of the material equal to or greater than that provided by water amended with a surfactant consisting of one ounce of a solution of 50 polyoxyethylene ester and 50 polyoxyethylene ether mixed with five gallons of water.

D. Provide a penetrating type encapsulant designed specifically for removal of asbestos- containing material. Use a material which results in wetting of the asbestos-containing material and retardation of fiber release during disturbance of the material equal to or greater than that provided by water amended with a surfactant consisting of one ounce of a solution of 50 polyoxyethylene ester and 50 polyoxyethylene ether mixed with five gallons of water.

2.3 GLOVEBAG

A. A minimum 6 mil polyethylene, polyvinylchloride or equivalent plastic sack.

B. With two sealed inward projecting long-sleeved gloves or mittens.

C. Preprinted with same warning notice as a disposal bag.

D. Equipped with a pouch for storage of tools.

E. Designated location for spray wand or HEPA vacuum wand.

F. Sufficient capacity to hold removed materials and permit sealing as specified.

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2.4 GARDEN SPRAYER

A. Hand pump type pressure-can garden sprayer fabricated out of either metal or plastic, equipped with a metal wand at the end of a hose that can deliver a stream or spray of liquid under pressure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Isolate area and provide worker protection as outlined in referenced sections.

3.2 REMOVALS

A. Check pipe where the work will be performed. Wrap damaged area of pipe with 6 mil plastic and "candy-stripe" with duct tape. Place one layer of duct tape around undamaged pipe at each end where the glove bag will be attached.

B. Slit top of the glove bag open (if necessary) and cut down the sides to accommodate the size of the pipe.

C. Place necessary tools into pouch located inside glove bag.

D. Place one strip of duct tape along the edge of the open top slit of glove bag for reinforcement.

E. Place the glove bag around section of pipe to be worked on and staple top together through reinforcing duct tape. Next, duct tape the ends of glove bag to pipe itself, where previously covered with plastic or duct tape.

F. Use smoke tube and aspirator bulb to test seal. Place tube into water sleeve squeezing bulb and filling bag with visible smoke. Remove smoke tube and twist water sleeve closed. While holding the water sleeve tightly, gently squeeze glove bag and look for smoke leaking out. If leaks are found, tape closed using duct tape and re-test.

G. Insert wand from garden sprayer through water sleeve. Duct tape water sleeve tightly around the wand to prevent leakage.

H. Thoroughly wet material to be worked on with amended water or removal encapsulant and allow to soak in. Wet adequately to penetrate and soak material through to substrate.

I. One person places his hands into the long-sleeved gloves while the second person directs garden sprayer at the work.

J. Cut insulation at each end of the section to be removed. While spraying amended water or removal encapsulant on the cutting area to keep dust to a minimum.

K. Remove insulation using putty knives or other tools. Place pieces in bottom of bag without dropping.

L. Rinse all tools with water inside the bag and place back into pouch.

M. Scrub and wipe down the exposed pipe.

N. Remove water wand from water sleeve and attach the small nozzle from HEPA-filtered vacuum. Turn on the vacuum briefly to collapse the bag.

O. Remove the vacuum nozzle, twist water sleeve closed and seal with duct tape.

P. From outside the bag, pull the tool pouch away from the bag. Place duct tape over twisted portion and then cut the tool bag from the glove bag, cutting through the twisted/taped section. Contaminated tools

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may then be placed directly into next glove bag without cleaning. Alternatively, tool pouch with the tools can be placed in a bucket of water, opened underwater, and tools cleaned and dried.

Q. With removed insulation in the bottom of the bag, twist the bag several times and tape it to keep the material in the bottom during removal of the glove bag from the pipe.

R. Slip a 6 mil disposal bag over the glove bag (still attached to the pipe). Remove tape or cut bag and open the top of the glove bag and fold it down into disposal bag.

S. Clean all surfaces in the WORK AREA using disposable cloths wetted with water with surfactant or removal encapsulant added. When these surfaces have dried, clean with a HEPA filtered vacuum. Material adhered to a surface with removal encapsulant may require the application of additional removal encapsulant to facilitate cleaning.

T. Seal exposed ends of remaining pipe insulation.

U. Remove disposable suits and place these into bag with waste.

V. Collapse the bag with a HEPA vacuum twist top of bag, seal with at least 3 wraps of duct tape, bend over and seal again with at least 3 wraps of duct tape.

3.3 MODIFIED GLOVEBAG PROCEDURES

A. Any modifications to above process must be submitted in writing as a substitution and approved by the OWNER'S REPRESENTATIVE.

3.4 MINI-ENCLOSURES

A. Construct Work Room in the same manner as Primary Barrier fabricated from 6 mil sheet plastic. Arrange so that Primary Barrier provides both a Critical and Primary Barrier. Line walls and floor of Work Room with a continuous Secondary Barrier.

B. Provide an approximately 3'-0" by 3'-0" Change Room, with additional space as required for storage, attached to each Work Room. Fabricate Change Room from 6 mil sheet plastic in the same manner as a Primary Barrier. Locate so that access to WORK AREA is through Change Room.

C. Cover floor in front of entry to Change Room with one layer of 6 mil sheet plastic. Securely anchor sheet plastic to prevent slipping.

D. Provide flapped door as entry to Change Room and entry from Change Room to Work Room. Fabricate each flapped door from overlapping contacting layers of sheet plastic. Fasten each layer on the top and one side. Each flap is to be 3" longer than door opening. Reinforce free side and bottom of each sheet with duct tape. Alternate sides that are fastened on each layer. Form arrows pointing to entry side from duct tape on inside and outside of door.

E. At entry to Change Room post an approximately 20 inch by 14 inch manufactured caution sign displaying the legend with letter sizes and styles of a visibility required by 29 CFR 1926.

F. Provide worker and respiratory protection as specified in Specification Section 02 09 10.

G. HEPA filtered vacuum cleaner with vacuum in space outside Mini-Enclosure may be used to provide a minimum of 8 air changes per hour in the Work Room.

H. Outside of Change Room remove all street clothes and don clean coveralls and respirator. A swim suit or second disposable suit may be worn beneath outer coveralls. Enter Change Room be sure that entry is completely closed. Enter Work Room be sure that entry is completely closed.

I. Worker Decontamination:

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1. Remove contaminated suit inside the WORK AREA. Leave respirator in place.
2. Wash hands, face and surface of respirator with water and wet paper towels. Use caution to avoid breaking seal between respirator face-piece and face.
3. Proceed with respirator in place to Change Room.
4. Be sure that entry to WORK AREA is completely closed.
5. In Change Room don clean disposable suit leaving respirator in place.
6. Exit change room be sure that entry to Change Room is completely closed.
7. Proceed to next Mini-Enclosure, or a remote shower.
8. At end of work day decontaminate fully in accordance with procedures in appropriate specification section describing Worker Protection.

J. Material Decontamination:

1. Three workers are required. One in the Work Room, one in the Change Room, and one on Step Off Area.
2. Worker in Work Room cleans equipment and bagged debris and hands one piece of equipment or one bag of debris at a time to worker in Change Room.
3. Worker in Change Room wet cleans each piece of equipment or bag and stores them in Change Room. Equipment is sealed completely in 6 mil sheet plastic in the Change Room.
4. When the amount of stored material in the Change Room becomes large enough that the worker cannot clean incoming material without contacting previously cleaned material the door between the WORK and Clean Room is closed.
5. The worker in the Changing Room then passes each item into a new disposal bag held open in the doorway between the Changing Room and Step Off Area by the work on the Step Off Area. The Worker on the Step Off Area places each bag in a sealed cart for transport to the load out area. No bags are to be stored outside of the Mini-Enclosure.
6. All bags are to be transported through the building in clean sealed containers that have never been in an asbestos WORK AREA, Mini-Enclosure or Decontamination Unit.

K. At completion of all work decontaminate the WORK and Changing Rooms as set forth in Section 020913 Project Decontamination.

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SECTION 02 09 17 – ABATEMENT PROCEDURES – GENERAL

PART 1 - GENERAL

1.1 DEFINITIONS

A. Secondary Barriers.

B. Removal of ACM.

C. Clean of Surfaces Previously Covered by ACM.

D. Encapsulants.

1.2 SUBMITTALS

A. Submit product data, use instructions and recommendations from manufacturer of surfactant intended for use. Include data substantiating that material complies with requirements.

B. Submit product data, use instructions and recommendations from manufacturer of removal encapsulant intended for use. Include data substantiating that material complies with requirements.

C. Submit certification from manufacturer of surfactant or removal encapsulant that, the material, if used in accordance with manufacturer's instructions, will wet asbestos containing materials to which it is applied as required by the National Emission Standard for Hazardous Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M).

PART 2 - PRODUCTS

2.1 AMENDED WATER

A. Provide water to which a surfactant has been added.

B. Use a mixture of surfactant and water which results in wetting of the asbestos containing material and retardation of fiber release during disturbance of the material equal to or greater than that provided by the use of one ounce of a surfactant consisting of 50 polyoxyethylene ester and 50 polyoxyethylene ether mixed with five gallons of water.

2.2 REMOVAL ENCAPSULANT

A. Provide a penetrating type encapsulant designed specifically for removal of asbestos containing material.

B. Use a material which results in wetting of the asbestos-containing material and retardation of fiber release during disturbance of the material equal to or greater than that provided by water amended with a surfactant consisting of 50 polyoxyethylene ester and 50 polyoxyethylene ether mixed with five gallons of water.

2.3 POLYETHYLENE FILM SHEETING

A. Polyethylene film sheeting in the largest sheet size possible to minimize seams, 6.0 mils thick, clear, frosted, or black as indicated.

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B. Flame resistant polyethylene film sheeting that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mils thick, clear, frosted or black as indicated.

2.4 MISCELLANEOUS MATERIALS

A. Duct tape in 2" or 3" widths as indicated, with an adhesive which is formulated to stick tenaciously to sheet polyethylene.

B. Spray adhesive which is specifically formulated to stick tenaciously to sheet polyethylene.

C. Provide 6 mil thick leak-tight polyethylene bags labeled as indicated in the Specifications.

PART 3 - EXECUTION

3.1 SECONDARY BARRIER

A. A drop cloth of clear 6 mil sheet plastic in all areas where asbestos removal work is to be carried out. Completely cover floor with sheet plastic.

B. Where the WORK is within 10'-0" of a wall extend the Secondary Barrier up wall to ceiling.

C. Support sheet plastic on wall with duct tape, seal top of Secondary plastic to Primary Barrier with duct tape so that debris is unable to get behind it.

D. Provide cross strips of duct tape at wall support as necessary to support sheet plastic and prevent its falling during removal operations.

E. Install Secondary Barrier at the beginning of each work shift.

F. Remove Secondary Barrier at end of each work shift or as work in an area is completed.

G. Fold plastic toward center of sheet and pack in disposal bags. Keep material on sheet continuously wet until bagged.

H. Install Walkways of black 6 mil plastic between active removal areas and decontamination units to protect Primary layer from tracked material. Install walkways at the beginning of, and remove at the end of each work shift.

3.2 WET REMOVAL

A. Thoroughly wet asbestos-containing materials to be removed prior to removal to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant.

B. Saturate material sufficiently to wet to the substrate without causing excess dripping. Allow time for water or removal encapsulant to penetrate material thoroughly.

C. When amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. When a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions.

D. Perforate outer covering of any installation which has been painted and/or jacketed in order to allow penetration of amended water or removal encapsulant, or where necessary, carefully strip away while simultaneously spraying amended water or removal encapsulant on the installation to minimize dispersal of asbestos fibers into the air.

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E. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.

F. Remove saturated asbestos-containing material in small sections from all areas. As it is removed, pack material while still wet into disposal bags.

G. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to wash-down station adjacent to material decontamination unit.

3.3 FIREPROOFING OR ARCHITECTURAL FINISH ON SCRATCH COAT

A. Spray asbestos-containing fireproofing or architectural acoustic finish with a fine mist of amended water or removal encapsulant. Allow time for amended water or removal encapsulant to saturate materials to substrate.

B. Scrape materials from substrate. Remove materials in manageable quantities and control the decent to staging or floor below.

C. If using amended water, spray mist surface continuously during work process. If using removal encapsulant follow manufacturer's written instructions.

D. Remove residue remaining on scratch coat after scraping using stiff nylon bristled hand brush, or high pressure washer.

E. If a removal encapsulant is used remove residue completely before encapsulant dries. If substrate dries before complete removal of residue re-wet with amended water or removal encapsulant.

F. Double-bag or containerize the material for disposal.

3.4 FIREPROOFING OR ARCHITECTURAL FINISH ON WIRE LATH

A. Spray asbestos-containing fireproofing or architectural acoustic finish with a fine mist of amended water or removal encapsulant. Allow time for amended water or removal encapsulant to completely saturate material.

B. If surface of material has been painted or otherwise coated cut small holes as required and apply amended water or removal encapsulant from above.

C. Cut wire lath into sections and cut hanger wires. Roll up complete with asbestos-containing material and hand place in disposal bag. Do not drop on floor.

D. After removal of lath and asbestos-containing material remove any overspray on decking and structure above.

E. Deposit the sections of plaster and lath in double bags as required for disposal, being careful to prevent jagged edges of lath from tearing disposal bags. If bags continue to tear double bags then boxes or drums must be used and sealed as directed by the OWNER'S REPRESENTATIVE.

3.5 PIPE INSULATION

A. Spray with a mist of amended water or removal encapsulant. Allow amended water or removal encapsulant to saturate material to substrate. If a removal encapsulant is used, use in strict accordance with manufacturer's instructions.

B. Cut bands holding performed pipe insulation, slit jackets at seams, remove and hand-place in a disposal bag. Remove job molded fitting insulation in chunks and hand place in a disposal bag. Do not drop to floor.

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C. Remove any residue on pipe or fitting with stiff bristle nylon hand brush.

D. Where pipe fitting insulation is removed from pipe with straight runs insulated with fibrous glass or other non-asbestos containing fibrous material, remove fibrous material 3" from the point where it contacts the asbestos-containing insulation.

3.6 ENCAPSULATION

A. Upon completion of removal and cleaning of surfaces, have surfaces visually inspected by the OWNER'S REPRESENTATIVE. When surfaces have passed the visual inspection, they shall be sprayed with an approved encapsulant.

3.7 PRESSURE DIFFERENTIAL AND AIR CIRCULATION SYSTEM

A. Provide pressure differential and air circulation systems as described below for each area where asbestos-containing material is being removed or otherwise disturbed.

B. Provide HEPA filtered fan units, one for each scraping activity, in addition to those required by section 020904, in the vicinity of the work. Arrange so that exhaust is into the work area oriented in a direction away from the work. Extend a 12" diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0 from any scraping or wire brushing activity.

3.8 AIRBORNE FIBER COUNTS

A. Use work procedures that result in an 8 hour Time Weighted Average (TWA) airborne fiber count less than that indicated in Section 020903 Abatement Air Monitoring.

B. If airborne fiber counts exceed this level immediately mist the area with amended water to lower fiber counts and revise work procedures to maintain airborne fiber levels at or less than the required limit.

END OF SECTION 02 09 17

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SECTION 02 09 18 – DISPOSAL OF REGULATED ASBESTOS-CONTAINING WASTE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Disposal of Asbestos-Containing Materials.

B. Packaging of asbestos-containing waste materials.

C. Disposal may be accomplished either by landfilling or converting asbestos containing materials to non-asbestos waste.

1.2 SUBMITTALS

A. Copy of state or local license for waste hauler.

B. Name and address of landfill where asbestos-containing waste materials are to be buried. Include contact person and telephone number.

C. Name and address of processor where asbestos-containing waste materials are to be process into non-asbestos waste. Include contact person and telephone number.

D. Product data on process to be used.

E. Letters or other documents from the United States Environmental Protection Agency relative to the process; indicating compliance with Section 61.152(a) of NESHAP regulations.

F. Chain of Custody form and form of waste manifest proposed.

G. Sample of disposal bag and any added labels to be used.

PART 2 - PRODUCTS

2.1 DISPOSAL BAGS

A. Provide 6 mil thick leak-tight polyethylene bags labeled with four labels with text as follows:

1. First Label:

CAUTION
CONTAINS ASBESTOS FIBERS
AVOID OPENING OR BREAKING CONTAINER
BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH

2. Second Label: Provide in accordance with 29 CFR 1910.1200(f) of OSHA's Hazard Communication Standard:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING AIRBORNE ASBESTOS, TREMOLITE, ANTHOPHYLLITE, OR
ACTINOLITE FIBERS IS HAZARDOUS TO YOUR HEALTH

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3. Third Label: Provide in accordance with U.S. Department of Transportation regulation on hazardous waste marking. 49 CFR Parts 171 and 172. Hazardous Substances: Final Rule. Published November 21, 1986 and revised February 17, 1987:

RQ HAZARDOUS
SUBSTANCE,
SOLID, NOS,
ORM-E, NA 9188
(ASBESTOS)

4. Fourth Label:

NAME OF GENERATOR
NAME OF CONTRACTOR

PART 3 - EXECUTION

3.1 GENERAL

A. All waste is to be hauled by a waste hauler with all required licenses form all state and local authority with jurisdiction.

B. Load all asbestos-containing waste material in disposal bags or leak-tight drums.

C. Protect interior of truck or dumpster with Critical and Primary Barriers as described in Section 020905 Temporary Enclosures.

D. Carefully load containerized waste in fully enclosed dumpsters, trucks or other appropriate vehicles for transport. Exercise care before and during transport, to ensure that no unauthorized persons have access to the material.

E. Advise the landfill operator or processor, at least ten days in advance of transport, of the quantity of material to be delivered.

3.2 DISPOSAL

A. Sealed plastic bags must be carefully unloaded from the truck. If bags are broken or damaged, return to work site for re-bagging. Clean entire truck and contents using procedures set forth in Section 020913 Project Decontamination.

B. At a processing site truck and loading dock are arranged as a controlled work area and containerized waste is transferred to storage area by site personnel. All bags including broken ones will be transferred. Clean truck, using procedures set forth in Specification Section 020913 “Project Decontamination.”

C. Retain receipts from landfill or processor for materials disposed of.

D. At completion of hauling and disposal of each load submit copy of waste manifest, chain or custody form, and landfill receipt to OWNER'S REPRESENTATIVE within 35 days from the time the waste is deposited at the landfill.

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SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused.

B. Related Requirements:

1. Division 01 Section "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Division 01 Section "Execution" for cutting and patching procedures.
3. Division 01 Section "Cutting and Patching" for cutting and patching requirements.

1.3 DEFINITIONS

A. Remove: Carefully detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse and store as indicated.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor to legally dispose off site.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

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1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for dust control. Indicate proposed locations and construction of barriers.

B. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

1.6 CLOSEOUT SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified in related Division 02 Sections.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform regular surveys as the Work progresses to detect hazards resulting from selective demolition activities.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

1. Comply with all requirements specified in Division 01 Section.
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Contractor shall arrange to shut off indicated services/systems as required by the performance of the work.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

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b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

3.3 PROTECTION

A. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

B. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Maintain fire watch during and after flame-cutting operations in accordance with Owner’s requirements and local codes.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

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8. Dispose of demolished items and materials legally and promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's designated storage area.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.

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2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

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SECTION 03 54 16 - HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

1.3 ALLOWANCES

A. Work included in Base Bid: The Contractor shall include in the space provided on the Bid Form, the allowances for work of this Section as itemized on the Bid Form. The cost of these quantities shall be computed using Unit Prices stated on the Bid Form. The work of the Allowance is in addition to that required to complete the Work of the Contract. Subsequently, the sum or any unused portion thereof, shall be deducted from the Contract if the corresponding work is not required by actual conditions encountered.

1.4 UNIT PRICES

A. Specific work of this section is itemized as Unit Prices on the Bid Form to add or deduct specific units of work to the Project. Unit Price descriptions, requirements, and units of work are enumerated in Division 01 Section “Unit Prices.” Unit Prices are inclusive of labor, materials, overhead, and profit per unit of work indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans indicating substrates, locations, and average anticipated depths of underlayment based on field survey of substrate conditions.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.

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1.7 QUALITY ASSURANCE

A. Product Compatibility: Manufacturers of underlayment and floor-covering systems shall certify in writing that products are compatible.

B. Installer Qualifications: Installer shall be approved by manufacturer for application of underlayment products required for this Project.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

B. Coordinate application of underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 HYDRAULIC CEMENT UNDERLAYMENTS

A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch (average depth to be assumed for bidding purposes) and that can be feathered at edges to match adjacent floor elevations.

1. Basis of Design: Subject to compliance with requirements, hydraulic cement underlayment incorporated into the project shall be based on systems as follows:

a. ARDEX Americas; "V 1000™" or "V 1200™" or MAPEI; “Ultraplan 1 Plus” or “Ultraplan M20 Plus” for use to level subfloor to comply with flooring manufacturer's requirements for use on all new and existing surfaces to receive new flooring unless noted otherwise.

2. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturers, Contractor may provide products from the following manufacturers that meet or exceed the published data of the specified Basis of Design product.

a. Custom Building Products; CustomTech™.
b. Laticrete International, Inc.; NXT® Level.
c. Master Builders Solutions; MasterTop.

3. Cement Binder: ASTM C150/C150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C219.
4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C109/C109M.

B. Water: Potable and at a temperature of not more than 70 deg F.

C. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.

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D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

E. Corrosion-Resistant Coating: Recommended in writing by underlayment manufacturer for metal substrates.

PART 3 - EXECUTION

3.1 GENERAL

A. General: Underlayment is required to be provided on all new and existing substrates indicated to receive new flooring unless specifically stated otherwise.

3.2 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of the Work.

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

3.3 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform tests so that each test area does not exceed 500 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test, ASTM F1869: Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours. Comply with manufacturer’s requirements if they are more stringent.

C. Metal Substrates: Mechanically remove, according to manufacturer's written instructions, rust, foreign matter, and other contaminants that might impair underlayment bond. Apply corrosion-resistant coating compatible with underlayment if recommended in writing by underlayment manufacturer.

D. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.

E. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

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3.4 INSTALLATION

A. Mix and install underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after installation recommended in writing by manufacturer.
2. Coordinate installation of components to provide optimum adhesion to substrate and between coats.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Install underlayment to produce uniform, level surface with feathered edges to match adjacent floor elevations as follows:

1. Install underlayment at all irregularities, depressions, etc. in accordance with flooring manufacturer's requirements on all new concrete surfaces indicated to receive flooring.
2. Install underlayment on all existing concrete surfaces indicated to receive new flooring.
3. If multiple layers are required, final layer shall be installed without aggregate to produce surface.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.5 INSTALLATION TOLERANCES

A. Finish and measure surface, so gap at any point between gypsum cement underlayment surface and an unleveled, freestanding, 10-foot-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and 1/16 inch in 2 feet.

3.6 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 54 16

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SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Masonry lintels.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Miscellaneous masonry accessories.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
2. Division 06 Section "Rough Carpentry" for wood nailers built into masonry.

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

1. Steel lintels and shelf angles for unit masonry, furnished under Division 05 Section "Metal Fabrications."
2. Wood nailers and blocking built into unit masonry specified in Division 06 Section "Rough Carpentry."
3. Hollow-metal frames in unit masonry openings, furnished under Division 08 Section "Hollow Metal Doors and Frames."

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

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2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement. "Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

1.5 INFORMATIONAL SUBMITTALS

A. 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 identify materials used. Include mix proportions for mortar and grout and source of aggregates.

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

B. Qualification Data: For firms indicated in "Quality Assurance Article."

C. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent testing agency acceptable to the authorities having jurisdiction, qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations 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 single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

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E. Preconstruction Testing Service: The contractor or manufacturer shall engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by the contractor or manufacturer. Retesting of materials failing to meet specified requirements shall be done at contractor's expense.

1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
2. Mortar Test: For mortar properties per ASEM C 270.
3. Grout Test: For compressive strength per ASTM C 1019.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

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.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, 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 down both sides of walls 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 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 three days after building masonry walls or columns.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions.

1. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and as follows:

a. 40 to 32 deg F: Heat mixing water or sand to produce mortar temperatures between 40 and 100 deg F.
b. 32 to 25 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 100 deg F. Heat grout materials to produce grout temperatures between 40 and 100 deg F. Maintain mortar and grout above freezing until used in masonry.
c. 25 to 20 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 100 deg F. Heat grout materials to produce grout temperatures between 40 and 100 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F if grouting. Use heat on both sides of walls under construction.

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d. 20 deg F and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 100 deg F. Heat grout materials to produce grout temperatures between 40 and 100 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F. Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F within the enclosures.

2. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:

a. 40 to 25 deg F: Cover masonry with a weather-resistant membrane for 48 hours after construction.
b. 25 to 20 deg F: Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mi./h.
c. 20 deg F and Below: Provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after construction.

3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. 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.
2. Do not apply mortar to substrates with temperatures of 100 deg F and above.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

C. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

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2. Provide bullnose units for outside corners unless otherwise indicated.

B. Concrete Masonry Units (CMUs): ASTM C 90.

1. Unit shall conform to ASTM C90. f'm = 2,000 psi.
2. Density Classification: Normal weight
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide uniform texture type, aggregate size and mix ratio adjusted to provide an extremely fine smooth face texture free of fissures, voids and other defects.
5. Products: Subject to compliance with requirements, provide concrete masonry units from one of the following manufacturers:

a. Fizzano Brothers Concrete Products, Inc.
b. Keystone Concrete Block & Supply Co., Inc.
c. Standard Concrete.
d. Terre Hill Concrete Products.
e. York Building Products.

2.3 MASONRY LINTELS

A. Masonry Lintels: Prefabricated masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing.

1. Where exposed to interior finished spaces, provide masonry lintels in lengths that match vertical coursing and simulate masonry joints to match adjacent masonry joints.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement.

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

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

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

a. Davis Colors; "True Tone Mortar Colors."
b. Lanxess Corporation; "Bayferrox Iron Oxide Pigments."
c. Solomon Colors, Inc.; "SGS Mortar Colors."

E. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. White-Mortar Aggregates: Natural white sand or crushed white stone.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

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F. Aggregate for Grout: ASTM C 404.

G. Water: Potable.

2.5 REINFORCEMENT

A. Basis of Design: Subject to compliance with requirements, Masonry Joint Reinforcement incorporated into the project shall be based on products manufactured as follows:

a. Single Wythe Wall: Hohmann & Barnard, Inc.; "#120 Truss Mesh."

B. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor may provide products from other manufacturers that meet or exceed the published data of the specified Basis of Design product.

C. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior and Exterior Walls: Hot-dip galvanized, carbon steel.
2. Wire Size for Side Rods: 0.148-inch diameter.
3. Wire Size for Cross Rods: 0.148-inch diameter.
4. Wire Size for Veneer Ties: 0.148-inch diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry Joint Reinforcement for Single-Wythe Masonry: Truss type with single pair of side rods.

2.6 TIES AND ANCHORS

A. Basis of Design: Subject to compliance with requirements, Ties and Anchors incorporated into the project shall be based on products as manufactured by as follows, in sizes as required by project conditions:

1. Masonry to Masonry Wall Ties: Hohmann & Barnard, Inc.; "MWT-Mesh Wall Tie."

B. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor may provide products from other manufacturers that meet or exceed the published data of the specified Basis of Design product.

C. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

E. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

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1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.

2.7 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

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

2.9 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

B. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor may provide products from the following manufacturers that meet or exceed the published data of the specified Basis of Design product:

1. Diedrich Technologies, Inc.
2. EaCo Chem, Inc.

2.10 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. Use portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For reinforced masonry, use Type S.
2. 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 S.

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3. For interior non-load-bearing partitions, Type S.

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 1.15.1 in 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/C 143M.

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 the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.2 INSTALLATION, GENERAL

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

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

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

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Do not install unit masonry that is defective, damaged, cracked or has chipped corners. Remove and replace any unit masonry that contain these issues.

F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

G. Do not wet CMUs.

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3.3 SPECIAL UNIT MASONRY PROJECT TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/4 inch or minus 1/8 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/4 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/8 inch in a story height or 1/4 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 5 feet or 1/4 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 3/16 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.
5. For lines and surfaces do not vary from straight by more than 3/16 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 3/16 inch in 10 feet, or 1/2 inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.
6. For exposed bed joints interrupted by control or expansion joints, bed joint line and level shall not vary by more than 1/8 inch.

D. Masonry installations that do not conform to the Special Unit Masonry Tolerances indicated above shall be removed and reinstalled.

3.4 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: Unless otherwise indicated, lay exposed masonry in running bond, unless noted otherwise on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

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

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

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

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

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

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in grouted masonry, including starting course.
3. With entire units, including areas under cells, fully bedded in mortar at starting course where cells are not grouted.
4. In accordance with the Special Unit Masonry Project Tolerances listed in this Section.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. Masonry joints above ceilings shall be struck flush starting two masonry courses above ceiling.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.

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2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

D. Control Joint Spacings: If location of control (vertical movement) joints is not shown, place vertical joints at not more than 25'-0" center-to-center spacing; locate joints at columns when spacing exceeds 20'-0". Verify location of all control joints with Architect.

3.8 LINTELS

A. Install steel lintels where indicated and above all openings in masonry walls including above all metal frames (unless scheduled to be framed with metal studs and gypsum board/veneer plaster); above all wall openings, passages, windows, metal louvers, grilles, elevator doors, roll up shutters, etc.; above all HVAC ducts passing through masonry walls, return air openings, etc. (Refer to HVAC drawings for locations); above all built-in items, (cabinet heaters, convectors, louvers, fans, access panels, fire extinguisher cabinets, plumbing valve cabinets, hose cabinets, recessed electric panels, etc.); and in addition to locations noted or shown on the Drawings.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels when approved in advance by the Architect.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 REINFORCED UNIT MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

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

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1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height and as follows:

    a. Do not exceed the following pour heights for fine grout:

        1) For minimum widths of grout spaces of 3/4 inch or for minimum grout space of hollow unit cells of 1-1/2 by 2 inches, pour height of 12 inches.
        2) For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2 by 3 inches, pour height of 60 inches.
        3) For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 12 feet.
        4) For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 24 feet.

    b. Do not exceed the following pour heights for coarse grout:

        1) For minimum widths of grout spaces of 1-1/2 inches or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches, pour height of 12 inches.
        2) For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 60 inches.
        3) For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 12 feet.
        4) For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 4 inches, pour height of 24 feet.

3.10 REPAIRING, POINTING, CLEANING, AND PROTECTION

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units or installations out of compliance with the Special Unit Masonry Project Tolerances indicated in this Section. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

1. Contractor shall identify and replace units noted above as part of their quality control program. Architect reserves the right to back charge Contractor for their time to identify masonry units if Contractor fails to identify and replace non-compliant installations.

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 sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before 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; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

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5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

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

3.11 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials and waste are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Masonry Waste Recycling: Return broken CMU's not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

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SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for countertops.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.

B. Products furnished, but not installed, under this Section:

1. Loose steel lintels for all masonry wall penetrations.

C. Related Sections:

1. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Division 09 Section "Painting & Finishing."

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design, engineer, fabricate, and install the following metal fabrications to withstand the required structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each metal fabrication.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

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

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

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1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For traffic-control gates, include analysis and data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.5 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications 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 without causing delay in the work.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

C. Professional Engineer Qualifications: The Contractor shall engage 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 installation of handrails and railing that are similar to those indicated for this Project in material, design, and extent.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

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PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

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

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

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

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3500 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. 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.

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B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

J. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.
3. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.

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2.7 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

2.8 LOOSE STEEL LINTELS

A. Provide steel lintels above all openings in masonry walls and brick veneer including above all metal frames (unless scheduled to be framed with metal studs and gypsum board/veneer plaster); above all wall openings, passages, windows, metal louvers, grilles, etc.; above all HVAC ducts passing through masonry walls, return air openings, etc. (Refer to HVAC drawings for locations); above all built-in items, (cabinet heaters, convectors, louvers, fans, access panels, fire extinguisher cabinets, plumbing valve cabinets, hose cabinets, recessed electric panels, etc.) in addition to those noted/shown on the plans, wall sections and details.

B. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.9 FINISHES, GENERAL

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

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

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

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

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C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 PREPARATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. 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, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

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E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.4 ADJUSTING AND CLEANING

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

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

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SECTION 06 10 00 - ROUGH CARPENTRY (FOR NON-COMBUSTIBLE STRUCTURES)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking and nailers.
3. Plywood backing panels.

1.3 DEFINITIONS

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

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

1.4 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

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

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

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2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

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

1. Blocking and nailers that are part of a rated assembly.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber and any of the following species:

1. Hem-fir; WCLIB or WWPA.
2. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:

1. Hem-fir or hem-fir (north); Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

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2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.5 MISCELLANEOUS MATERIALS

A. Provide other materials, not specifically described, but required for a complete and proper installation.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

B. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

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

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

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

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E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

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

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

END OF SECTION 06 10 00

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SECTION 06 20 00 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plastic laminate-clad countertops and other plastic laminate fabrications.
2. Epoxy, including countertops and backsplashes.
3. Simulated stone, including quartz countertops.
4. Miscellaneous finished carpentry.
5. Shop finishing of finished carpentry.

B. Related Requirements:

1. Division 06 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Division 09 Section "Painting and Finishing" for priming, backpriming and staining of interior finish carpentry.
3. Division 12 Section "Plastic-Laminate-Faced Casework" for stock-designed cabinets and accessories.

1.3 DEFINITIONS

A. MDO: Plywood with a medium-density overlay on the face.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, details of joints, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show direction of veining, grain, or other directional patterns.
4. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural cabinets.

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C. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures. Provide complete sample box with all colors and patterns from price ranges specified included for selection.

D. Samples for Verification:

1. For each species and cut of lumber and panel products with transparent, non-transparent or non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
2. Exposed cabinet hardware.
3. Plastic laminate, Quartz, and Epoxy for each type, color, pattern, and surface finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For each type of product.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finish carpentry to include in maintenance manuals. Include product data for use and care products used or recommended by Installer, and names, addresses, and telephone numbers of local sources for products.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm experienced in successfully producing finished carpentry similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

B. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

C. Installer Qualifications: Arrange for installation of finished carpentry by a firm that can demonstrate successful experience in installing finished carpentry and solid surfacing items similar in type and quality to those required for this project.

D. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

1.8 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site:

1. Review specification requirements.
2. Review installation procedures.
3. Inspect project conditions.

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1.9 DELIVERY, STORAGE, AND HANDLING

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

B. Deliver finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.10 FIELD CONDITIONS

A. Field Measurements: Where finish carpentry is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of work.

1. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

B. Established Dimensions: Where countertops and assemblies are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

D. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and the following grading rules:

1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."
2. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."
3. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
4. SPIB: The Southern Pine Inspection Bureau, "Standard Grading Rules for Southern Pine Lumber."
5. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
6. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

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B. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

C. Softwood Plywood: DOC PS 1.

D. Hardboard: AHA A135.4.

E. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.

F. Particleboard: ANSI A208.1, Grade M-2 made with binder containing no urea-formaldehyde resin.

2.2 PLASTIC-LAMINATE COUNTERTOPS AND ASSEMBLIES

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.

B. Grade: Premium.

C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP.

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

a. Formica Corporation.
b. Pionite; a Panolam Industries International, Inc. brand.
c. Wilsonart LLC.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from manufacturer's full range in the following categories:

a. Solid colors.
b. Wood grains.
c. Patterns.

2. Grain Direction: Parallel to cabinet fronts.
3. A maximum of 10 laminates will be selected.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces, applied before top material.

F. Outside Corner Treatment: 2-inch radius.

G. Core Material: Particleboard.

H. Core Thickness: 1-3/16 inch.

I. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

J. Wood Materials:

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1. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
2. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

    a. Particleboard: ANSI A208.1. Density 45#-48#, 3-ply ASTM DD1037-91A, Grade M-2.

K. Accessories

1. Grommets for Cable Passage through Countertops: 3-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

L. Fabrication

1. Sand wood lightly to remove raised grain on exposed surfaces before fabrication.
2. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Provide continuous drip groove on under-surface 1/2-inch from the edge. Ease edges to radius indicated for the following:

    a. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

3. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

    a. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

2.3 EPOXY COUNTERTOP AND BACKSPLASHES

A. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.

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

    a. Durcon , a Wilsonart Company.
    b. Prime Industries, Inc.
    c. Thermo Fisher Scientific.
    d. Plastic Laminate Casework manufacturer.

2. Physical Properties:

    a. Flexural Strength: Not less than 10,000 psi.
    b. Modulus of Elasticity: Not less than 2,000,000 psi.
    c. Hardness (Rockwell M): Not less than 100.
    d. Water Absorption (24 hours): Not more than 0.02 percent.
    e. Heat Distortion Point: Not less than 260 deg F.

3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:

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a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formaldehyde, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).

4. Color: Black.

B. Epoxy Countertops:

1. Countertop Fabrication: Fabricate with factory cutouts for sinks, holes for service fittings and accessories, and butt joints assembled with epoxy adhesive and concealed metal splines.

a. Countertop Configuration: Flat, 1-inch thick, with beveled or rounded edge and corners, and with drip groove and applied backsplash.

2.4 SIMULATED STONE COUNTERTOPS AND FABRICATIONS

A. Quartz Countertops and Fabrications:

1. Configuration: Provide countertops with the following front and backsplash style:

a. Front: Straight, slightly eased at top and as indicated on Drawings.
b. Other Fabrications: As indicated on Drawings.

2. Countertops: 3/4-inch-thick, quartz with front edge built up with same material.
3. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

B. Countertop Materials:

1. Plywood: Exterior softwood plywood complying with DOC PS1, Grade C-C Plugged, touch sanded.

2. Quartz: Solid sheet consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.

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

1) Cambria.
2) DuPont (Corian Quartz); DuPont de Nemours, Inc.
3) Meganite Inc.
4) Wilsonart LLC.

b. Colors and Patterns: As selected by Architect from manufacturer's full range equal to DuPont & Company's Price Groups 1-3. For purposes of bidding, Price Group 3 shall be included in the bid. A credit shall be provided should a lesser price group be selected.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

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B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

D. Prefabricated, factory-finished, heavy-duty countertop support brackets equal to Universal Heavy-Duty Commercial Support Bracket by Iron Supports. Unless otherwise indicated, provide 18-inch long by 12-inch high brackets mounted as recommended by manufacturer for indicated applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

C. Advise installers of other work about specific requirements for placement of inserts and similar items to be used by countertop Installer for anchoring countertops. Furnish installers of other work with Drawings or templates showing locations of these items.

3.3 CONSTRUCTION TOLERANCES FOR COUNTERTOPS

A. Variation from Level: Do not exceed 1/8 inch in 96 inches, ¼ inch maximum.

B. Variation in Joint Width: Do not vary joint thickness more than one-fourth of nominal joint width.

C. Variation in Plane at Joints (Lipping): Do not exceed 1/64-inch difference between planes of adjacent units.

D. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64-inch difference between edges of adjacent units, where edge line continues across joint.

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3.4 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.

B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.5 COUNTERTOP AND FABRICATION INSTALLATION

A. Plastic Laminate Countertop and Fabrication Installation

1. Grade: Install countertops to comply with same grade as item to be installed.
2. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

    a. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.

3. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

    a. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

4. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
5. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
6. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

    a. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
    b. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

B. Epoxy Countertops and Backsplashes:

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1. Comply with installation requirements in SEFA 2.3. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports places to prevent deflection. Locate joints only where indicated on Drawings.

2. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Shop prepare edges for field-made joints.

    a. Use concealed clamping devices for filed-made joints in plastic-laminate countertops. Locate clamping devices within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.

3. Fastening:

    a. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or more fasteners at each cabinet front, end, and back.
    b. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.
    c. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

4. Provide required holes and cutouts for service fittings.
5. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.
6. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
7. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Quartz Countertops and Fabrications Installation:

1. Install countertops and fabrications level to a tolerance of 1/8 inch in 8 feet.
2. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

    a. Seal edges of cutouts in particleboard subtops by saturating with varnish.

3.6 ADJUSTING

A. Replace finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

A. Clean finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

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3.8 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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SECTION 07 81 00 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes sprayed fire-resistive materials (SFRM) to repair existing areas damaged by new construction.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans, schedules, or both, indicating the following:

1. Extent of fireproofing for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of fireproofing after application.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From Applied Fireproofing manufacturer, certifying compatibility of applied fireproofing and accessory materials with Project materials that connect to or that come in contact with applied fireproofing.

C. Evaluation Reports: For fireproofing, from ICC-ES.

D. Preconstruction Test Reports: For fireproofing.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

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1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.

1. Basis of Design: Subject to compliance with requirements, Spray Fire-Resistive Materials incorporated into the project shall be based on products/systems as follows:

a. GCP a Saint-Cobain Company; "Monokote MK-6-Series."

2. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor may provide products from the following manufacturers that meet or exceed the published data of the specified Basis of Design product:

a. Isolatek International.
b. Then Schundler Company.

3. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
4. Density: Not less than 15 lb/cu. ft. as specified in the approved fire-resistance design, according to ASTM E 605.
5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.
6. Combustion Characteristics: ASTM E 136.

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7. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 5 or less.
   b. Smoke-Developed Index: 5 or less.

8. Compressive Strength: Minimum 10 lbf/sq. in. according to ASTM E 761.
9. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
10. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
11. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
12. Air Erosion: Maximum weight loss of in 24 hours according to ASTM E 859.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:

   1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

E. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

   1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
   2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

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3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Verify that concrete work on steel deck has been completed before beginning fireproofing work.

C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work.

D. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:

1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary

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materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

J. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

K. Cure fireproofing according to fireproofing manufacturer's written recommendations.

L. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

M. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC, 1704.10.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

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B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 00

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SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.

B. Related Sections:

1. Division 07 Section "Joint Firestopping" for joints in or between fire-resistance-rated construction.

1.3 ACTION SUBMITTALS

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

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

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1.6 QUALITY ASSURANCE

A. Installer Qualifications: Firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

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

    a. 3M Fire Protection Products.
    b. Hilti, Inc.
    c. Nelson Firestop Products, a brand of Emerson Industrial Automation.
    d. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

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I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

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3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Contractor shall schedule the Authority Having Jurisdiction to perform inspections of installed penetration fireproofing.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after installations comply with requirements.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

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SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.

B. Related Requirements:

1. Division 07 Section "Penetration Firestopping" for penetrations in fire-resistance-rated walls, and horizontal assemblies.
2. Division 09 Section "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

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1.6 QUALITY ASSURANCE

A. Installer Qualifications: Firm experienced in installing joint firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."

2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.

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

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a. 3M Fire Protection Products.
b. Hilti, Inc.
c. Nelson Firestop; a brand of Emerson Industrial Automation.
d. Roxul Inc.
e. Thermafiber, Inc.; an Owens Corning company.
f. Tremco, Inc.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

2.3 SAFING INSULATION

A. Mineral Wood Loose Fill Insulation: ASTM E 136 with maximum flame spread and smoke developed indexes of 0; ASTM E 84 and density of 4.0 pcf.

1. Basis of Design: Subject to compliance with requirements, Safing Insulation incorporated into the project shall be based on products as manufactured as follows:

a. Thermafiber by Owens-Corning; "Safing Insulation."

2. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor may provide products from manufacturers that meet or exceed the published data of the specified Basis of Design product.

B. Safing Clips: Z-Shaped galvanized steel clips formed from 1 inch wide strips of 20 gauge galvanized steel; 3 inches high with 2 inch and 3 inch upper and lower horizontal legs. See specific UL or OPL/Intertek design to verify if safing clips are required.

C. Backer / Reinforcement Member: Thermafiber Impasse T-Bar or other light gauge steel channel or angle approved by the primary manufacturer. Place horizontally at the safe-off line to support the curtain wall insulation to prevent bowing of curtain wall insulation caused by compression fitting of the Safing insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

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

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3.2 PREPARATION

A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

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3.5 FIELD QUALITY CONTROL

A. Contractor shall engage the Authority Having Jurisdiction to perform inspections.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Urethane joint sealants.
2. Mildew-resistant joint sealants.
3. Latex joint sealants.

1.3 ACTION SUBMITTALS

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

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

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized installer who is trained and approved by manufacturer.

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1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review specifications.
2. Review installation procedures.
3. Inspect project conditions.

1.7 FIELD CONDITIONS

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

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

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

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

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

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

2.2 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide the following:

a. Sika Corporation U.S.; "Sikaflex 15LM".

2. Joint Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
3. Joint Locations:

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a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of windows, doors and other openings.
c. Other interior joints.

2.3 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

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

    a. Dow Corning Corporation; "786-M White".
    b. GE Silicones; "SCS1700 Sanitary".
    c. Sika Corporation U.S.; "Bondaflex Sil 100 WF".
    d. Pecora Corporation; "898 NST".
    e. Sherwin Williams Company (The); "White Lightning Silicone All Purpose Sealant".
    f. Tremco Incorporated; "Tremsil 200".

2. Joint Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
3. Joint Locations:

    a. Joints between plumbing fixtures and adjoining walls, floors and counters.
    b. Other joints in similar conditions noted above.

2.4 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

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

    a. Master Builders Solutions; "MasterSeal NP520".
    b. Pecora Corporation; "AC-20".
    c. Sherwin-Williams Company (The); "950A Siliconized Acrylic Latex Caulk".
    d. Tremco Incorporated; "Tremflex 834".
    e. Sherwin Williams; "SherMax Acrylic".

2. Joint Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
3. Joint Locations:

    a. Control joints on exposed surfaces of walls.
    b. Perimeter joints between interior wall surfaces and frames of doors, windows, and other openings.

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2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) and as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

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

2.6 MISCELLANEOUS MATERIALS

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

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

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

3.2 PREPARATION

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

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

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a. Concrete.
b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

a. Metal.
b. Glass.

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

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

3.3 INSTALLATION OF JOINT SEALANTS

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

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

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

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

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

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

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

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

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1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 CLEANING

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

3.5 PROTECTION

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

END OF SECTION 07 92 00

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SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes hollow-metal doors, frames and accessories.

B. Related Requirements:

1. Division 04 Section "Unit Masonry" for anchoring and grouting hollow metal frames set in masonry construction.
2. Division 09 Section "Painting and Finishing" for finishing.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

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

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C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Ceco Door; AADG, Inc.; Assa Abloy.
2. Curries; AADG, Inc.; Assa Abloy.
3. Republic Doors and Frames; an Allegion brand.
4. Steelcraft; an Allegion brand.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
d. Edge Construction: Model 2, Seamless.

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e. Core: Polystyrene.

3. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
b. Construction: Full profile welded.

4. Exposed Finish: Prime.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.4 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

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2.5 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
3. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
4. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

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2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.7 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable stops located on secure side of opening.

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d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

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SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Access doors and frames for walls and ceilings.

B. Related Requirements:

1. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
2. Division 08 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
3. Division 09 Section "Gypsum Board Assemblies" for openings in gypsum board walls.

1.3 ALLOWANCES

A. Work Included in Base Bid: The Contractor shall include in the space provided on the Bid Form, the allowances for work of this section itemized on the Bid Form. The cost of this work shall be computed based upon the scope indicated in this Section. The work listed is in addition to that required to complete the work of the Contract and, consequently, the sum therefore may be deducted from the Contract amount if the corresponding work is not required by actual conditions encountered.

B. Actual sizes and quantities furnished are in addition to those shown on the Drawings or required by other trades, and may be adjusted by the Architect as required to suite project requirements.

C. Doors not required shall be credited to the Owner as a deduct to the Contract. Contractor shall not procure access doors and frames without Architect's approval. Contractor shall anticipate multiple orders.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

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

1. Babcock-Davis.
2. J. L. Industries, Inc.; Activar Construction Products Group.
3. Karp Associates, Inc.
4. Larsen's Manufacturing Company.
5. Nystrom, Inc.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.

    a. Finish: Factory prime.

3. Frame Material: Same material, thickness, and finish as door.
4. Hinges: Manufacturer's standard.
5. Hardware: Provide one cylinder lock per access door to match keyway selected by Owner.

D. Fire-Rated, Flush Access Doors with Exposed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame, uninsulated. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.

    a. Finish: Factory prime.

4. Frame Material: Same material, thickness, and finish as door.
5. Hinges: Manufacturer's standard.
6. Hardware: Provide one cylinder lock per access door to match keyway selected by Owner.

E. Hardware:

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1. Latch: Cam latch operated by screwdriver.
2. Lock: Cylinder.

    a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 08 71 00 "Door Hardware."

2.3 MATERIALS

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

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

E. Frame Anchors: Same type as door face.

F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.
3. Provide mounting holes in frame for attachment of masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.5 FINISHES

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

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

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

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

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

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

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

3.4 ACCESS DOOR SCHEDULE

A. Provide access doors as indicated on the Drawings.

B. The following access doors are in excess of those indicated elsewhere and shall be included in the allowances for the project.

1. Flush access doors with exposed flanges:

a. (2) 16" x 16" access doors for gypsum board assemblies.
b. (2) 18" x 18" access doors for masonry assemblies.

2. Fire-rated flush access doors with exposed flanges:

a. (2) 16" x 16" access doors for gypsum board assemblies.
b. (2) 18" x 18" access doors for masonry assemblies.

END OF SECTION 08 31 13

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SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Door hardware for swinging doors.
2. Door hardware for other doors to the extent indicated.
3. Cylinders for door hardware specified in other sections.

B. Related Sections:

1. Division 08 Section "Hollow Metal Doors and Frames".
2. Division 08 Section "Access Doors and Frames" for access door hardware.

C. Mechanical Finish Hardware

1. Furnish, deliver, and coordinate all mechanical finish hardware as indicated, specified and required. Include all hardware under this Section that is not specified in other Sections, whether or not such hardware is scheduled herein, and include all trim, attachments and fastenings specified or required for proper and complete installation for given application. Items of hardware (not limited to mounting accessories required by door or frame details and required to properly install hardware and have it function properly and in conjunction with specified interacting hardware) not definitely specified herein and necessary for completion of the Work shall be provided. Such items shall be of type and quality suitable to the service required and comparable to adjacent hardware. Where size and shape of member is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

1. Provide complete manufacturer's catalog cuts for each item scheduled.

B. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.

C. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

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1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents, in vertical format (horizontal format will not be reviewed).
3. Content: Include the following information:

    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, swing, quantity, function, and finish of each door hardware product.
    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    e. Fastenings and other pertinent information.
    f. Explanation of abbreviations, symbols, and codes contained in schedule.
    g. Mounting locations for door hardware.
    h. List of related door devices specified in other Sections for each door and frame.

D. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For electrified door hardware, from the manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Independent Architectural Hardware Consultant report of door hardware deficiencies.

B. Manufacturer's data for each piece of hardware.

C. Maintenance Data: For each type of door hardware to include in maintenance manuals.

D. Installation instructions for each piece of hardware for each door.

E. Bitting Lists for all keys.

F. Complete set of wiring diagrams for each door with door number indicated.

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G. Final, as-built copy of hardware and keying schedule.

H. Warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of door hardware from a single manufacturer.

C. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

E. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and a representative of the Door Hardware Manufacturer. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

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

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1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.8 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with the Owner.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

a. Locksets: Ten years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

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B. Follow-Up Services: The hardware installer shall confirm, in writing, the operation of all door hardware is within tolerances prior to the General Contractor requesting Substantial Completion. In addition to warranty service required for issues realized post-occupancy during the warranty period, the installer shall re-review the operation of all door hardware ten months after Substantial Completion and shall make all adjustments required.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

C. Basis of Design: Hardware scheduled in Part 3 "Door Hardware Schedule" shall be considered the Basis of Design product. Acceptable manufacturers listed in this Part shall provide products that meet or exceed the published data of the Basis of Design product where their product is provided in lieu of the Basis of Design product.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

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

a. Hager Companies.
b. IVES Hardware; an Allegion company.
c. McKinney Products Company; an ASSA ABLOY Group company.
d. Stanley Commercial Hardware; a dormakaba company.

2.3 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors.

C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

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D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

E. Mortise Locks: BHMA A156.13; Security Grade 1; stamped steel case with steel or brass parts; Series 1000.

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

a. Best; a dormakaba company.
b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
c. Schlage Commercial Lock Division; an Allegion company.

2.4 AUXILIARY LOCKS

A. Mortise Auxiliary Locks: BHMA A156.5; Grade 1; with strike that suits frame.

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

a. Best; a dormakaba company.
b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
c. Schlage Commercial Lock Division; an Allegion company.

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum ten (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer’s cylinder and door hardware.

D. Security Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed security cylinders and keys able to be used together under the same facility master or grandmaster key system. Cylinders to be factory keyed.

1. New security key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.
2. Manufacturers:

a. Sargent (SA) – Signature.
b. No Substitution.

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2.6 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

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

a. Glynn-Johnson; an Allegion company.
b. Rockwood; an ASSA ABLOY Group company.
c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
d. Rixon Specialty Door Controls; an ASSA ABLOY Group company.
e. National Guard Products.

2.7 DOOR SILENCERS

A. Door Silencers: BHMA A 156.16; rubber door silencer.

1. Basis of Design: Subject to compliance with requirements, Door Silencers incorporated into the project shall be based on products as follows:

a. Rockwood Manufacturing Company, an ASSA ABLOY Group company; "608".

2. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor may provide products from the following manufacturers that meet or exceed the published data of the specified Basis of Design product.

a. IVES Hardware, an Allegion Company.
b. Hager Company.

2.8 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

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

a. IVES Hardware; an Allegion company.
b. Hager Companies.
c. National Guard Products, Inc.
d. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
e. Reese Enterprises, Inc.
f. Zero International; an Allegion brand

2.9 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

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

a. Hager Companies.

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b. Rockwood; an ASSA ABLOY Group company.
c. Stanley Commercial Hardware; a dormakaba company.
d. Allegion.

2.10 FABRICATION

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

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

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware or is indicated as a required use of through bolts. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt. Where through bolts are utilized, provide finish-threaded caps to fully conceal nuts.

a. Steel through bolts required at the following locations (no exceptions):

1) Door closers at all locations.

2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
5. Self-drilling "Tek" type screws are not acceptable. Use only fasteners supplied by hardware manufacturer.
6. Where it is not possible to reinforce substrate adequately for screws, use through-bolts with sleeves or use sex bolts.

a. Do not use where head or nut would be exposed on face of door, unless specifically indicated or made necessary by other requirements.
b. Finish exposed heads and nuts the same as hardware on that side of the door.

7. Use expansion shield anchors in concrete and masonry.

2.11 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

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

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

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C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying schedule.

E. Stops: Provide wall stops for doors unless floor or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

F. Door Silencers: Furnish at all hollow metal and wood frames. Each door leaf shall be supplied with three (3) bumpers each side. Do not provide on doors with sound seals or on exterior doors.

G. Primed Hardware: Paint factory-primed hardware in accordance with Division 09 Section "Painting & Finishing."

3.4 ADJUSTING

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

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.

B. Prior to Occupancy Adjustment: Adjust door closers to overcome air pressure produced by HVAC systems. If HVAC pressure, whether negative or positive, negates proper operation or function of any closing or latching device, or inhibits manufacturer’s intended performance (in any manner), supplier shall inform the GC in writing that type of hardware cannot operate nor function as manufacturer has designed and tested due to HVAC condition.

C. Post Occupancy Adjustment: Review operation of door hardware six to eight weeks after Substantial Completion in the presence of the Owner's Representative. Adjust hardware as required to ensure proper operation.

1. Contractor will be required to re-visit site to adjust hardware omitted from onsite review.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

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3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 HARDWARE MANUFACTURER LEGEND

Symbol	Manufacturer
MK	McKinney
RO	Rockwood
SA	Sargent

3.8 DOOR HARDWARE SCHEDULE

MARK 1

Door 238 — HM DR X HM FR

MK	Hinges	TA2714	US26D
SA	Lockset	10-63 8237 LE2P	US26D
SA	Cylinder	10-6300	US26D
SA	OH Stop	69OH	US26D
RO	Kickplate	K1050 x 8” h. x dr. width	US32D

END OF SECTION 08 71 00

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SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: Submit evaluation reports certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.

B. Manufacturer's Certification: Submit manufacturer's certification of product compliance with codes and standards along with product literature and data sheets for specified products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design and provide framing systems in accordance with AISI 5220, “North American Specification for the Design of Cold-Formed Steel Framing – Nonstructural Members,” unless otherwise indicated.

2.2 FRAMING SYSTEMS

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

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: Comply with ASTM C 645; roll-formed from hot-dipped galvanized steel; complying with ASTM A 1003/A 1003M and ASTM A 653/A 653M G40 (Z120) or having a coating that provides equivalent corrosion resistance. A40 galvannealed products are not acceptable.

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B. Studs and Runners: ASTM C 645. Use either steel studs and runners or "EQ" Equivalent Gauge steel studs and runners where required for STC indicated.

1. Steel Studs and Runners:

a. Minimum Base-Metal Thickness: 0.0329 inch (20 gauge).
b. Depth: As indicated on Drawings.

2. Dimpled Steel Studs and Runners:

a. Minimum Base-Metal Thickness: 0.0269 inch (22 gauge).
b. Depth: As indicated on Drawings.

3. Basis of Design: Subject to compliance with requirements, provide products based on products as manufactured by:

a. ClarkDietrich Building Systems.

4. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor may provide products from another manufacturer that meet or exceed the published data of the specified Basis of Design manufacturer.

C. Slip-Type Head Joints: Where indicated, provide the following:

1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection and drift of structure above; in thickness not less than indicated for studs, in width to accommodate depth of studs, and with all accessory parts required for a complete installation.

a. Basis of Design: Subject to compliance with requirements, Deflection Track incorporated into the project shall be based on products as follows:

1) ClarkDietrich Building Systems; "Max Trak 2D."

b. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor may provide products from another manufacturer that meet or exceed the published data of the specified Basis of Design product.

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

1. Minimum Base-Metal Thickness: 0.0296 inch.
2. Depth: As indicated on Drawings.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

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1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

E. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

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SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Division 04 Section "Unit Masonry" for installation at masonry walls.
2. Division 07 Section "Joint Sealants."
3. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
4. Division 09 Section "Painting and Finishing."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

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

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

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2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

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

B. Abuse-Resistant Gypsum Board: ASTM C 1396, C 1629, D 4977, D 5420, and E 695.

1. Thickness: 5/8 inch, unless noted otherwise
2. Paper Face: None.
3. Long Edges: Tapered.
4. Fire Rated: Type X where required for fire rating.
5. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
6. Products:

    a. CertainTeed Corporation; Extreme Abuse Resistant Drywall with M2Tech."
    b. Georgia Pacific Gypsum; "Tough Rock Abuse-Guard."
    c. National Gypsum Company; "Gold Bond BRAND Hi-Abuse XP Gypsum Board."
    d. USG Corporation; "SHEETROCK Brand Mold Tough AR."

7. Locations: All walls, soffits, etc., in classrooms, corridors, administration offices, and general use spaces and as indicated on Drawings.

2.2 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

    a. Cornerbead.
    b. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    c. Expansion (control) joint.

2.3 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

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1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 INSTALLATION AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

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D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

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C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. U-Bead: Use at exposed panel edges and where indicated.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: For concealed areas of fire-resistive-rated assemblies, sound rated assemblies, areas receiving heavy-textured finish.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Division 09 Section "Painting & Finishing."

5. Level 5: Where indicated on Drawings.

    a. Primer and its application to surfaces are specified in Division 09 Section "Painting & Finishing."
    b. On moisture- and mold-resistant gypsum board scheduled to be painted.
    c. On abuse- and impact-resistant gypsum board scheduled to be painted.

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 29 00

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SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.3 UNIT PRICES

A. Specific work of this section is itemized as Unit Prices on the Bid Form to add or deduct specific units of work to the project. Unit Price descriptions, requirements and units of work are enumerated in Division 01 Section "Unit Prices". Unit Prices are inclusive of all labor, materials, overhead and profit per unit of work indicated.

1.4 ALLOWANCES

A. Work Included in Base Bid: The Contractor shall include in the space provided on the Bid Form, the allowances for work of this section itemized on the Bid Form. The cost of these quantities shall be computed using the Unit Prices stated on the Bid Form. The work listed is in addition to that required to complete the work of the Contract and, consequently, the sum therefore may be deducted from the Contract amount if the corresponding work is not required by actual conditions encountered.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, minimum 6 inches in size of specified acoustical panel and 8 inch long samples of moldings and suspension systems.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: Manufacturer's certification that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material shall carry an approved independent laboratory classification.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

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1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.9 QUALITY ASSURANCE

A. Source Limitations: Obtain each set of linear metal pans and suspension systems from one source with resources to provide products of consistent quality in appearance, physical properties, and performance.

B. Surface-Burning Characteristics: Complying with ASTM E 1264 for Class A materials, as determined by testing identical products according to ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical ceiling area as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Installer Qualifications: Firm with not less than 3 years of successful experience in installation of acoustical ceilings similar to requirements for this project and has a successful record of installation in accordance with the manufacturer's installation requirements.

1.10 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review specification requirements.
2. Review installation procedures.
3. Inspect project conditions.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages that indicate UL classification on product label. Store acoustical panels, suspension-system components and accessories in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

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1.12 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.13 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace acoustical panel ceiling components that fail in materials or workmanship within the specified warranty period:

1. Failures include, but are not limited to, the following:

a. Acoustical panels that sag, warp or growth of mold or mildew on panels to resist antimicrobial growth.
b. Grid: Rust and manufacturer's defects.

2. Warranty Period: As indicated for each product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

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E. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.3 ACOUSTICAL PANELS

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

B. Mineral Fiber: Provide panels complying with ASTM E 1264 as follows:

1. Material: Wet Formed Mineral Fiber; Type III, Form 2, Pattern C D.
2. Texture: Medium.
3. Finish: Factory-applied Latex paint.
4. Edge Profile: Square, Lay-in.
5. Thickness: 5/8-inch.
6. Color: White.
7. Light Reflectance: .80
8. Noise Reduction Coefficient: .55
9. Warranty Period: 1 year.
10. Products:

    a. Armstrong: Cortega – 769/770.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

2.5 METAL SUSPENSION SYSTEM

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

1. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. Rockfon.
4. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to

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ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges. Main beams and cross tees shall have rotary stitching.

1. Structural Classification: Heavy-duty system.
2. Face Design: Flat, flush.
3. Cap Material: Steel cold-rolled sheet.
4. Cap Finish: Painted white to match ceiling tile.
5. Warranty: 10 years.

2.6 METAL EDGE TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.

B. Trim Accessories: Provide Manufacturer’s premanufactured outside corner pieces for use at bullnose masonry gypsum board assemblies.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

B. Coordination: Perform the following prior to installing ceiling grid:

1. Review reflected ceiling plans, lighting plans, ductwork plans, sprinkler shop drawings, electrical systems plans, coordination drawings, and other applicable project drawings prior to installing ceilings.
2. Confirm ceiling elevations and main runner locations with all Contractors with work located in or above the ceiling.
3. Report any conflicts promptly to the Architect in writing.

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4. Proceed with grid installation only after all conflicts have been resolved. Conflicts realized during installation will require removal and reinstallation of the ceiling grid at the Contractors expense.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. After installation of suspension-system, acoustical panels shall not be installed until after Architect has performed above ceiling inspection and all deficiencies have been rectified. Acoustical ceiling panels installed prior to this shall be removed at the Contractors expense.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Install hold-down clips in areas with fire-resistance rated ceilings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
2. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

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G. Install premanufactured outside corner pieces neatly and securely on all outside corners at masonry and gypsum wallboard assemblies. Inside corners shall be accurately and cleanly mitered and securely connected.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

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SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

B. Related Sections:

1. Division 03 Section "Hydraulic Cement Underlayment" for leveling compound.

1.3 UNIT PRICES

A. Specific work of this section is itemized as Unit Prices on the Bid Form to add or deduct specific units of the work to the project. Unit Price descriptions, requirements and units of work are enumerated in Division 01 Section "Unit Prices". Unit Prices are inclusive of all labor, materials, overhead and profit per unit of work indicated.

1.4 ALLOWANCES

A. Work included in the Base Bid: The Contractor shall include in the space provided on the Bid Form, the allowances for work of this Section as itemized on the Bid Form. The cost of these quantities shall be computed using Unit Prices stated on the Bid Form. The Work of the Allowance is in addition to that required to complete the Work of the Contract. Subsequently, the sum or any unused portion thereof, shall be deducted from the Contract if the corresponding work is not required by actual conditions encountered.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

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E. Product Schedule: For resilient base and accessory products.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

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

1. Flexco.
2. Johnsonite; a Tarkett company.
3. Roppe Corporation, USA.
4. Mannington Mills, Inc.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style: Cove.

C. Thickness: 0.125 inch.

1. Height: 4 inches and 6 inches as indicated.

D. Lengths: Coils in manufacturer's standard length.

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E. Outside Corners: Job formed or preformed.

F. Inside Corners: Job formed or preformed.

G. Colors: As selected by Architect from full range of industry colors.

2.2 VINYL MOLDING ACCESSORIES

A. Basis of Design: Subject to compliance with requirements, Vinyl Molding Accessories incorporated into the project shall be based on references of model numbers and in Description section below on products by:

1. Roppe Corporation.

a. Tile Reducer: Roppe #172.
b. Tile to Tile (dissimilar materials): Roppe #154.
c. Uneven Flooring Transition: Roppe Subfloor Leveler.

B. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor may provide products from the following manufacturers that meet or exceed the published data of the specified Basis of Design product:

1. Flexco.
2. Johnsonite; A Tarkett Company.
3. Mannington Mills, Inc.

C. Profile: As indicated.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

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1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

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2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 13

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SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Luxury vinyl floor tile.

B. Related Sections:

1. Division 03 Section "Hydraulic Cement Underlayment" for leveling compound for all new resilient flooring applications.

1.3 UNIT PRICES

A. Specific work of this section is itemized as Unit Prices on the Bid Form to add or deduct specific units of work to the project. Unit Price descriptions, requirements and units of work are enumerated in Division 01 Section "Unit Prices". Unit Prices are inclusive of all labor, materials, overhead and profit per unit of work indicated.

1.4 ALLOWANCES

A. Work included in the Base Bid: The Contractor shall include in the space provided on the Bid Form, the allowances for work of this Section as itemized on the Bid Form. The cost of these quantities shall be computed using Unit Prices stated on the Bid Form. The Work of the Allowance is in addition to that required to complete the Work of the Contract. Subsequently, the sum or any unused portion thereof, shall be deducted from the Contract if the corresponding work is not required by actual conditions encountered.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples for Initial Selection: For each type of floor tile indicated.

D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

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1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.10 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review specification requirements.
2. Review concrete slab moisture content.
3. Confirm specification requirements for floor flatness conform to project requirements on new concrete slabs and review floor leveler installation on existing concrete slabs.
4. Review installation procedures.
5. Review project schedule.
6. Review floor protection measures to be implemented after installation.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.12 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.

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3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL FLOOR TILE (LVT)

A. Basis of Design: Subject to compliance with requirements, luxury vinyl floor tile incorporated into the Project shall be based on products as follows:

1. Mannington Mills, Inc.; Spacia Xpress “Abstract,” “Stone,” and/or “Wood” Styles.

B. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor may provide products from the following manufacturers that meet or exceed the published data of the specified Basis of Design product.

1. Interface Flooring: “Steady Stride,” “Studio Set,” and/or “Level Set” Collections.
2. Mohawk Group: “Living Local,” “Premium Wood,” “Stones,” and/or “Terrazzo” Collections.

C. Tile Standard: ASTM F 1700.

1. Class: Class III, printed film vinyl tile.
2. Type: B, embossed surface.

D. Thickness: Minimum 2.5 mm.

E. Wear Layer Thickness: Minimum 20 mils.

F. Size: 7 1/4” x 48”, 18” square and 12” x 18”, depending on style selected.

G. Retain “Seamless-Installation Method” Paragraph below for seamless installation. Generally, only some large-size tiles can be heat welded or chemically bonded. See “General Comments” Article in the Evaluations for a discussion of seamless installation.

H. Colors and Patterns: As selected by Architect from full range of industry colors.

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2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Blended hydraulic-cement-based formulation as specified in Division 03 Section "Hydraulic Cement Underlayment" provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

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

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings, marks, dyes, paints, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound as specified in Division 03 Section "Hydraulic Cement Underlayment"; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

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1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern) and in pattern of colors and sizes indicated.

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

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

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

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

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

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

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D. Cover resilient tile flooring with paper-type roll goods acceptable to manufacturer until Substantial Completion.

END OF SECTION 09 65 19

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SECTION 09 91 00 – PAINTING AND FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on substrates.

B. Related Requirements:

1. Requirements for preparing, priming, painting, and finishing are included throughout the Specifications. All Specification Sections shall be reviewed for painting and finishing requirements.

1.3 DEFINITIONS

A. Gloss Level 1 (Matte Flat Finish): Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2 (Velvet-Like Flat Finish): Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3 (Eggshell Finish): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4 (Satin Finish): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5 (Semi-Gloss Finish): 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6 (Gloss Finish): 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7 (High-Gloss Finish): More than 85 units at 60 degrees, according to ASTM D 523.

1.4 UNIT PRICES

A. Specific work of this section is itemized as Unit Prices on the Bid Form to add or deduct specific units of work to the project. Unit Price descriptions, requirements and units of work are enumerated in Division 01 Section "Unit Prices." Unit Prices are inclusive of all labor, materials, overhead, and profit per unit of work indicated.

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1.5 ALLOWANCES

A. Work Included in Base Bid: The Contractor shall include in the space provided on the Bid Form, the allowances for work of this section itemized on the Bid Form. The cost of these quantities shall be computed using the Unit Prices stated on the Bid Form. The work listed is in addition to that required to complete the work of the Contract and, consequently, the sum therefore may be deducted from the Contract amount if the corresponding work is not required by actual conditions encountered.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

1. Submit manufacturer's standard "fan deck" of colors.
2. Architect will request Samples for Verification after receipt of manufacturer's "fan deck."

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.
5. Architect will furnish color schedule approximately 10 weeks after receipt of samples and other color-dependent submittals of other specification sections.

D. Product List: For each product indicated, include the following:

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

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 10 percent, but not less than 5 gal. of each material and color applied.

1.8 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site.

1. Review specification requirements.
2. Review installation procedures, including review of proper preparation of existing wall surfaces as indicated in the MPI Maintenance & Repainting Manual.
3. Inspect project conditions, including existing wall surfaces which require cleaning and spackling as part of the work.

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1.9 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to those indicated for the Project that have resulted in a construction record of successful in-service performance.

B. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

C. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue with manufacturer's data.
2. Remove rags and waste from storage areas daily.
3. Protect product from freezing.

1.11 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in rain, snow, fog, mist, or when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Where moisture is present, the general contractor shall provide the necessary ventilation to establish appropriate condition. Should the surface be too dry for the product application, the painting contractor shall provide the necessary methods to establish the appropriate conditions.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. The Sherwin Williams Company (SW).
2. PPG PAINTS Architectural Coatings (PPG).

2.2 PAINT, GENERAL

A. Material Compatibility:

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

B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

C. Colors: As selected by Architect from manufacturer's full range.

1. Interior Work: A maximum of 8 different pigmented colors will be used, with variations for trim, wall surfaces, wainscots, and graphics.
2. Dark Tones: A maximum of 4 dark tones will be used as accent colors for the interior.

D. Multiple Colors: Each room or space may have walls of more than one color. The right is reserved to vary the color after the first coat.

E. Color Guarantee: Painting Contractor shall guarantee all in-place paint and stain colors to match colors selected. Obtain copies of standard color charts used, and be certain all in-place paint and stain colors closely match selected colors. Surfaces which fail to pass color inspection shall be repainted at no additional cost to Owner.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

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

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. General: All areas listed in the Room Finish Schedule as receiving paint (i.e. walls, ceilings, etc.) shall be inclusive of all non-factory finished surfaces. All costs of preparation, cleaning, protection, priming, finishing, cleaning, etc. shall be included for all surfaces (wall, trim, moldings, frames, etc.) and materials (metal, wood, CMU, plaster, gypsum board, etc.) unless specifically noted otherwise. All work shall be in accordance with these Specifications and instructions in the Contract Documents.

B. Comply with manufacturer's written instructions and recommendations in "MPI Manual" and "Maintenance & Repainting Manual" as applicable to substrates indicated.

C. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

D. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
2. Clean existing surfaces of residue and miscellaneous applied finishes to provide a properly prepared surface to receive new finish.
3. Spackle holes, depressions and imperfections on existing gypsum board, concrete and plaster surfaces as recommended by manufacturer to provide a uniform surface to receive new finish.

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E. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

F. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

G. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer**.**

H. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

I. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

J. Aluminum Substrates: Remove loose surface oxidation.

K. Wood Substrates for Painting:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and according to recommendations in "MPI Manual."

1. Materials shall be applied with roller or brush, except that spraying will be permitted for items such as mechanical equipment, grilles, or similar items. Mask off adjoining areas not receiving a spray finish against overspray.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on existing surfaces painted previously or on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

    a. Spot prime where required or provide alternative preparation product as recommended by manufacturer.

B. Apply stains and finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.

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3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. If, in the opinion of the Architect, adequate block filler, primer, paint or coating coverage is not provided, Contractor shall apply additional coats to satisfy Architect, at no additional cost to the Owner.

D. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

E. Apply paints, stains and finishes to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

F. Paint exposed surfaces whether or not colors are designated in "schedules", except where natural finish of materials is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas. If color or finish is not designated, Architect will select these from standard colors available for materials systems specified.

G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint all new and existing mechanical and electrical work where exposed in occupied spaces including, but not limited to:

   a. Equipment not prefinished.
   b. Uninsulated metal piping, except chrome finished.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Electrical conduit, boxes, raceways and trays.
   f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   g. Other items as directed by Architect.

2. Mechanical and electrical items to be painted shall be finished the color(s) of the adjacent surface unless noted otherwise. Any questions regarding the color(s) to be provided shall be submitted to the Architect for clarification.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

   a. Color: SW 6991 "Black Magic".

H. Painting Frames: Hollow metal shall be painted different colors on each side of the door (split frames) unless indicated otherwise.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

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3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 PAINTING AND FINISHING SCHEDULE

A. Concrete and Masonry Substrates

1. Interior, Latex, Non-Traffic Surfaces: Gloss Level 3

a.	SW	Filler (masonry):	PrepRite Block Filler (B25W25)
		Primer (concrete):	Loxon Masonry Primer
		1st coat:	ProMar 200 Zero VOC
		2nd coat:	ProMar 200 Zero VOC
b.	PPG	Filler (masonry):	SPEEDHIDE Hi Fill Latex Block Filler 6-15X1 Series
		Primer (concrete):	SEAL GRIP Acrylic Universal Primer 17-921 Series
		1st coat:	SPEEDHIDE Zero 6-5310 Series
		2nd coat:	SPEEDHIDE Zero 6-5310 Series

B. Metal Substrates:

1. Interior, Ferrous Metals, Latex: Gloss Level 5

a.	SW	Primer*:	DTM Primer / Finish
		1st coat:	DTM Acrylic Finish
		2nd coat:	DTM Acrylic Finish
b.	PPG	Primer*:	Pitt Tech Plus DTM Industrial Primer 4020
		1st coat:	Pitt Tech Plus EP DTM Acrylic Semi-Gloss 90-1610 Series
		2nd coat:	Pitt Tech Plus EP DTM Acrylic Semi-Gloss 90-1610 Series

*Spot prime where metals are shop coated or primed

C. Wood Substrates:

1. Interior, Latex Paint System: Gloss Level 5

a.	SW	Primer:	ProMar 200 Zero VOC Primer
		1st coat:	ProMar 200 Zero VOC
		2nd coat:	ProMar 200 Zero VOC

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b. PPG
- Primer: SEAL GRIP Universal Primer 17-921 Series
- 1st coat: SPEEDHIDE Zero 6-5510
- 2nd coat: SPEEDHIDE Zero 6-5510

D. Gypsum Board and Plaster Substrates:

1. Interior, Latex Paint System: Gloss Level 3

a. SW
- Primer: ProMar 200 Zero VOC Primer
- 1st coat: ProMar 200 Zero VOC
- 2nd coat: ProMar 200 Zero VOC

b. PPG
- Primer: SPEEDHIDE Zero Primer 6-4900XI
- 1st coat: SPEEDHIDE Zero 6-5310 Series
- 2nd coat: SPEEDHIDE Zero 6-5310 Series

END OF SECTION 09 91 00

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SECTION 10 11 00 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Markerboards.
2. Tackboards.

B. Related Sections:

1. Division 10 Section "Tackable Wall Panels" for cellulose fiberboard wall panels.

1.3 DEFINITIONS

A. Tackboard: Framed or unframed, tackable, visual display board assembly.

B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.

C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

1. Include rated capacities, operating characteristics, electrical characteristics and individual panel weights for sliding visual display units.
2. Include computer system requirements for electronic markerboards.

B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of panel joints.
2. Include sections of typical trim members.

C. Samples for Initial Selection: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:

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1. Actual sections of porcelain-enamel face sheet and tackboard assembly.
2. Include accessory Samples to verify color selected.

D. Product Schedule: For visual display surfaces. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of motor-operated, sliding visual display units required for this Project.

B. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

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

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 Insert value or less.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

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1.10 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Visual Display Units: Subject to compliance with requirements, provide markerboard assemblies and tackboard assemblies, accessories and support materials by one of the following manufacturers:

1. Aywon.
2. Claridge Products.
3. Platinum Visual Solutions.
4. PolyVision Corporation.

B. Porcelain-Enamel Face Sheet: ASTM A 424, enameling-grade steel, uncoated thickness indicated; with exposed face and edges coated with primer, 1.7-to-2.5-mil- thick ground coat, and color cover coat; and with concealed face coated with primer and 1.7-to-2.5-mil- thick ground coat.

1. Gloss-Finish Cover Coat: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser. Minimum 3.0-to-4.0-mil- thick cover coat. Cover and ground coats shall be fused to steel at manufacturer's standard firing temperatures but not less than 1475 deg F.

a. Products: Subject to compliance with requirements, provide the following:

1) PolyVision Corporation, a Steelcase Company; e^3 ceramicsteel Markerboard.

C. Plastic-Impregnated Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.

D. Hardboard: ANSI A135.4, tempered.

E. Particleboard: ANSI A208.1, Grade M-1.

F. Fiberboard: ASTM C 208.

G. Extruded Aluminum: ASTM B 221, Alloy 6063.

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2.2 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- thick, porcelain-enamel face sheet with low-gloss finish.

1. Hardboard Core: 1/2 inch thick; with 0.015-inch- thick, aluminum sheet backing.
2. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

2.3 TACKBOARD ASSEMBLIES

A. Vinyl-Fabric-Faced Tackboard: 1/4-inch- thick, vinyl-fabric-faced cork sheet factory laminated to 1/4-inch-thick particleboard backing.

2.4 MARKERBOARD AND TACKBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; 1-inch-1-1/2 inch wide.

B. Chalktray: Manufacturer's standard, continuous, extended under adjacent tackboards, unless indicated otherwise.

1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

C. Map Rail: Provide the following accessories:

1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches wide.
2. End Stops: Located at each end of map rail.
3. Map Hooks: Two map hooks for every 48 inches of map rail or fraction thereof.
4. Flag Holder: One for each room.
5. Paper Holder: Extruded aluminum; designed to hold paper by clamping action.

2.5 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.
3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.

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4. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.6 GENERAL FINISH REQUIREMENTS

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

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

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

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.

C. Examine walls and partitions for proper preparation and backing for visual display surfaces.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

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C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

1. Prime wall surfaces indicated to receive direct-applied, visual display tack wall panels and as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
2. Prepare substrates indicated to receive visual display wall covering as required by manufacturer's written instructions to achieve a smooth, dry, clean, structurally sound surface that is uniform in color.

a. Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.
b. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer.
c. Painted Surfaces: Treat areas susceptible to pigment bleeding.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, review mounting heights with Architect. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches o.c.

a. Attach chalktrays to boards with fasteners at not more than 12 inches o.c.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

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SECTION 10 11 23 – TACKABLE WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Tackable cellulose fiberboard wall panels.
2. Installation accessories including adhesives and mechanical fasteners.

B. Related Sections:

1. Division 09 Section "Painting and Finishing” for requirements for tackable wall panels indicated to be painted.
2. Division 10 Section "Visual Display Surfaces” for markerboard and tackboard assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product specified, including manufacturer's technical data sheets, installation instructions, and maintenance recommendations.

B. Shop Drawings: Showing layout and installation details, including joint configurations, edge trim, and spacing of fasteners.

C. Samples for Verification: 6-by-6-inch samples of each type of tackboard panel showing texture, finish, and thickness.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: A company specializing in manufacturing products specified in this Section with a minimum of ten (10) years of documented experience.
2. Installers: Individuals that are thoroughly familiar with the product and the manufacturer’s installation requirements.

B. Fire-Test-Response Characteristics: Provide materials with fire-test-response characteristics indicated as determined by testing identical products per ASTM E-84 by a testing and inspecting agency acceptable to authorities having jurisdiction.

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1.5 MOCKUPS

A. Build mockups to set quality standards for installation.

1. Build mockup full height, at least two panels wide with all edge conditions completed.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturer's labels intact.

B. Store panels flat in a dry, enclosed space, protected from weather and direct sunlight. Elevate panels off the floor on sleepers.

1.7 FIELD CONDITIONS

A. Environmental Requirements: Condition panels by removing from packaging and acclimating them to the temperature and humidity conditions of the installation space for a minimum of 24 hours prior to installation.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Basis of Design: Subject to compliance with requirements, tackable wall panels incorporated into the project shall be based on products and systems as follows:

1. Subject to compliance with requirements, provide Homasote PINnacle™ 440 as manufactured by Homasote Company, West Trenton, NJ 08628; Telephone: (800) 257-9491; Website: www.homasote.com.

B. Porcelain-Enamel Face Sheet: ASTM A 424, enameling-grade steel, uncoated thickness indicated; with exposed face and edges coated with primer, 1.7-to-2.5-mil- thick ground coat, and color cover coat; and with concealed face coated with primer and 1.7-to-2.5-mil- thick ground coat.

1. None.

2.2 TACKABLE WALL PANELS

A. Material Composition: Homogeneous cellulosic fiberboard manufactured from 100% recycled paper/wood fibers, bonded with paraffin wax.

B. Physical Properties:

1. Thickness: 1/2-inch nominal.
2. Density: 26 to 28 lb/cu. ft. (400 to 460 kg/m³) per ASTM C208.
3. Tensile Strength: When tested in accordance with ASTM C 209:

a. Parallel: 450-700 psi (3,100-4,830 kPa).

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b. Transverse: 750-1000 psi (5.1171-6.894 kPa).

4. Water Absorption by Volume: When tested in accordance with ASTM C 209: 2-hour immersion: 7% maximum.
5. Expansion: 50% to 90% relative humidity, 0.25 percent in accordance with ASTM C 209.
6. Thermal Resistance: When tested in accordance with ASTM C 209 per ASTM C 518: R-value: 1.2 for 1/2-inch-thick board.
7. Noise reduction coefficient (NRC): 0.20
8. Flame Spread: 76 to 200 tested in accordance with ASTM E 84, Class III or C.
9. Panel Size: 4 feet by 8 feet.
10. Edge Profile: Square edges.
11. Finish: Unfinished, sanding-refined decorative surface suitable for painting or direct use.

C. Fire-Test-Response Characteristics: Class III or C Surface Burning Characteristics per ASTM E-84 (Flame Spread Index 76-200, Smoke Developed Index 0-450).

2.3 ACCESSORIES

A. Adhesives: Low-VOC, high-strength panel adhesive recommended by the manufacturer for bonding cellulosic fiberboard to substrate material.

B. Mechanical Fasteners: Non-corrosive, coarse-thread drywall screws or ring-shank nails of length sufficient to penetrate wood studs or steel tracking at least 3/4 inch.

1. Metal Framing: 22- to 25-gauge, drywall type steel screw.

C. Joint and Edge Trim: Manufacturer’s standard aluminum J-trim, H-driver, and/or custom trim as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the work.

B. Retain any materials that are wet, moisture damaged, or mold damaged. Verify that substrate surfaces are clean, dry, flat, and structurally sound prior to installation.

C. Examine roughing-in for electrical devices to verify actual locations of connections before installation.

D. Verify framing member spacing complies with manufacturer’s requirements for substrates and installation methods.

E. Verify that environmental conditions are, and will continue to be maintained in accordance with manufacturer’s recommendations.

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

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3.2 PREPARATION

A. Clean substrates of dust, oil, grease, or other contaminants that may affect adhesive bonding.

B. Ensure panels have completed the required acclimation period within the installation workspace. Separate and allow panels to be exposed to environmental temperature and humidity conditions for not less than 24 hours before start of installation.

3.3 INSTALLATION

A. General: Install tackable wall panels straight, plumb, and level in accordance with manufacturer's written instructions. Wet panels or panels that exhibit exposure to moisture shall not be installed.

B. Field Layout: Arrange panels symmetrically on walls, minimizing small cut pieces. Plan joints to occur over framing members where applicable.

C. Install blocking for any devices to mounted integrally with or after the installation of the tackable wall panels.

D. Mechanical Fastening: Space fasteners 3/8 inch from panel edges and 6 inches on center along boundaries; space 12 inches on center over intermediate framing supports.

E. Joint Configurations: Maintain a 1/8-inch expansion gap between panels to account for seasonal relative humidity fluctuations, or fit joints tight where decorative trim or fabric wrap wraps boundaries.

3.4 CLEANING AND PROTECTION

A. Prior to painting, Contractor shall clean all surfaces using a vacuum or soft brush to remove dust and installation debris.

B. Contractor shall touch up minor abrasions or surface damage according to manufacturer’s instructions or replace panels that cannot be repaired to pristine condition.

C. Protect installed tackboard panels from damage by subsequent construction activities until final acceptance of the Project.

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SECTION 10 14 23 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Panel signs.

B. Related Requirements:

1. Division 22 Section "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
2. Division 23 Section "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
3. Division 26 Section "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
4. Division 26 Section "Emergency and Exit Lighting" for illuminated, self-luminous, and photoluminescent exit sign units.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

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1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Full-size Sample.

E. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL SIGNS

A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Basis-of-Design Product: Subject to compliance with requirements, Panel Signs incorporated into the project shall be based on products as follows:

a. Mohawk Sign Systems, Inc.; "200A Sand Carved" Series.

B. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor shall provide products from one of the following manufacturers that meet or exceed the published data of the specified Basis of Design product.

1. APCO Graphics, Inc.
2. ASI Sign Systems, Inc.
3. Best Sign Systems, Inc.
4. Bunting Graphics, Inc.

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5. inpro Corporation.
6. Mohawk Sign Systems.
7. Nelson-Harkins Industries.

C. Solid-Sheet Sign: Sandblasted, plastic laminate with contrasting core color as follows:

1. All signs shall be manufactured by sandblasting sign face to a depth of 1/32-inch for tactile characters and Grade 2 braille. Laminated or applied letters, characters, or braille are not acceptable.
2. All text shall be accompanied by Grade 2 braille which shall be separated from the corresponding raised characters or symbols to comply with prevailing regulations. Accurate Grade 2 braille translation shall be provided by signage manufacturer.
3. All text, characters, symbols, etc. shall contrast with their background, either light characters on a dark background or dark characters on a light background. Characters and background shall have a non-glare finish.
4. Sign panel material shall be melamine plastic laminate, minimum 1/8-inch thick with contrasting core color. Melamine shall be non-static, fire-retardant and self-extinguishing and shall be impervious to acids, alkalis, alcohol, solvents, abrasives and boiling water.

D. Sign-Panel Perimeter: Finish edges smooth.

1. Edge Condition: Square cut.
2. Corner Condition in Elevation: Square.

E. Mounting: Manufacturer's standard method for substrates indicated with countersunk flathead stainless steel torx fasteners.

F. Text and Typeface: Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color.

1. Font: Helvetica.

G. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

2.2 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:

1. Exposed Metal-Fastener Components, General:

a. Fastener Heads: For nonstructural connections, use flathead screws and bolts with tamper-resistant slots.

2.3 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

2.4 GENERAL FINISH REQUIREMENTS

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

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B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods:

1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23

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SECTION 10 26 13 – CORNER GUARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Corner guards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include example top caps.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of corner guard product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 84-inch- long units.

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2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store corner guards in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers in a vertical position.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARDS

A. Surface-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.

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1. Basis of Design: Subject to compliance with requirements, Corner Guards incorporated into the project shall be based on products as follows:

    a. IPC Door and Wall Protection Systems; Division of InPro Corporation; "Surface-Mount Corner Guard Model 160."

2. Acceptable Manufacturers: Subject to compliance with requirements, in lieu of the Basis of Design manufacturer, Contractor may provide products from the following manufacturers that meet or exceed the published data of the specified Basis of Design product and are in compliance with the requirements of this section.

    a. Construction Specialties, Inc.
    b. Korogard Wall Protection Systems; a Division of RJF International Corporation.

3. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; as follows:

    a. Profile: Nominal 2-inch-long leg and 1/4-inch corner radius.
    b. Height: 8 feet unless indicated otherwise on Drawings.
    c. Color and Texture: As selected by Architect from manufacturer's full range.

4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.4 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.5 FABRICATION

A. Fabricate corner guards according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

2.6 FINISHES

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

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which corner guards will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

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

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing corner guards.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install corner guards according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install corner guards in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Adjust end and top caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

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SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Owner-Furnished Material: Paper towel and soap dispenser.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for blocking required to mount Owner’s supplied accessories.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Owner-supplied accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

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SECTION 10 44 15 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers, mounting brackets and fire extinguisher cabinets.

1. Portable fire extinguishers.
2. Fire extinguisher brackets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, rating and material classification descriptions, dimensions of individual components and profiles, and finishes for fire extinguishers and mounting brackets.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

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1. Failures include, but are not limited to, the following:

    a. Failure of hydrostatic test according to NFPA 10.
    b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire extinguisher cabinet and mounting bracket indicated.

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

    a. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
    b. Kidde; Carrier Global Corporation.
    c. Larsen's Manufacturing Company.
    d. Potter Roemer LLC; a Division of Morris Group International.

2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 FIRE EXTINGUISHER BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

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

    a. Badger Fire Protection; a Kidde company.
    b. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    c. Larsen's Manufacturing Company.
    d. Potter Roemer LLC.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

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a. Orientation: Horizontal or Vertical as directed by Owner.

2.4 GENERAL FINISH REQUIREMENTS

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

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.2 PREPARATION

A. Prepare recesses for semirecessed fire extinguisher cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

3.4 FIRE EXTINGUISHER SCHEDULE

A. Drawing Designation: FEB

1. Fire Extinguisher: Multipurpose Dry Chemical Type in Steel Container.
2. Mounting: Fire Extinguisher Bracket.

END OF SECTION 10 44 15

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SECTION 12 32 16 - PLASTIC-LAMINATE-FACED CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes plastic-laminate-faced cabinets and accessories of stock design and modified as indicated.

B. Related Requirements:

1. Division 06 Section "Rough Carpentry" for wood blocking for anchoring casework.
2. Division 06 Section "Finish Carpentry" for plastic-laminate-clad countertops," "simulated stone countertops (Quartz)," and for epoxy countertops.
3. Division 09 Section "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.
4. Division 09 Section "Resilient Base and Accessories" for resilient base applied to plastic-laminate-faced casework.
5. Division 22 Sections for sinks installed in plastic laminate-faced casework.

1.3 ALTERNATE BIDS

A. Plastic-Laminate-Faced Casework as manufactured by Stevens Industries, Inc. is not included in the Base Bid. Provide alternate prices for the total change in cost to provide plastic-laminate-faced casework by one of the listed manufacturer's products in the space provided on the Bid Form for items of work as scheduled hereinafter, and in accordance with the following requirements:

1. All work to be performed under accepted alternate prices shall conform to the applicable Contract Documents, and shall include all work in connection with or consequent to the alternate price work to produce a complete installation. Work associated with countertops in rooms with plastic-laminate-faced casework shall be considered part of the Alternate Bid Series.
2. Alternate prices shall be all inclusive of the cost of materials, work and profit, supervision, administration, and any and all other costs in connection therewith for work in place and accepted or omitted as the case may be, and shall hold for the same period as the bid.
3. Coordinate related work and modify or adjust adjacent work as necessary to ensure that work affected by the accepted Alternate is complete and fully integrated into the project. All costs to modify or adjust the adjacent work of other trades for a complete installation shall be included in the Alternate Bid.
4. Alternate Bids shall be inclusive of all costs to provide all countertops, backsplashes, and wall caps.

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1.4 DEFINITIONS

A. Definitions in the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" apply to the work of this Section.

1.5 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware. Show installation details, including field joints and filler panels. Indicate manufacturer's catalog numbers for casework.

C. Keying Schedule: Include schematic keying diagram and index each key set to unique designations that are coordinated with the Contract Documents.

D. Samples for Initial Selection: For cabinet finishes.

E. Samples for Verification: 8-by-10-inch Samples for each type of finish.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Quality Standard: AWI Certified manufacturer.

C. Sample Warranty: For special warranty.

1.8 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review specification requirements.
2. Review installation procedures.
3. Inspect project conditions.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Field Conditions" Article.

B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

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1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete, and HVAC system is operating or adequate temporary controls are in place to maintain temperature and relative humidity at occupancy levels during the remainder of the construction period. Maintain temperature and relative humidity during the remainder of the construction period in range recommended for Project location by the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of components or other failures of glue bond.
b. Warping of components.
c. Failure of operating hardware.

2. Warranty Period: Three (3) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Subject to compliance with requirements, Plastic-Laminate-Faced Casework incorporated into the Project shall be based on products of the following manufacturer as indicated:

1. Stevens Industries, Inc.; "1200 Series" and items scheduled on the Drawings.

B. Alternate Series A1200: The alternate bid manufacturers listed shall provide products in accordance with this Section and products that meet or exceed the minimum standards of quality of the Basis of Design manufacturer's specified products. Provide Plastic-Laminate-Faced Casework from one of the following manufacturers as included in Alternate Series A1200.

1. Alt. No. A1201: Stevens Industries, Inc. (Basis of Design)
2. Alt. No. A1202: Case Systems.
3. Alt. No. A1203: TMI Systems Design Corporation.

C. Source Limitations: Obtain plastic-laminate-faced cabinets from single manufacturer.

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2.2 CASEWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.

1. Grade: Premium.

B. Product Designations: Drawings indicate sizes, configurations, and finish materials of manufactured plastic-laminate-faced cabinets by referencing basis of design manufacturer's catalog numbers. Alternate bid manufacturers' casework shall be of equal or approximate sizes, door and drawer configurations, same finish materials, and comply with the Specifications.

2.3 CASEWORK

A. Design:

1. Flush overlay.

B. Grain Direction for Wood Grain Plastic Laminate:

1. Vertical on doors, horizontal on drawer fronts.
2. Lengthwise on face frame members.
3. Vertical on end panels.
4. Side to side on bottoms and tops of units.
5. Vertical on knee-space panels.
6. Horizontal on aprons.

C. Exposed Materials:

1. Plastic Laminate: Grade HGS.

a. Colors and Patterns: As selected by Architect from manufacturer's full range.

2. Unless otherwise indicated, provide specified edgebanding on all exposed edges.

D. Semiexposed Materials:

1. Plastic Laminate: Grade VGS unless otherwise indicated. Provide plastic laminate for semiexposed surfaces unless otherwise indicated.

a. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

2. Hardboard: Use only for cabinet backs where exterior side of back is not exposed.
3. Unless otherwise indicated, provide specified edgebanding on all semiexposed edges.

E. Concealed Materials:

1. Solid Wood: Any hardwood or softwood species, with no defects affecting strength or utility.
2. Plywood: Hardwood plywood.
3. Plastic Laminate: Grade BKL.
4. Particleboard.
5. MDF.

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2.4 MATERIALS

A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

B. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.

C. Softwood Plywood: DOC PS 1.

D. Particleboard: ANSI A208.1, Grade M-2.

E. MDF: ANSI A208.2, Grade 130.

F. Hardboard: ANSI A135.4, Class 1 Tempered.

G. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

H. Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, 1 mm thick elsewhere.

I. Glass for Glazed Doors: Clear laminated tempered glass complying with ASTM C 1172, Kind LT, Condition A, Type I, Class I, Quality-Q3; with two plies not less than 3.0 mm thick and with clear, polyvinyl butyral interlayer.

2.5 COLORS AND FINISHES

A. Plastic-Laminate Colors, Patterns, and Finishes: As selected by Architect from plastic-laminate manufacturer's full range in the following categories:

1. Solid colors.
2. Wood grains.
3. Patterns.

B. PVC Edgebanding Color: As selected from casework manufacturer's full range.

C. A maximum of 10 laminates will be selected and a maximum of 6 edgebands will be selected.

2.6 FABRICATION

A. Construction: Provide plastic-laminate laboratory casework of the following minimum construction unless noted otherwise:

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch- thick particleboard.
2. Sink Bases: 3/4-inch – thick MDF.
3. Shelves: 3/4-inch- thick particleboard up to 36 inches in length and 1-inch-thick particleboard for shelves 36 inches and longer.
4. Exposed Backs of Cabinets: 1/2-inch- thick particleboard or MDF.
5. Backs of Cabinets: 1/4-inch MDF.
6. Mounting Frames: 3/4-inch- thick particleboard with a minimum of two dowel pins per frame end joint.
7. Boxes (toe kicks): 3/4-inch exterior grade plywood.
8. Glazed Door Frames: 3/4-inch, one-piece panel with cutout for insertion of glass pane, held in place with extruded two trim mounting with removable back bead.

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9. Drawer Fronts: 3/4-inch- thick particleboard.
10. Drawer Sides and Backs: 3/4-inch- thick particleboard.
11. Drawer Bottoms: 1/4-inch MDF glued and dadoed into front, back, and sides of drawers.

B. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

2.7 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard finish, commercial-quality, heavy-duty hardware.

1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.
2. Color and finish to be selected from manufacturer's full range of colors and finishes.

B. Butt Hinges: Steel, semiconcealed, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.

C. Pulls: Solid wire pulls, fastened from back with two screws. For sliding doors, provide recessed stainless-steel or chrome-plated flush pulls. Provide two pulls for drawers more than 24 inches wide.

D. Door Catches: Nylon-roller spring catch. Provide two catches on doors more than 48 inches high.

E. Drawer Slides: BHMA A156.9, Type B05091.

1. Standard Duty (Grades 1, 2, and 3): Side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated steel with polymer rollers.
2. Box Drawer Slides: Grade 1HD-100, for drawers not more than 6 inches high and 24 inches wide.

F. Drawer and Hinged Door Locks: Cylindrical (cam) type, five-pin tumbler or deadbolt type, 6 tumbler, brass with chrome-plated finish, and complying with BHMA A156.11, Grade 1.

1. Provide a minimum of two keys per lock and six master keys.
2. Provide locks on all doors and drawers.
3. Keying: Key locks alike within each room, key each room the same unless otherwise noted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.

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

3.2 CASEWORK INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

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B. Install casework level, plumb, and true; shim as required, using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.

D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch.

E. Fasten cabinets to adjacent cabinets and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

G. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 12 32 16

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SECTION 22 00 10 - BASIC REQUIREMENTS – PLUMBING CONSTRUCTION

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 general administrative and procedural requirements for plumbing system installations. Administrative and procedural requirements are included in this Section and in various Division 1 Sections.

1.3 PERMITS AND FEES

A. Refer to Non-Technical Specifications, General Conditions for information relating to permits and fees.

1.4 PROJECT SCHEDULE

A. Refer to applicable Non-Technical Specification Sections for contract completion time and project construction schedule.

1.5 SHOP DRAWINGS AND SUBMITTALS

A. Follow the procedures specified in the Division 01 sections. Also refer to individual sections of the Division 22 specifications for additional shop drawing and Submittal requirements.

B. It is the responsibility of the contractor to thoroughly review any and all shop drawings prior to submission to the Architect/Engineer. The contractor’s review shall include verifying conformance to the project documents. The contractor will also be responsible for verifying the quantities of materials are adequate.

C. All shop drawings shall be submitted with a cover sheet indicating the name of the project, the Architects and Engineers name, the name of the vendor and the contractor. There must be sufficient space on the title sheet to allow the appropriate stamping by both the Architect and the Engineer. Shop drawings and submittals not conforming to the above may be returned without review.

D. All shop drawing submittals will include a listing of any and all exceptions to the requirements indicated in the specifications and on the drawings. Where there are no exceptions, the submittals shall indicate such. Submittals that do not have this listing will not be reviewed.

1.6 INSTALLATION ACCESSIBILITY

A. The installation of all equipment and appurtenances shall be done so that access and clearances meet the requirements of the equipment manufacturer and all applicable codes.

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1.7 ACCEPTABLE MANUFACTURERS

A. The design of the mechanical systems is based on the equipment manufacturer indicated on the drawings. Although individual sections of the specifications may list other manufacturers, these manufacturers will be accepted only if the following occurs:

1. Performance, as judged by the engineer, must be equal to the design-based equipment.
2. Operating characteristics, as judged by the engineer, must be identical to those of the design-based equipment.
3. Physical size of the equipment must be such that it can be installed in the available space, maintaining all required clearances for access / maintenance and meet the architectural requirements of the project such as installed height, length, width and operating weight. The contractor shall be responsible for verifying the equipment meets this requirement.
4. The contractor will be responsible for any costs associated with additional supports, changes in electrical wiring, or piping changes that may be required if equipment other than the design based is used.

1.8 RECORD DOCUMENTS

A. Prepare record documents in accordance with applicable Division 01 sections. In addition to the requirements specified, indicate the following installed conditions:

1. Mains and branches of piping systems, with valves and control devices and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
4. Contract Modifications, actual equipment and materials installed.
5. Record Documents are to be prepared and/or revised to indicate the room names and numbers to be used by the owner after the projects is complete.

1.9 OPERATING AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with applicable Division 01 sections.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. When materials and products are stored on site, provide protection from weather and temperatures that may cause damage to the items.

1.11 EXTRA MATERIALS

A. Various specification sections may indicate extra materials that are to be provided with the respective equipment. Where indicated the contractor shall provide the required extra materials. If no additional installation is required, the contractor shall forward, to the owner, all extra materials. When forwarding materials obtain a receipt for any materials forwarded.

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1.12 WARRANTY

A. All equipment, material and labor provided by the contractor shall be warranted for a minimum period of one year after the date of substantial completion.

PART 2 - PRODUCTS

2.1 Not Applicable.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Obtain equipment shop drawings for the various items that require rough-in.

3.2 INSTALLATIONS

A. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Coordinate requirements for chases slots, and openings in other building components during the progress of construction, to allow for mechanical installations.
4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
6. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
10. Install systems, materials, and equipment giving right-of-way priority to the systems required to be installed at a specified slope.
11. Seal all places where piping or ducts pass through walls and floors.

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3.3 CUTTING AND PATCHING

A. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Removal and replacement of defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.

B. Upon written instructions from the Architect, uncover and restore work to provide for Architect/Engineer observation of concealed Work.

C. In areas of the building where new finishes are being provided, the patching required on a surface which is to receive a new finish will be to bring the underlying surface up to the finish required to receive the final finish. This contractor shall coordinate subsurface finish requirements with the finish trade contractor(s).

D. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

E. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.4 CLEANING

A. This contractor shall be required to thoroughly clean all installed equipment, duct work and piping. Cleaning shall be required before substantial completion on any phase of the project. Do not use cleaning materials and agents that are hazardous to health or property or that may damage the finished surfaces.

END OF SECTION 22 00 10

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SECTION 22 05 00 - COMMON WORK REQUIREMENTS - PLUMBING CONSTRUCTION

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 materials and methods that are common to various Plumbing Systems.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated 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 temperatures 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 chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. 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. Mechanical sleeve seals.
2. Escutcheons.
3. Access Doors.

B. Welding certificates.

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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 involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum 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 plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for all system items requiring access that are concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 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.

2.2 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

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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. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. 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.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 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 pressure at 180 deg F.

1. Manufacturers:

    a. Capitol Manufacturing Co.
    b. Epco Sales, Inc.
    c. Hart Industries, International, Inc.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 minimum working pressure as required to suit system pressures.

1. Manufacturers:

    a. Capitol Manufacturing Co.
    b. Epco Sales, Inc.
    c. 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.

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c. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150 psi minimum working pressure where required to suit system pressures.

F. 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).

1. Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.

2.4 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal 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 water stop, 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.

2.5 ROOF PENETRATIONS

A. Provide pre-fabricated roof cub with piping portal for all pipe gas piping penetrations through the roof. Curbs to be manufactured by the Pate Co. or equal.

B. Roof Curbs with Pipe Portals: Provide prefabricated galvanized steel roof curbs fabricated from minimum 16-gauge steel with welded corners. Curbs to be internally reinforced, factory insulated with 1.5” thick 3 lb. Density fiberboard insulation. Where required provide curbs with wood nailers fastened from the underside of the wood nailer.

C. Refer to drawing details for the type of curb required for the specified roofing system. Provide curbs with an integral metal cant, stepped integral metal cant raised the thickness of roof insulation or no integral cant, as required to suit the details. Provide curbs to meet the installed curb height as detailed on the drawings.

D. Pipe portal curb cover furnished with a laminated acrylic coated ABS plastic curb cover with pre-punched holes and molded sealing ring on a collared opening, and an EPDM compression molded cap with stainless steel snap lock clamps. Curbs covers shall be resistant to ozone and ultraviolet rays and shall have a serviceable temperature range of -40 degrees F to positive 250 degrees F. The molded sealing ring on the collared opening and the groove in the rubber cap shall be installed to assure a weather-tight pressure and mechanical seal. The protective rubber caps shall have a serviceable temperature range of -60 degrees F to positive 250 degrees F and shall be resistant to ozone and ultraviolet rays. The conical shaped steps of the nipple shall provide a weatherproof seal around the penetration. The stainless-steel snap lock clamps shall provide added protection to guarantee the seal.

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2.6 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 opening.

B. One-Piece, Cast-Brass Type: With set screw.

C. Finish: Polished chrome-plated and rough brass.

2.7 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 (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.8 CONCRETE EQUIPMENT BASES

A. Minimum compressive strength: 3500 p.s.i. at 28 days.

B. Minimum cementitious material content: 520 lb/cu. Yd.

2.9 ACCESS DOORS

A. Manufacturers: Subject to review, provide access doors manufactured by Milcor, Inc or equal.

B. Description: Steel access doors and frames for installation in masonry and/or drywall/gypsum board assemblies. Provide fire rated access doors when doors are installed in a fire rated assembly.

C. Frames: minimum 16 gage steel with exposed nominal 1” flange around the perimeter of the unit. Where doors are to be installed in drywall/gypsum board assemblies provide frames with a drywall bead. Doors to be installed in masonry shall be furnished with adjustable metal masonry anchors.

D. Flush Panel Doors: minimum 14 gage steel with concealed spring or piano hinge(s) with a minimum swing of 175 degrees. Finish to be a factory-applied primer, suitable for field painting. Provide flush cylinder lock with key. Key all locks alike.

2.10 FIRESTOPPING

A. The contractor shall be responsible for providing permanent, UL approved firestopping systems for all penetrations through fire rated floor or fire rated wall assemblies. All firestopping shall meet the requirements of ASTM E-814 and UL 1479.

B. Subject to compliance with project requirements, firestopping materials may be provided by one of the following manufacturers:

1. Specified Technologies Inc. (STI) Somerville, NJ.
2. Tremco, Beechwood, OH.
3. 3M, St. Paul MN.

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C. Submit for review the following product data

1. Product data sheets.
2. UL System drawings for each firestopping application
3. Manufacturer's Certificates of Compliance for their products.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping 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. Maintain unobstructed passageway of not less than 42" in width and 80" minimum head clearance as required by code.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. Install piping to permit valve servicing. Install piping at indicated slopes. Install piping free of sags and bends.

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

G. Install piping to allow application of insulation.

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

I. Install escutcheons for penetrations of walls, ceilings, and floors.

J. Sleeves are not required for core-drilled holes.

K. Permanent sleeves are not required for holes formed by removable sleeves.

L. 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 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 (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

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a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating 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 07 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.

M. Seal annular space between sleeve or opening and pipe or pipe insulation, using sealants appropriate for size, depth, and location of joint.

N. Aboveground and Underground, Exterior-Wall Pipe Penetrations: Provide Mechanical Sleeve Seal and wall sleeve.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and sized per manufacturer’s recommendations. Position the pipe in center of sleeve. Assemble mechanical 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.

O. Corrosion Protection: Pipes passing through concrete walls and/or floors and through block walls shall be protected against external corrosion by a protective sheathing or wrapping that will withstand any reaction from wall or floor material.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at all pipe penetrations. Where required seal all pipe penetrations with fire stop materials.

Q. Roof penetrations: provide roof curbs with pipe portals at all locations where gas piping penetrates the roof.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying 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 assembly.

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.

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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 welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

B. Install equipment to maintain unobstructed passageway of not less than 42” in width and 80” minimum head clearance as required by code.

C. Install plumbing 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.

3.5 CONCRETE EQUIPMENT BASES

A. Provide concrete bases for all floor mounted mechanical equipment unless otherwise noted on the contract drawings.

1. Construct concrete bases with a minimum height of 6” and extend bases not less than 6” larger, in all directions, than supported equipment.
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.

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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 and according to anchor-bolt manufacturer's written instructions.
6. Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project when applicable.

3.6 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors. Clean surfaces that will come into contact with grout.

B. Provide forms as required for placement of grout. Avoid air entrapment during placement of grout. Place grout, completely filling equipment bases. Place grout on concrete bases and provide smooth bearing surface for equipment.

C. Place grout around anchors. Cure placed grout.

3.7 INSTALLATION OF PIPING UNDER EXISITNG FLOORS

A. Where the drawings indicate new piping is to be installed under existing slab-on-grade construction, the installing contractor will be required to verify the location(s) of any existing pipes, conduits or any other system components, that are required to remain in service, before saw cutting existing slabs.

3.8 ACCESS DOORS

A. Comply with manufacturer's written instructions for installing access doors and frames. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

B. Adjust doors and hardware after installation for proper operation. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 22 05 00

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SECTION 22 05 40 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Ball valves.
2. Butterfly valves.
3. Check valves.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

D. The installation and materials shall comply with the requirements of the 2015 International Plumbing Code and any applicable local code amendments. Verify code with requirements with the local code officials.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

B. Valve Sizes: Same as upstream piping unless otherwise indicated.

C. Valves in Insulated Piping: With stem extensions and the following features:

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1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
2. Butterfly Valves: With extended neck.

D. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

E. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-piece full-port, Brass Ball Valves with Brass Trim:

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

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Stockham.
e. Jomar Valve.

2. Description:

a. Standard: MSS SP-110, MSS SP-145
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.

2.3 BRONZE BALL VALVES

A. Full-Port, Bronze Ball Valves with Bronze Trim:

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

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110, MSS SP-145.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).

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d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.

2.4 BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

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

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated or -coated ductile iron.

B. Grooved Copper Butterfly: DN65-DN150, 300 psi max pressure rati4ng with copper tubing sized grooved ends. Cast bronze body to CDA-836 (85-5-5-5). Elastomer encapsulated ductile iron disc, ASTM A-536, Grade 65-45-12, with integrally cast stem.

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

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

a. Crane Co.; Crane Valve Group
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Jomar Valve.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.

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f. Disc: Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or butterfly valves.
2. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided check valves.

END OF SECTION 22 05 40

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SECTION 22 07 00 - PLUMBING SYSTEM INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes insulation materials and accessories for insulating Plumbing piping and equipment.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity and jackets (both factory- and field-applied, if any).

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields. Coordinate clearance requirements with piping Installer for insulation application.

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PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Mineral-Fiber Plumbing Pipe Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Products: Subject to compliance with requirements, provide Johns Manville Micro-Loc insulation or equal products manufactured by one of the following:

   a. Knauf Insulation.
   b. Owens Corning Fiberglas Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL jacket.
3. Provide High-impact-resistant, UV-resistant PVC jacketed fitting covers complying with ASTM D 1784, Class 16354-C; Flame spread 25 or less; Smoke development 50 or less.

B. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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

   a. CertainTeed Corp.; CrimpWrap.
   b. Johns Manville; MicroFlex.
   c. Knauf Insulation; Pipe and Tank Insulation.
   d. Manson Insulation Inc.; AK Flex.
   e. Owens Corning; Fiberglas Pipe and Tank Insulation.

C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide products manufactured by one of the following:

   a. Aeroflex USA Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

2.2 FIELD-APPLIED JACKETS

A. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.

B. Aluminum Jacket: Comply with ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

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C. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane, consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

D. Self-Adhesive Indoor/Outdoor Jacket (Non-Asphaltic): Vapor barrier and waterproofing jacket for installation over insulation located aboveground outdoors or indoors. Specialized jacket with five layers of laminated aluminum and polyester film with low-temperature acrylic pressure-sensitive adhesive. Outer aluminum surface is coated with UV-resistant coating for protection from environmental contaminants.

2.3 CEMENTS, ADHESIVES AND MASTICS

A. Provide all required types of cements, adhesives, mastics and other accessories required to install all insulation materials and systems per the Manufacturer’s Installation Requirements. Prepare surfaces as required by the insulation manufacturers. Install cements, adhesives and mastics per manufacturer’s recommendations.

PART 3 - EXECUTION

3.1 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

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1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal metal jacket to roof flashing with vapor-retarder mastic.

Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

S. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

1. Firestopping and fire-resistive joint sealers are specified in other Division 22 Sections.

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

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

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3.2 MINERAL-FIBER INSULATION APPLICATION

A. Insulation Installation on Straight Pipes and Tubes per manufacturer's instructions. Where vapor barriers are required, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings, Elbows, Valves and Pipe Specialties:

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

3.3 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

B. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches (300 mm) o.c. and at end joints.

3.4 FLEXIBLE ELASTOMERIC INSULATION APPLICATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Apply Insulation on Pipe Fittings, Elbows, Valves and Pipe Specialties.

3.5 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.6 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic hot and re-circulated hot water.

1. Operating Temperature: 60 to 140 deg F.
2. Insulation Material: 1 ½" Mineral fiber.

B. Service: Domestic cold water.

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1. Operating Temperature: 35 to 60 deg F.
2. Insulation Material: 1” thick Mineral fiber with vapor barrier.

C. Service: Rainwater conductors and roof drain bodies.

1. Insulation Material: 1” Mineral fiber with vapor barrier.

D. Service: Condensate drain piping.

1. Insulation Material: ¾” Flexible elastomeric.

E. Service: Sanitary drain piping and accessories, associated with condensate drains, where indicated on the drawings.

1. Insulation Material: ¾” Flexible elastomeric.

END OF SECTION 22 07 00

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SECTION 22 11 10 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes domestic water piping for underground, under slab and above ground installations including accessories.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Piping materials.

B. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

C. System purging and disinfecting activities report.

1.4 QUALITY ASSURANCE

A. The installation shall comply with the requirements of the International Plumbing Code (IPC) and any applicable local code amendments. Verify the code with requirements with the local code official(s) before beginning the work.

B. All domestic water piping and fittings are required to bear the identification of the manufacturer as required in Chapter 3; paragraph 303.1 of the IPC.

C. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt service to any portion of the existing occupied facilities until receiving permission. If interruption of the existing service is required, coordinate the work with the Owner and, if necessary, perform the work at a time, other than normal working hours, which is suitable to the owner.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

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PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

C. Grooved Joint Copper Piping Systems: Provide grooved copper products manufactured by Victaulic. All grooved copper system components are to be supplied by the same manufacturer.

1. Copper Tube: ASTM B 88, Type L roll grooved in accordance with the manufacturer's standards and copper tube dimensions.
2. Couplings for grooved piping to consist of ductile iron cast housings with synthetic rubber gasket of a pressure responsive design with plated nuts and bolts to secure the unit. Couplings shall be manufactured to connect to copper tubing and fittings without flaring.

    a. Coupling housings: ductile iron (ASTM A-536, grade 65-45-12) coated with copper colored alkyd enamel.
    b. Coupling Gaskets: gasket to be Grade EHP EPDM compound with red color code design for operating temperatures from minus 30 degrees F to plus 250 degrees F.
    c. Victaulic Style 607 installation ready coupling for direct stab installation with filed disassembly.

3. Fittings: manufactured to copper tube sizes with grooves designed to accept grooved couplings. Fittings shall be wrought copper conforming to ASTM B-75 alloy C12200 or ASTM B-152 alloy C11000 and ANSI B16.22.

D. Press-Fit Joint Copper Piping Systems: Provide Press-fit copper pipe products manufactured by Viega, Mueller Industries or NIBCO, Inc

1. Hard Copper Tube: ASTM B88.
2. Copper fittings: ASME B16.18, ASME B16.22 or ASME B16.26.
3. Press Fitting: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press ends shall have SC (Smart Connect™) feature design (leakage path). In ProPress ½" to 4" dimensions the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.

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2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.
2. Compact-Pattern, Mechanical-Joint Fittings: AWWA C153, ductile iron.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.4 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.5 FLEXIBLE CONNECTORS

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

1. Hyspan Precision Products, Inc.
2. Metraflex, Inc.
3. Universal Metal Hose; a Hyspan company.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

2.6 PRE-INSULATED PIPING SYSTEM

A. Provide products manufactured by Tricon Piping Systems or Thermal Pipe Systems.

1. Hard Drawn seamless copper tube, ASTM B 88, Type L (ASTM B 88M, Type B, WWT-799); wrought-copper solder-joint fittings and brazed joints. Insulation shall be foamed in place closed cell polyurethane meeting ASTM D-1621, 2.0 lb./cu ft. / 147 “K” Factor BTU/Hr sq.ft/ deg F/in. (ASTM C-177) with seamless extruded white PVC type 1, Grade 1 class 12454-B per ASTM D-1784.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

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C. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.

E. Install shutoff valve, drain valve, pressure gage, inside the building at each domestic water service entrance.

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

G. When required, rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas. Install exposed piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install piping adjacent to equipment and specialties to allow service and maintenance. Install piping to permit valve servicing.

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

K. Install piping free of sags and bends.

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

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

N. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump.

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

P. Install pre-insulated underground piping system per Manufacturer details and installation instructions

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

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

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

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

D. Joint Construction for Grooved-End Copper Tubing: Make joints according to the manufacturer’s instructions and AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes

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or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

E. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

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

G. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

A. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 3 and smaller. Use butterfly valves for piping NPS 3 and larger.

B. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

C. 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.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.5 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

3.6 WATER METER INSTALLATION

A. Where required, rough-in domestic water piping for water meter installation, and install water meters according to utility company's requirements. Install water meters according to AWWA M6, utility company's requirements.

3.7 PIPE HANGER AND SUPPORT INSTALLATION

A. Support all domestic water piping in accordance with the International Plumbing Code or local code requirements.

B. Hangers shall be of materials that will not support galvanic action. Support piping with adjustable clevis hangers for all horizontal piping. Provide a 12” long 18 gage protective saddle for all clevis hangers that

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support insulated piping. Support each system independently of other piping systems, allowing for expansion of the pipe.

C. Install hangers for copper tubing with the following spacing:

1. NPS 1-1/4” and smaller: 6 feet maximum horizontal.
2. NPS 1-1/2” and larger: 10 feet maximum horizontal.
3. Install supports for vertical pipe at a maximum spacing of 10 feet.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to equipment and machines to allow service and maintenance.

B. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet 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. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
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 (DN 65) and larger.

3.9 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

3.10 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls. Sleeves are not required for core-drilled holes.

B. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated. Install sleeves in new partitions, slabs, and walls as they are built.

C. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Provide fireproofing where required.

D. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using wall penetration systems.

E. Install sleeve materials according to the following applications:

1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.

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2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe. Extend sleeves 2 inches above finished floor level.
3. Sleeves for Piping Passing through Gypsum-Board Partitions:

    a. Galvanized-steel sheet sleeves for pipes NPS 6 (DN 150) and larger. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations.

3.11 FIELD QUALITY CONTROL

A. Test systems according to procedures of authorities having jurisdiction or, in absence of such procedures, testing shall be per the requirements on the International Plumbing Code Section 312, Test and Inspections.

B. Piping Inspections: coordinate all inspection requirements with the Authorities Having Jurisdiction. Do not enclose, cover, or put piping into operation until it has been inspected and approved.

C. Domestic water piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 ADJUSTING

A. Perform the following adjustments 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. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.13 DISINFECTION OF POTABLE WATER SYSTEM(S)

A. All domestic water piping shall be purged and disinfected prior to utilization. The method to be followed shall be that required by the International Plumbing Code, Section 610, or the requirements of the local authorities.

B. Prepare and submit reports of purging and disinfecting activities.

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3.14 PIPING SCHEDULE

A. Under-building-slab, domestic water, building service piping, NPS 3 (DN 80) and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type L (ASTM B 88M, Type B)]; wrought-copper solder-joint fittings; and brazed or copper pressure-seal fittings and joints.

B. Exterior Underground, Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 (DN 100 to DN 200) shall be the following:

1. Mechanical-joint, ductile-iron pipe; mechanical-joint fittings; and mechanical restrained joints.

C. Aboveground domestic water piping, shall be the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) copper solder-joint fittings; and soldered, press-fit or grooved joints.

D. Exterior Underground, domestic water, building service piping, NPS 3 (DN 80) and smaller, shall be the following:

1. Pre-insulated piping system; Hard Drawn seamless copper tube, ASTM B 88, Type L (ASTM B 88M, Type B, WWT-799); wrought-copper solder-joint fittings and brazed joints. Insulation shall be foamed in place closed cell polyurethane meeting ASTM D-1621, 2.0 lb./cu ft. / 147 “K” Factor BTU/Hr sq.ft/ deg F/in. (ASTM C-177) with seamless extruded white PVC type 1, Grade 1 class 12454-B per ASTM D-1784.

3.15 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 10

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SECTION 22 11 20 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:

1) Vacuum breakers.
2) Balancing valves.
3) Temperature-actuated, water mixing valves.
4) Strainers for domestic water piping.
5) Outlet boxes.
6) Hose bibbs.
7) Wall hydrants.
8) Roof hydrants.
9) Drain valves.
10) Water-hammer arresters.
11) Trap-seal primer device.
12) Trap-seal primer systems.
13) Flexible connectors.

1.3 SUBMITTALS

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

B. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. The installation and manufacture of all products shall conform to the requirements of the following:

1. International Plumbing Code and any local code amendments. Verify the code requirements with the local code official(s) before beginning the work.
2. Lead Free Law as adapted effective January, 2014.
3. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

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PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

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

   a. Ames Co.
   b. Cash Acme.
   c. Conbraco Industries, Inc.
   d. Watts Industries, Inc.; Water Products Div.
   e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze where concealed, Chrome plated where exposed.

B. Hose-Connection Vacuum Breakers:

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

   a. Cash Acme.
   b. Conbraco Industries, Inc.
   c. Watts Industries, Inc.; Water Products Div.
   d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze where concealed, Chrome plated where exposed.

2.2 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

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

   a. Bell & Gossett Model CS Plus
   b. Armstrong Pump Model CVB
   c. Flow Design Inc. Model UA
   d. Flo Pac Model MB/MBF/MBG
   e. Jomar Valve

2. Valves: venturi type bronze body, chrome plated ball, EPDM seals. Provide pressure & temperature test ports across valve measurement area. Ports to be fitted with dual durometer EPDM cores, brass cap & O-ring seal. Valves to have drain/purge port. Provide valve with memory stop, memory lock and calibrated position indicator. Valves to be rated at 200 PSIG at 2500 F and be 100% positive shut-off. Accuracy to be +/- 3%.

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2.3 MIXING VALVES

A. Individual-Fixture, Water Tempering Valves:

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

   a. Cash Acme.
   b. Conbraco Industries, Inc.
   c. Lawler Manufacturing Company, Inc.
   d. Leonard Valve Company.
   e. Powers; a Watts Industries Co.
   f. Watts Industries, Inc.; Water Products Div.
   g. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1016, thermostatically controlled water tempering valve.
3. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating for NPS 2-1/2 and larger.
3. Screen: Stainless steel with round perforations, unless otherwise indicated.
4. Perforation Size:

   a. Strainers NPS 2 and Smaller: 0.033 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
   c. Strainers NPS 5 and Larger: 0.125 inch.

5. Drain: Factory-installed, hose-end drain valve.

2.5 OUTLET BOXES

A. Clothes Washer Outlet Boxes WOB-1:

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

   a. Guy Gray Manufacturing Co., Inc. or equal.

2. Material and Finish: Epoxy-painted-steel or enameled-steel box and faceplate.
3. Mounting: Recessed. Provide fire-rated construction where installed within fire-rated walls.
4. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: NPS 1/2 ball valves and NPS 1/2 copper, water tubing.
6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
7. Accessory: Water hammer arresters.

B. Icemaker Outlet Boxes IMB1:

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

    a. Guy Gray Manufacturing Co., Inc. or equal.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Accessory: Water hammer arrestor.
6. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.6 HOSE BIBBS

A. Hose Bibbs HB:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Pressure Rating: 125 psig.
5. Vacuum Breaker: Integral.
6. Finish for Equipment Rooms: Rough bronze.
7. Finish for Service Areas: Chrome plated.
8. Finish for Finished Rooms: Chrome plated.
9. Operation: operating key.
10. Include operating key with each operating-key hose bibb.
11. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.7 WALL HYDRANTS

A. A. Non-freeze Wall Hydrants WH-1:

1. Manufacturers: Zurn Model Z1320-C or equal.
2. Provide anti-siphon, automatic draining non-freeze wall hydrant with integral backflow preventer.
3. Operation: Loose key.
4. Provide length required to match wall thickness.
5. Nozzle and Wall-Plate Finish: Chrome plated cast bronze.
6. Operating Keys(s): Two with each wall hydrant.

B. Interior Hot & Cold Water Wall Hydrants WH-2:

1. Manufacturers: Acorn model 8156 or equal.
2. Provide Acorn Recessed Hose Box model 8156 with Wall Flange.
3. Box shall be fabricated with 18 gage, type 304 stainless steel, with a satin finished exterior. Flange shall be 16 gage stainless steel and be polished to a satin finish. Door shall be 16 gauge with satin finish and removable hinge and cylinder lock
4. Valve shall be cartridge-operated type with vandal-resistant lock shield, removable loose key wheel handle and screwdriver operated stops.
5. Provide hydrant with vacuum breaker.

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2.8 ROOF HYDRANTS

A. Non-freeze, Draining-Type Roof Hydrants RH-1:

1. Manufacturers: Woodford Manufacturing Company; a division of WCM Industries, Inc Model SRH-MS or equal.
2. Standard: ASSE 1052 and 1057, ASME A112.21.3M.
3. Type: Non-freeze, exposed-outlet roof hydrant.
4. Operation: Lever Lock with plunger.
5. Casing and Operating Rod: cast iron underdeck flange with EDPM boot cover and 35 ½" operating rod.
6. Casing: 1 ¼".
7. Inlet: NPS 3/4 (DN 20).
8. Outlet: Garden-hose thread complying with ASME B1.20.7.
9. Drain: Designed with hole to drain to indirect waste inlet when shut off.
10. Vacuum Breaker:

    a. Non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052. Garden-hose thread complying with ASME B1.20.7 on outlet.

2.9 WATER HAMMER ARRESTERS

A. Water Hammer Arresters

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

    a. AMTROL, Inc.
    b. Josam Company.
    c. MIFAB, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Tyler Pipe; Wade Div.
    f. Watts Drainage Products Inc.
    g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.10 TRAP-SEAL PRIMER VALVES

A. Trap-Seal Primer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products conforming to ASSE 1018 manufactured by one of the following:

    a. MIFAB, Inc.
    b. Precision Plumbing Products Inc.
    c. Sioux Chief Manufacturing Company, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Watts Industries, Inc.; Water Products Div.

2. Body: Bronze.

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3. Inlet and Outlet Connections: NPS 1/2 threaded or solder joint.
4. Gravity Drain Outlet Connection: NPS ½ threaded or solder joint.
5. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.11 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products conforming to ASSE 1044 and manufactured by Precision Plumbing Products Inc. or equal.
2. Piping: NPS 3/4, ASTM B 88, Type L copper, water tubing.
3. Cabinet: Surface-mounting steel box with stainless-steel cover.
4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
5. Vacuum Breaker: ASSE 1001.

2.12 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1) Working-Pressure Rating: Minimum 200 psig.
2) End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3) End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless Steel-Hose Flexible Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.

1) Working-Pressure Rating: Minimum 200 psig.
2) End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3) End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet. Install thermometers and water regulators if specified. Install cabinet-type units recessed in or surface mounted on wall as specified.

B. Install balancing valves in locations where they can easily be adjusted.

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

D. Install outlet boxes recessed in wall.

E. Install non-freeze, nondraining-type post hydrants set in concrete or pavement.

F. Connect drain piping from roof hydrant and route to nearest indirect waste termination.

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

H. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

J. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each vacuum breaker assembly according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

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

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

C. Adjust each pressure vacuum breaker, in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

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SECTION 22 13 11 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes soil, waste, and vent piping inside the building.

1.3 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. The installation shall comply with the requirements of the International Plumbing Code (I.P.C.) and any applicable local code amendments. Verify the code with requirements with the local code officials before beginning the work.

C. All sanitary piping and fittings are required to bear the identification of the manufacturer as required in Chapter 3; 303.1 of the IPC.

D. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be Third Party Tested per the requirements of the I.P.C.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

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

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Hub and Spigot Cast Iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A 74. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute® and listed by NSF® International. Pipe and fittings to be Service (SV) class.

B. Provide joints using a compression gasket manufactured from an elastomer meeting the requirements of ASTM C 564 or lead and oakum.

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C. All pipe and fittings to be produced by a single manufacturer and are to be installed in accordance with manufacturer's recommendations and applicable code requirements.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Hubless Cast Iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A 888 and CISPI Standard 301. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF® International.

B. Hubless Couplings shall conform to ASTM C 1540 for heavy duty couplings. Gaskets shall conform to ASTM C 564.

C. All pipe and fittings to be produced by a single manufacturer and are to be installed in accordance with manufacturer's recommendations and applicable code requirements. Couplings shall be installed in accordance with the manufacturer's band tightening sequence and torque recommendations. Tighten bands with a properly calibrated torque limiting device.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: cast copper or wrought copper, solder-joint fittings.

B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn 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. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

C. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, condensate drain, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.

C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:

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1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel rigid, couplings; and hubless-coupling joints.

E. Aboveground, vent piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

F. Underground, soil, waste, and vent piping shall be:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

3.2 EXCAVATION AND BACKFILL

A. Provide all excavation and backfill required for underground piping installations. Perform excavation and backfill work conforming to the requirements of Section 306, Trenching, Excavation and Backfill, of the International Plumbing Code.

3.3 PIPING INSTALLATION

A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

B. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

C. 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."

D. 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 reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

E. 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.

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

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.

G. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

H. Where existing below slab sanitary laterals are connected to a new below slab branch or main pipe extension, the Contractor shall investigate and verify the existing piping condition and ensure functionality

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prior to connection. The Contractor shall utilize ground penetrating radar to locate existing below slab piping and investigate by using pipeline inspection gauge (PIG) or “push camera” and provide video recording for review.

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

J. Install radon pipe in locations detailed on the contract drawings.

3.4 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

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

C. 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.

3.5 VALVE INSTALLATION

A. Shutoff Valves: Install shutoff valve on each sump pump discharge.

1. Install full-port ball valve for piping NPS 2 (DN 50) and smaller.
2. Install butterfly valve for piping NPS 2-1/2 (DN 65) and larger.

B. Check Valves: Install swing check valve, between pump and shutoff valve, on each sump pump discharge.

C. Backwater Valves: Install backwater valves where indicated.

3.6 HANGER AND SUPPORT INSTALLATION

A. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. All sizes: 60 inches.
2. Hangers spacing may be increased to 10’-0” when 10-foot lengths of pipe are used.

B. Install supports for vertical cast-iron soil piping every 15 feet and at all floors.

C. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches.
2. NPS 1-1/2 and larger: 120 inches.

D. Install supports for vertical copper tubing every 10 feet and at all floors.

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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.
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.
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 (DN 65) and larger.

3.8 FIELD QUALITY CONTROL

A. Test systems according to procedures of authorities having jurisdiction or, in absence of such procedures, testing shall be per the requirements on the International Plumbing Code Section 312, Test and Inspections.

B. Piping Inspections: coordinate all inspection requirements with the Authorities Having Jurisdiction. Do not enclose, cover, or put piping into operation until it has been inspected and approved.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 13 11

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SECTION 22 13 20 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes sanitary drainage piping specialties.

1.3 SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, and accessories.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals. Provide wiring diagrams for power, signal, and control wiring, where applicable.

C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate size and location of concrete bases where applicable. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Cast-Iron Backwater Valves:

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

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
    c. Tyler Pipe; Wade Div.

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d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Specification Drainage Operation.

2.2 CLEANOUTS

A. Provide cleanouts and all required accessories manufactured by one of the following:

1. Josam Company.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Watts Drainage Products Inc.
5. Zurn Plumbing Products Group.

B. Brass cleanout plugs shall conform to ASTM A74, ASME A112.3.1 or ASME A112.36.2N.

C. Cleanout locations and details are indicated on the drawings and noted in Part 3.

2.3 FLOOR DRAINS

A. Provide cast-iron and/or stainless-steel floor drains per the model numbers indicated on the drawings included all required accessories. Provide drains manufactured by one of the following:

1. Josam Company; Josam Div.
2. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
3. Tyler Pipe; Wade Div.
4. Watts Drainage Products Inc.
5. Zurn Plumbing Products Group.

B. Floor drains shall conform to the requirements of Section 412 of the International Plumbing Code.

C. Floor drains to have removable strainers and constructed so the drain can be cleaned.

D. Polypropylene Floor Drains: Where indicated, on the drawings, provide polypropylene floor drains manufactured by Ipex Inc or equal. Provide all accessories indicated and required.

2.4 DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

a. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.

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5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Barrier-Type Trap Seal Devices:

1. Description: Elastomeric, normally closed seal to prevent evaporation and protect against sewer gases from entering habitable spaces. Inlet and outlet shall match connected piping and assembly shall conform to ASSE 1072.

D. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counter flashing.

2.5 SOLIDS INTERCEPTORS

A. Interceptors are shown on the drawings. Provide the applicable model and all required accessories manufactured by one of the following:

1. Josam Company; Josam Div.
2. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
3. Tyler Pipe; Wade Div.
4. Watts Drainage Products Inc.
5. Zurn Plumbing Products Group.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping where indicated on the drawings. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts in piping located below floors, install cleanout deck plates with top flush with finished floor.

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D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall. If cleanout is more than 2-inches from wall surface, provide pipe extension to wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install fixture air-admittance valves on fixture drain piping.

G. Install stack air-admittance valves at top of stack vent and vent stack piping.

H. Install air-admittance-valve wall boxes recessed in wall.

I. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

J. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

K. Install through-penetration firestop assemblies at floor penetrations.

L. Install deep-seal traps on floor drains and other waste outlets, if indicated.

M. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

N. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

O. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

P. Install vent caps on each vent pipe passing through roof.

Q. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

R. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

S. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

T. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.

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

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V. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

W. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work. Place plugs in ends of uncompleted piping at end of each day or when work stops.

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SECTION 22 40 00 – PLUMBING FIXTURES

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 conventional plumbing fixtures and related components.

1.3 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 WARRANTY

A. All equipment, material and labor provided under this specification section shall be warranted for a period of one year after project completion.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O Rings: Equal to 10 percent of amount of each type and size installed.

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2. Faucet Cartridges and O Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Moen Commercial
2. Chicago Faucets
3. Zurn Plumbing Products Group; Commercial Brass Operation.
4. Elkay Manufacturing Co.
5. Just Manufacturing Company.
6. Speakman Company.
7. T & S Brass and Bronze Works, Inc.
8. American Standard

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

1. Acorn Engineering Company.
2. Advance Tabco
3. Elkay Manufacturing Co.
4. Just Manufacturing Company.
5. Eagle Group.

C. Solids Interceptors: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company; Josam Div.
2. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
3. Wade Drains
4. Watts Drainage Products, Inc.
5. Zurn Plumbing Products Group.

2.2 FIXTURES

A. F1 – Single Bowl Art Sink (ADA):

1. Elkay single bowl LRAD252155L type 304 #18 stainless steel, three faucet holes, and rear left offset drain. 25”x22”x5 ½” deep. The Plumbing contractor shall make final connections and provide all required valves, fittings, traps etc.
1. Faucet; Elkay LK810GN08T4, exposed deck faucet, 8” gooseneck spout, with wrist blade handles, 1.5 gpm, chrome finish.
2. Drain: LK35.
3. Supplies: Chrome ¼ turn angle supplies – FIP x slip-joint with check stops and loose key handle.
4. Provide solid interceptor(s) Wade 5730.

B. F2 – Single Bowl Art Sink (ADA):

1. Elkay single bowl LRAD252155R type 304 #18 stainless steel, three faucet holes, and rear right offset drain. 25”x22”x5 ½” deep. The Plumbing contractor shall make final connections and provide all required valves, fittings, traps etc.

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2. Faucet; Elkay LK810GN08T4, exposed deck faucet, 8” gooseneck spout, with wrist blade handles, 1.5 gpm, chrome finish.
3. Drain: LK35.
4. Supplies: Chrome ¼ turn angle supplies – FIP x slip-joint with check stops and loose key handle.
5. Provide solid interceptor(s) Wade 5730.

C. F3 – Not Used

D. F4 – Double Bowl FCS Sink (ADA):

1. Elkay double bowl LRAD332155 type 304 #18 stainless steel. three faucet holes and rear center drains. 33”x22"x5 1/2” deep. The Plumbing contractor shall make final connections and provide all required valves, drain, fittings, traps etc.
2. Faucet; T&S Brass B-2731 single lever handle and 9” swivel spout, 1.5 gpm. chrome finish.
3. Drain; LK35 with continuous waste.
4. Supplies: Chrome ¼ turn angle supplies – FIP x slip-joint with check stops and loose key handle.

E. F5 - Single Bowl FCS Sink (ADA):

1. Elkay single bowl LRAD252255 type 304 #18 stainless steel. three faucet holes and rear center drains. 25”x22”x5 1/2” deep. The Plumbing contractor shall make final connections and provide all required valves, drain, fittings, traps etc.
2. Faucet; T&S Brass B-2731 single lever handle and 9” swivel spout, 1.5 gpm. chrome finish.
3. Drain; LK35.
4. Supplies: Chrome ¼ turn angle supplies – FIP x slip-joint with check stops and loose key handle.

F. Solids Interceptors:

1. Interceptors shall be provided with a removable bucket and have 3/32 perforated stainless steel screens, with bottom access gasket cover.
2. Acid resistant coated aluminum interceptor to be provided in lieu of fixture P-trap, for off-floor installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off floor supports, affixed to building substrate, for wall mounting fixtures.

C. Use carrier supports with waste fitting and seal for back outlet fixtures.

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D. Use carrier supports without waste fitting for fixtures with tubular waste piping.

E. Use chair type carrier supports with rectangular steel uprights for accessible fixtures.

F. Install back outlet, wall mounting fixtures onto waste fitting seals and attach to supports.

G. Install floor mounting fixtures on closet flanges or other attachments to piping or building substrate.

H. Install wall mounting fixtures with tubular waste piping attached to supports.

I. Install floor mounting, back outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

J. Install counter mounting fixtures in and attached to casework.

K. Install fixtures level and plumb according to roughing in drawings.

L. Install water supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation

1. Exception: Use ball if supply stops are not specified with fixture. Valves are specified in Division 22 Section "Valves."

M. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

N. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

O. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

P. Install toilet seats on water closets.

Q. Install faucet spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

R. Install water supply flow control fittings with specified flow rates in fixture supplies at stop valves.

S. Install faucet flow control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

T. Install shower flow control fittings with specified maximum flow rates in shower arms.

U. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep pattern escutcheons if required to conceal protruding fittings.

1. Seal joints between fixtures and walls, floors, and countertops using sanitary type, one part, mildew resistant silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

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B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

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

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts. Remove sediment and debris from drains. After completing installation of exposed, factory finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

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SECTION 23 00 10 - BASIC REQUIREMENTS – HVAC CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for HVAC installations. Administrative and procedural requirements are included in this Section and in other Non-technical/Division 01 Specification Sections.

1.3 PERMITS AND FEES

A. Refer to Non-technical/Division 01 Specification Sections, General Conditions of The Contract, for information relating to permits and fees.

1.4 PROJECT SCHEDULE

A. Refer to Non-technical/Division 01 Specification sections for contract completion time and project construction schedule.

1.5 SHOP DRAWINGS AND SUBMITTALS

A. Follow the procedures specified in the Non-technical/Division 01 Specification Sections. Also refer to individual sections of the Division 23 specifications for additional shop drawing and submittal requirements.

B. It is the responsibility of the contractor to thoroughly review any and all shop drawings prior to submission to the Architect/Engineer. The contractor's review shall include verifying conformance to the project documents. The contractor will also be responsible for verifying the quantities of materials are adequate.

C. All shop drawings shall be submitted with a cover sheet indicating the name of the project, the Architects and Engineers name, the name of the vendor and the contractor. There must be sufficient space on the title sheet to allow the appropriate stamping by both the Architect and the Engineer. Shop drawings and submittals not conforming to the above may be returned without review.

D. All shop drawing submittals will include a listing of any and all exceptions to the requirements indicated in the specifications and on the drawings. Where there are no exceptions, the submittals shall indicate such. Submittals that do not have this listing will not be reviewed.

1.6 INSTALLATION ACCESSIBILITY

A. The installation of all equipment and appurtenances shall be completed so that access and clearances meet the requirements of the equipment manufacturer as well as the requirements of all applicable codes.

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1.7 ACCEPTABLE MANUFACTURES

A. The design of the mechanical systems is based on the equipment manufacturer indicated on the drawings. Although individual sections of the specifications may list other manufacturers, these manufacturers will be accepted only if the following occurs:

1. Performance, as judged by the engineer, must be equal to the design-based equipment.
2. Operating characteristics, as judged by the engineer, must be identical to those of the design-based equipment.
3. Physical size of the equipment must be such that it can be installed in the available space, maintaining all required clearances for access/maintenance and meet the architectural requirements of the project such as installed height, length, width and operating weight. The contractor shall be responsible for verifying the equipment meets this requirement.
4. The contractor will be responsible for any costs associated for adding additional supports, changes in electrical wiring, piping changes, ductwork changes and / or controls that may be required if equipment other than the design based is used.

1.8 RECORD DOCUMENTS

A. Prepare record documents, including Operating and Maintenance Manuals, in accordance with Non-technical/Division 01 Specification Sections. In addition to the requirements specified, indicate the following installed conditions:

1. Mains and branches of piping systems, with valves and control devices and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
4. Contract Modifications, actual equipment and materials installed.
5. Record Documents are to be prepared and/or revised to indicate the room names and numbers to be used by the owner after the projects is complete.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. When materials and products are stored on site, provide protection from weather and temperatures that may cause damage to the items.

1.10 EXTRA MATERIALS

A. Various Division 23 Specification Sections may indicate extra materials (filters, fan belts, etc.) that are to be provided with the respective equipment. Where indicated, the contractor shall provide the required extra materials.

B. When directed by the owner’s representative, the contractor shall install extra filters in the respective equipment. If no additional installation is required, the contractor shall forward, to the owner, all extra materials. When forwarding materials obtain a receipt for any materials forwarded.

C. The contractor shall also provide a list of all filter sizes for each type and size of unit provided on the project.

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1.11 WARRANTY

A. All equipment, material and labor provided by the contractor shall be warranted for a minimum period of one year after the date of substantial completion. Refer to Division 23 Technical Specification sections for additional Warranties that may be required.

PART 2 - PRODUCTS

2.1 Not Applicable.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Obtain equipment shop drawings for the various items that require rough-in.

3.2 HVAC INSTALLATIONS

A. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Coordinate requirements for chases slots, and openings in other building components during the progress of construction, to allow for mechanical installations.
4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
6. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
10. Install systems, materials, and equipment giving right-of-way priority to the systems required to be installed at a specified slope.
11. Seal all places where piping or ducts pass through walls and floors.

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3.3 CUTTING AND PATCHING

A. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Removal and replacement of defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.

B. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. In areas of the building where new finishes are being provided, the patching required on a surface which is to receive a new finish will be to bring the underlying surface up to the finish required to receive the final finish. This contractor shall coordinate subsurface finish requirements with the finish trade contractor(s).

D. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

E. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.4 CLEANING

A. This contractor shall be required to thoroughly clean all installed equipment, ductwork and piping. Cleaning shall be required before substantial completion on any phase of the project. Do not use cleaning materials and agents that are hazardous to health or property or that may damage the finished surfaces.

END OF SECTION 23 00 10

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SECTION 23 05 00 – COMMON WORK REQUIREMENTS – HVAC CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes materials and methods that are common to various HVAC installations.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated 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 temperatures 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 chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Mechanical sleeve seals.
2. Escutcheons.
3. Access Doors.

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."

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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 involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum 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 HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 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.

2.2 JOINING MATERIALS

A. Refer to individual Division 23 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.

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C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. 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.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 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.

2.4 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal 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.

2.5 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 opening.

B. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated and rough brass.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.7 ACCESS DOORS

A. Manufacturers: Subject to review, provide access doors manufactured by Milcor, Inc or equal.

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B. Description: Steel access doors and frames for installation in masonry and/or drywall/gypsum board assemblies. Provide fire rated access doors when doors are installed in a fire rated assembly.

C. Frames: minimum 16 gage steel with exposed nominal 1” flange around the perimeter of the unit. Where doors are to be installed in drywall/gypsum board assemblies provide frames with a drywall bead. Doors to be installed in masonry shall be furnished with adjustable metal masonry anchors.

D. Flush Panel Doors: minimum 14-gauge steel with concealed spring or piano hinge(s) with a minimum swing of 175 degrees. Finished with a factory-applied primer, suitable for field painting. Provide flush cylinder lock with key. Key all locks alike.

2.8 FIRESTOPPING

A. The contractor shall be responsible for providing permanent, UL approved firestopping systems for all penetrations through fire rated floor or fire rated wall assemblies. All firestopping shall meet the requirements of ASTM E-814 and UL 1479. Firestopping for ducts shall be installed with materials and methods identified in UL Ventilation Duct Assemblies (HNLJ), V Series as applicable to the wall assembly specified.

B. Subject to compliance with project requirements, firestopping materials may be provided by one of the following manufacturers:

1. Specified Technologies Inc. (STI) Somerville, NJ.
2. Tremco, Beechwood, OH.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping 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, 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. Where piping and ducts are exposed in areas such as mechanical rooms and boiler rooms the installation shall an unobstructed passageway of not less than 42” in width and 80” minimum head clearance, as required by code.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. Install piping to permit valve servicing. Install piping at indicated slopes. Install piping free of sags and bends.

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

H. Install piping and pipe supports to allow application of insulation.

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

J. Install escutcheons for penetrations of walls, ceilings, and floors.

K. Sleeves are not required for core-drilled holes.

L. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor 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.

2. Install sleeves in all new walls and floor slabs as walls and slabs are constructed.
3. Install sleeves that are large enough to provide sufficient 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 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 above finished floor level.

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.

M. Aboveground and Underground, Exterior-Wall Pipe Penetrations: Provide Mechanical Sleeve Seal and wall sleeve.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and sized per manufacturer's recommendations. Position pipe in center of sleeve. Assemble mechanical 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.

N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at all pipe and duct penetrations. Where required seal all pipe and duct penetrations with firestop materials.

O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying 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 assembly.

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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 welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment to maintain unobstructed passageway of not less than 42” in width and 80” minimum head clearance as required by code.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install HVAC 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 to allow right of way for piping installed at required slope.

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3.5 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors. Clean surfaces that will come into contact with grout.

B. Provide forms as required for placement of grout. Avoid air entrapment during placement of grout. Place grout, completely filling equipment bases. Place grout on concrete bases and provide smooth bearing surface for equipment.

C. Place grout around anchors. Cure placed grout.

3.6 ACCESS DOORS

A. Comply with manufacturer's written instructions for installing access doors and frames. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

B. Adjust doors and hardware after installation for proper operation. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 23 05 00

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SECTION 23 06 00 - HVAC TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Testing, Adjusting and Balancing (TAB) work is to be provided a qualified TAB firm and shall be part of the HVAC Contractor’s work.

B. Work under this section includes, but is not limited to, Testing, Adjusting and Balancing (TAB) of the following air systems and HVAC equipment:

1. All constant-volume air systems.
2. Existing air systems where noted on the drawings.

C. All TAB work shall comply with the requirements of TAB procedures required by the Associated Air Balancing Council, National Environmental Balancing Bureau, Testing Adjusting and Balancing Bureau and ASHRAE.

D. Coordinate and witness the installation work of the HVAC Contractor including all sub-contractors working for the HVAC Contractor and Electrical Contractor. Provide progress inspections of the work to ensure the installation of all systems is progressing as required and will operate as specified when completed. Report results of the progress inspection to the Owner's Representative.

E. Submit balancing reports for all air and water systems.

F. Validate the start-up and operation of all HVAC equipment and systems by the HVAC Contractor.

G. Validate the start-up and operation of the HVAC Controls system. Submit reports indicating the operation of all equipment, throughout the range of operation, meets the requirement of the Sequence of Operations.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TABB: Testing Adjusting and Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

1.4 SUBMITTALS

A. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified herein.

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1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB, AABC and/or TABB in the testing, adjusting and balancing of both air and water systems. The firm shall guarantee that all work will be performed in accordance with the applicable NEBB, AABC and/or TABB procedures. Evidence of the firm's certification shall be provided to the engineer or designated owner's representative.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

C. The TAB firm shall have a minimum of 5 years' experience with projects of a similar size and scope.

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and portions of the existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations. Review the project's construction phasing plan and provide the necessary number of TAB visits to comply with the phasing plan.

B. Review the project's construction phasing plan and provide the necessary number of site visits to comply with the phasing plan and complete all tab work before each phase is scheduled to be complete.

PART 2 - PRODUCTS

2.1 DUCT ACCESSORY HARDWARE

A. Instrument Test Ports: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit the specified eternal duct insulation thickness. Provide special gaskets where test holes are to be installed in round or oval ducts. Test Ports to be Duro-Dyne model TH1, IP2 and/or IP4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

B. Refer to the Contract Drawings for notes that relate to balancing of the air and water systems.

C. Examine the approved shop drawing submittals for all HVAC systems and equipment prior to starting the TAB work.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section Metal Ducts, and are properly

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separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine operating safety interlocks and controls on HVAC equipment.

O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Verify all systems are complete, including controls, before starting the TAB work.

B. Provide duct system leak testing verification as required by this section and Section 233110 “Metal Ducts”.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

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

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors where required.
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish to meet the requirements of the installation.

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

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

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3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

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

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

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

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

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

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

G. Check for airflow blockages.

H. Check condensate drains for proper connections and functioning.

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

J. Where required, verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

K. Install instrument test holes in ducts at all required locations for testing and balancing purposes.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

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

1. Measure total airflow. Measure air flows in main ducts and at terminal outlets and inlets.
2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

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

1. Measure airflow of branch ducts.
2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

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3. Re-measure each branch duct after all have been adjusted. Continue to adjust branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents. Adjust patterns of adjustable outlets for proper distribution without drafts.

E. Measure and verify ventilation air flows are as indicated on the equipment schedules.

3.6 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.
4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.7 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

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B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.8 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

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

1. Title page.
2. Name and address of the TAB contractor.
3. Project name and location.
4. Architect's and Engineer’s name and address.
5. Contractor's name and address.
6. Report date.
7. Signature of TAB supervisor who certifies the report.
8. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
9. Summary of contents.
10. Data for terminal units, including manufacturer's name, type, size, and fittings.
11. Notes to explain why certain final data in the body of reports vary from indicated values.
12. Test conditions for fans and pump performance forms.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

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E. Air Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

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

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches w.g.
c. Fan rpm.
d. Discharge static pressure in inches w.g.
e. Filter static-pressure differential in inches w.g.
f. Dirty filter setpoint.
g. Preheat-coil static-pressure differential in inches w.g.
h. Cooling-coil static-pressure differential in inches w.g.
i. Heating-coil static-pressure differential in inches w.g.
j. Outdoor airflow in cfm.
k. Return airflow in cfm.
l. Outdoor-air damper position.
m. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft.
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Total supply air flow.
b. Total system static pressure in inches w.g.
c. Fan(s) rpm.
d. Discharge static pressure in inches w.g.
e. Filter static-pressure differential in inches w.g.
f. Dirty filter set point.
g. Preheat-coil static-pressure differential in inches w.g.

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h. Cooling-coil static-pressure differential in inches w.g.
i. Heating-coil static-pressure differential in inches w.g.
j. Outdoor airflow in cfm.
k. Return airflow in cfm.
l. Outdoor-air damper position.
m. Return-air damper position.
n. Airflow monitor verification.

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

1. Fan Data:

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

2. Motor Data:

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

3. Test Data (Indicated and Actual Values):

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

H. Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg. F.
d. Duct static pressure in inches w.g.
e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

I. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

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2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Entering-water temperature in deg. F.
c. Leaving-water temperature in deg. F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg. F.
f. Leaving-air temperature in deg. F.

J. Instrument Calibration Reports:

1. Report Data:

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

3.9 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing is complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verify that testing and balancing are complete and accurately documented in the final report, submit the final report for review.
2. The Owner may select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
3. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
4. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.10 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 06 00

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SECTION 23 31 10 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes metal ducts and accessories for various types of air distribution systems.

1.3 SUBMITTALS

A. Shop Drawings: Provide ductwork shop drawings to indicate the dimensioned locations and elevations of all ducts and duct accessories.

B. Provide submittal data for Cable Support Systems with SMACNA STRI verification.

C. Product data for each of the following products:

1. Duct liner and adhesives.
2. Duct sealants.

1.4 PERFORMANCE REQUIREMENTS

A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article as indicated in Part 3 of this specification.

B. Refer to the contract drawings for any notes that indicate requirements for duct construction that may differ from the SMACNA standard requirements. Where indicated provide duct construction that meets requirements.

1.5 QUALITY ASSURANCE

A. Comply with the requirements of NFPA 90A and 90B.

B. The installation of all ductwork shall comply with the requirements of the 2021 International Mechanical Code and all applicable local codes and code amendments.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protect all ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent dirt and moisture from entering ducts and duct fittings. Store ductwork in an area which is protected from the weather. All ductwork shall be shipped with a protective polyethylene film or other

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watertight covering at the ends of all ducts and fittings. To prevent condensation in the ducts, the covering shall not be added while excessive moisture is present in the duct.

B. While ducts are stored on-site the protective covering shall remain in place with the ducts stores on skids and placed such that the duct openings are not subject to water infiltration.

PART 2 - PRODUCTS

2.1 SINGLE WALL RECTANGULAR DUCTS AND FITTINGS

A. Refer to and comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Rectangular Duct Construction," for fabrication of ducts based on the static-pressure class indicated in Part 3 of this specification.

B. Unless otherwise indicated on the drawings fabricate ducts with a gauge thickness per the requirements of Chapter 2.

C. Longitudinal Seam, Traverse Joints and Reinforcements: Select and fabricate seam, joint, reinforcement types and sealing requirements and according to the requirements in Chapter 2 for required static-pressure class, applicable sealing requirements, duct-support intervals, and other provisions in the SMACNA Standard."

D. Duct fittings: fabricate elbows, turning vanes, branch connecters, offsets and transitions in accordance with Chapter 4 of the SMACNA "HVAC Duct Construction Standards - Metal and Flexible."

1. Radius elbows: type RE 1 with a center line radius equal to 1.5 times the duct width.
2. Square throat elbows: type RE 2 with turning vanes per figure 4-3 and 4.4.
3. Branch connections: 45-degree entry.

2.2 SINGLE WALL ROUND DUCTS AND FITTINGS

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

B. Unless otherwise indicated on the drawings fabricate ducts with a gauge thickness per the requirements of Chapter 3.

C. Longitudinal Seam, Traverse Joints and Reinforcements: Select seam, joint, reinforcement types and sealing requirements and fabricate according to the requirements in Chapter 3 for required static-pressure class, applicable sealing requirements, duct-support intervals, and other provisions in the SMACNA Standard."

D. Duct fittings: fabricate elbows and tees in accordance with Chapter 3.

1. Elbows: fabricate with a center line radius equal to 1.5 times the duct diameter.
2. Tees and laterals: fabricate per figure 3-5.

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2.3 SHEET METAL MATERIALS

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

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

1. Galvanized Coating Designation: G60 for interior ductwork conveying non-hazardous materials; G90 for interior ductwork conveying hazardous materials; G90 for exterior ducts without exterior insulation.
2. Finishes for Surfaces Exposed to View: Mill phosphatized and suitable for painting.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions.
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

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

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

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

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

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

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

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

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

a. CertainTeed Corporation.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.

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2. Materials: ASTM C 1071; surfaces exposed to airstream shall have a factory applied coating to prevent erosion of glass fibers and a factory applied coating on the edge of the liner.

    a. Thickness: 1 inch or as noted on the drawings.
    b. Density: 2.0 pcf.
    c. Thermal performance: “R” equals 4.2 for 1” thick; 6.0 for 1.5” thick; 8.0 for 2” thick.
    d. Sound Absorption Coefficient (NRC): 0.70 for 1” thick; 0.80 for 1.5” thick; 0.85 for 2” thick.
    e. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
    f. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    g. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

B. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," and manufacturer’s instructions.

1. Where lined ducts are indicated, the duct dimensions indicated on the drawings are the metal size. The net free area size of the duct is the metal size minus the liner thickness.
2. Adhere to a single layer of liner with adhesive coverage per the manufacturer’s recommendations.
3. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
4. Butt-transverse joints without gaps, and coat joint with adhesive.
5. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted edge overlapping.
6. Secure liner with mechanical fasteners per SMACNA standards and the manufacturer’s recommendations.
7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.

8. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

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

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.

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9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

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

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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

F. Round Duct Joint O-Ring Seals:

1. Seals shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

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

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

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

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

E. Trapeze and Riser Supports:

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

F. Cable Support Systems: Provide cable support systems and accessories that have been verified through the SMACNA Testing and Research Institute (STRI).

1. Manufacturers:

a. Duro Dyne.
b. Gripple Hang-Fast Systems.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Fabricate, install and support ductwork and accessories according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

B. The installing contractor is required to field verify all duct locations and elevations prior to fabrication of the ductwork.

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

D. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures. Do not locate ducts over electrical panels.

E. Ship and store all ductwork with a protective closure at the ends of all ducts and fittings. During construction, provide temporary polyethylene film enclosures at all openings in the duct systems, at the time of ductwork installation, to prevent entrance of dust and debris until final connections are completed.

1. Protective film shall be applied only after excessive moisture has been removed from ductwork, including moisture generated from sealants and adhesives. If moisture levels are not acceptable within the sealed ductwork, provide relief vent in temporary film.
2. Failure to protect duct systems from construction dust and debris will result in the installing contractor being required to Mechanically Clean the affected duct system(s) as indicated in this specification.

F. Install round and flat-oval ducts in maximum practical lengths.

G. Install ducts with fewest possible joints. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

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

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

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

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K. Where ducts pass through non-fire-rated interior masonry or drywall partitions and any type of exterior wall(s), cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

L. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Duct Accessories" for fire and smoke dampers. Provide firestopping as specified in Section 233300.

M. Paint interiors of metal ducts that do not have duct liner for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer.

N. Refer to contract drawings for locations where sprinklers are to be located within various duct systems. Coordinate locations with the sprinkler installer. Refer to contract drawing details for work required for a complete duct installation.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

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

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports and the requirements of the International Mechanical Code Section 603. Support spacing of all hangers shall be per SMACNA standards but in no case shall hangers be spaced at more than 10’-0” intervals.

B. Supports for Clothes Dryer exhaust ducts shall be at a maximum spacing of 4’-0”.

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

D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 12 feet.

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

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

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

G. Cable Support Systems: Where ducts are exposed to view in finished areas provide cable duct support systems installed per the manufacturer’s installation instructions.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

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

3.6 DUCT CLEANING

A. Where indicated on the contract drawings mechanically clean all ductwork connected to existing systems as described in this specification section.

B. New duct system installations: manually clean ductwork internally, section by section as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

C. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturers. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

D. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

E. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

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2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

3.7 MECHANICAL DUCT CLEANING METHODOLOGY

A. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

B. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

C. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

D. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

E. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

F. Provide drainage and cleanup for wash-down procedures.

G. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.8 DUCT SCHEDULE

A. Fabricate ducts with G90 galvanized sheet steel unless otherwise indicated in the following:

1. Type I range hood exhaust duct construction: comply with the requirements of Section 506 of the 2021 International Mechanical Code (IMC) and NFPA 96.

    a. Concealed ducts: minimum 14-gauge carbon steel with liquid tight welded joints.
    b. Exposed ducts: minimum 14-gauge Type 304 stainless steel with liquid tight welded joints.

2. Dishwasher exhaust ducts: Type 304 stainless steel. Provide watertight joints and slope ducts to allow drainage to the dishwasher.
3. Shower area exhaust ducts: Aluminum ducts and fittings with sealed watertight joints.
4. Dust collector ducts: Minimum 18-gauge G90 coated galvanized spiral duct and fittings with sealed joints.
5. Science hood exhaust ducts: PVC coated G90 galvanized ducts and fittings.
6. Clothes dryer exhaust ducts: Minimum 28-gauge aluminum. Installation to comply with all requirements indicated in the 2021 International Mechanical Code; Chapter 5, Section 504.

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B. Supply Ducts:

1. Ducts Connected to the discharge of Fan Coil Units, Unit Ventilators, Furnaces, Heat Pumps, and Air Terminal Units:

    a. Pressure class: positive 1-inch wg.
    b. Minimum SMACNA seal class: B.

2. Ducts Connected to the discharge of Modular and Packaged Air-Handling Units:

    a. Pressure class: positive 2-inch wg.
    b. Minimum SMACNA seal class: B.

3. Ducts Connected to the discharge of Variable Air Volume Air-Handling Units:

    a. Pressure class: positive 4-inch wg.
    b. Minimum SMACNA seal class: A.
    c. SMACNA leakage class for rectangular ducts: 4.
    d. SMACNA leakage class for round and oval ducts: 2.

4. Exterior Round Ducts: Pre-insulated double wall, shop-fabricated ducts.

C. Return Ducts:

1. Pressure Class: Positive or negative 2-inch wg.

    a. Interior ducts: minimum SMACNA seal class B.
    b. Exterior ducts: minimum SMACNA seal class B.

2. Exterior Ducts: Pre-insulated double wall shop fabricated ducts.

D. Exhaust Ducts:

1. Pressure Class: Positive or negative 1-inch wg.

    a. Minimum SMACNA seal class: B if negative pressure, and B if positive pressure.

2. Exterior Ducts: Pre-insulated double wall shop fabricated ducts.
3. Dust collections systems: negative 10” w.g. SMACNA leakage class 3.

E. Outdoor-Air:

1. Pressure Class: positive or negative 1-inch wg.

    a. Minimum SMACNA Seal Class: B.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

    a. Radius Elbows: type RE-1 with a center line radius of R= (3W)/2
    b. Square (mitered) Elbows: type RE-2 with the fitting width (W) equal.

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2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

        1) Radius-to Diameter Ratio = 1.5.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-5, "Divided Flow Branches."

    a. Type 2 or 3 as indicated on the contract drawings.

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

    a. Rectangular Main to Rectangular Branch: 45-degree entry.

3. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Provide fittings as indicated on the contract drawings.

END OF SECTION 23 31 10

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SECTION 23 33 00 - DUCT ACCESSORIES

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 various duct accessories such as fire dampers, volume dampers and other items that are typically part of a duct system.

1.3 SUBMITTALS

A. Submit Product Data for all accessories provided on the project.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Where indicated in Part 2, provide products manufactured by the listed companies.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 or G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

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D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

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

2.3 BACKDRAFT DAMPERS

A. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

B. Frame: 0.052-inch thick, galvanized sheet steel, with welded corners and mounting flange.

C. Blades: 0.025-inch thick, roll-formed aluminum.

D. Blade Seals: Vinyl or Neoprene.

E. Blade Axles: Nonferrous.

F. Tie Bars and Brackets: Galvanized steel.

G. Return Spring: Adjustable tension.

2.4 MANUAL BALANCING DAMPERS

A. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

B. Standard Balancing Dampers: Multiple or single-blade, with opposed blade design, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications. Provide single blade dampers where the duct dimension is 10 inches or less in height. Provide dampers with multiple blade design in larger ducts.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; provide frames with flanges where required for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Molded synthetic.
5. Tie Bars and Brackets: Galvanized steel.

C. Jackshaft: 1-inch diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

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1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include factory supplied or field installed elevated platform for insulated duct mounting.

2.5 FIRE DAMPERS

A. Manufacturers:

1. Arrow.
2. CESCO Products.
3. Greenheck.
4. Nailor Industries Inc.
5. Pottoroff, Inc.
6. Ruskin Company.

B. Fire dampers shall be listed and bear the label of an approved testing agency indicating compliance with the requirements of the International Mechanical Code 607.3.1. Fire dampers shall be labeled according to UL 555.

C. Fire Rating: 1-1/2 or 3 hours as noted on the drawings.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, minimum 22-gauge galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory or field-installed, galvanized sheet steel.

F. Mounting Orientation: Vertical or horizontal as required.

G. Blades: Roll-formed, interlocking, minimum 24-gauge galvanized sheet steel. In place of interlocking blades, use full-length galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Fusible Links: Replaceable, 165 deg F rated.

2.6 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes with the edge of the vanes parallel with the air flow.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch wide, double vane, curved blades of galvanized sheet steel; support with bars perpendicular to blades set 2 inches and set into vane runners suitable for duct mounting.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill and install where noted on the drawings.

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2.7 DUCT MOUNTED ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
2. Provide number of hinges and locks as follows:

a. Less Than 12 Inches Square: Secure with two sash locks.
b. Up to 18 Inches Square: Two hinges and two sash locks.
c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

D. Insulation: 1-inch thick, fibrous-glass or polystyrene-foam board.

2.8 FLEXIBLE CONNECTORS

A. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 0.028-inch thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Select metal compatible with ducts.

C. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

D. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.9 FLEXIBLE DUCTS AND ACCESSORIES

A. Manufacturers:

1. Thermaflex MK-E or equal.

B. Insulated Flexible Duct: UL 181, Class 1, flexible air duct complying with NFPA Standards 90A and 90B. Flexible duct shall be factory made and composed of a resilient film liner duct liner permanently bonded to a coated spring steel wire helix and supporting a fiberglass insulating blanket. Provide with a low permeability outer vapor barrier of fiberglass reinforced film laminate insulation.

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C. Operating temperatures: -20 Deg. F. minimum; 250 deg. F. maximum.

D. Operating pressure: 10” w.g. positive; 1” w.g. negative.

E. Insulation: minimum R 6.0.

F. Rated velocity 5000 fpm.

G. Maximum flame spread = 25. Maximum smoke developed = 50.

H. Flexible Duct Clamps: Nylon strap to suit duct size.

I. Flexible duct elbow supports: Thermaflex FlexFlow or FlexRight.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Ports: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit the specified eternal duct insulation thickness. Provide special gaskets where test holes are to be installed in round or oval ducts. Test Ports to be Duro-Dyne model TH1, IP2 and/or IP4.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Install manual balancing dampers in ducts with liner utilizing an insulated “hat” section at the damper frame. Avoid damage to and erosion of duct liner. Where balancing dampers are located in ducts with exterior insulation, provide and insulated hat section to house the damper operator.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

F. Provide test holes at fan inlets and outlets and elsewhere as required.

G. Install fire with fusible links, according to manufacturer's UL-approved written instructions. Provide the required identification for all fire, smoke and combination fire/smoke dampers as indicated in the International Mechanical Code, Chapter 6; 607.4

H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

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1. Adjacent to all fire dampers, providing access to reset or reinstall fusible links.
2. To interior of ducts for cleaning at maximum 100-foot spacing between access doors.

I. Install the following sizes for duct-mounting, rectangular access doors:

1. Minimum size 12 x 12 inches.
2. Ducts with one dimension 24" or larger, install a 20" x 20" access door.

J. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

K. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

L. Where indicated on the drawings, connect diffusers to low pressure ducts with maximum 72-inch length of insulated flexible duct. Connect flexible ducts to metal ducts and support flexible ducts in accordance with SMACNA Duct Construction Standards Metal and Flexible, Chapter 3. Install flexible duct elbow supports at all 90-degree flex connections to diffusers.

M. Install duct test holes, where indicated and required for testing and balancing purposes. Coordinate location with testing, adjusting and balancing contractor.

N. Provide turning vanes in all mitered elbows.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

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SECTION 23 37 10 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes ceiling and wall mounted diffusers, registers, grilles and accessories.

1.3 DEFINITIONS

A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

C. Register: A combination grille and damper assembly over an air opening.

1.4 SUBMITTALS

A. Submit manufacturer’s technical product data for all air outlets. For each model indicated, include the following:

1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
2. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished. The schedule shall also indicate static-pressure drop, and noise criteria ratings (NC) for each air outlet and inlet. A generic catalog sheet indicating pressure drop and NC ratings is not acceptable.

1.5 QUALITY ASSURANCE

A. Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems.

B. Source Limitations: Obtain diffusers, grilles and registers through one source from a single manufacturer, regularly engaged in production of the equipment.

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PART 2 - PRODUCTS

2.1 REGISTERS AND GRILLES

A. General: Provide registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation. Provide opposed blade damper on all registers. Provide registers and grilles manufactured by Titus. Subject to review, registers and grilles meeting the full requirements of the specifications and manufactured by one of the following will be considered:

1. Krueger
2. Price Industries.
3. Nailor.
4. Anemostat.
5. Metalaire.

B. Performance: Provide registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Structural Integrity: floor registers and grilles are required to meet the structural requirements indicated in the International Mechanical Code Chapter 6: 603.18.1.

D. Compatibility: Provide registers and grilles with border styles indicated and that are compatible with adjacent wall or ceiling systems, and that are specifically manufactured to fit into construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of construction which will contain each type of register and grille.

E. Types: The model numbers and manufacturers indicated on the drawing schedules set the standard for the product(s) to be provided. Provide registers and grilles of type as scheduled, with accessories as required to match the basis of design product named on the drawing.

F. Provide each register and/or grille in manufacturer’s standard white electro-coated finish. Refer to equipment schedules for grilles/registers that require a custom color. When required, the Architect will select the custom colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as

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much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. Provide any fasteners (screws, tamper proof screws, etc.) that are required by the manufacturer for installation.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION 23 37 10

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SECTION 26 00 10 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Submittals.
2. Coordination Drawings.
3. Record documents.
4. Maintenance manuals.
5. Rough-ins.
6. Electrical installations.
7. Cutting and patching.

1.2 SUBMITTALS

A. Follow the procedures specified in Division 1.

B. Submittals must be provided with all catalog information clearly identified indicating all options to be provided as part of the product. Any submittal not containing this information will be rejected.

C. Provide the following shop drawings in booklet form:

1. Wire devices shall be submitted all at one (1) time in a single packet and be from one (1) manufacturer.
2. **All required layout drawings shall be shown on architectural backgrounds and not the electrical drawings to ensure that the manufacturer locates all devices. It is the contractor's responsibility to acquire the CAD drawings per Division 1 requirements.**

1.3 PRODUCT REVIEWS AND SUBSTITUTIONS

A. Refer to Division 1 for substitutions requirements under this contract. Division 1 requirements supersede requirements listed elsewhere.

1.4 SHOP DRAWINGS

A. Refer to the Conditions of the Contract (General and Supplementary) and Division-1 for submittal definitions, requirements, and procedures.

B. Where submittals include multiple items, a bill of material (not including quantity) shall be provided at the front of the shop drawing. The bill of material shall include product identification, manufacturer and model number.

C. Submittal of Shop Drawings, Product Data, and Samples will be reviewed only when submitted by the Prime Contractor. Submittals from sub-Contractors and material suppliers directly to the Architect/Engineer

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will not be reviewed. No equipment/materials shall be installed until the Shop Drawings have been stamped with "No Exceptions Taken" or "Make Corrections Noted" by the Architect/Engineer.

D. Submit Shop Drawings as listed in each specification section. Following is a list of shop drawings to assist the contractor; however, the contractor shall supply all shop drawings as listed in each individual section whether listed below or not.

1. Power and Lighting Panelboards.
2. Disconnect Switches.
3. Fuses.
4. Wiring Devices and Wall Plates.
5. Flush Floor Outlets / Boxes and/or poke-thrus.
6. Surface Raceway.
7. All Lighting Fixtures (submit in booklet form and with detail drawings where required).
8. Fire Stopping Material.

E. When preparing submittals and any required final programming, use a room number schedule generated by the architect and/or the owner, which indicates the actual room numbers that will be used when the building is occupied. If the schedule is not available, revise the initial submittal, when a schedule is available, to reflect the proper room numbers.

F. Submittal Plans: Submittal plans **MUST** be provided with only the system being presented. Plans not submitted that have not been cleaned of extraneous systems (i.e. a low voltage system being installed on the power drawing, showing all the power and other low voltage systems), will be grounds for immediate rejection without review.

1.5 PRODUCT OBSOLESCENCE

A. In all cases, the most current iteration of the specified product shall be submitted. Where the specified product is no longer manufactured, the contractor shall submit an equivalent product with the same or better specifications. Where specific manufacturers are specified, the contractor shall supply from the same manufacturer the recommended replacement; however, under no circumstances shall the replacement product be deficient in any aspect to the specified product.

B. In the submittal for the product, the Contractor shall provide a signed letter clearly indicating the reason for the replacement product, and confirmation that the replacement product meets or exceeds all of the specified product's specifications to the best of the Contractor's knowledge.

C. The replacement product shall be provided at no additional cost to the owner, and shall not constitute any extension to the project schedule.

D. These requirements shall be inclusive to requirements listed elsewhere in the specifications, and shall not void any other requirements.

1.6 INSPECTIONS

A. The Contractor shall provide certificates of approval, in triplicate, for service equipment, building rough wiring, and building finished wiring.

B. Inspection certificates shall be submitted to the Engineer within 30 days after the inspections are made. Contractor shall use an independent NEC Certified Inspection Agency as the approved agency. Contractor must verify that the Certified Inspection Agency is approved by the local municipality and the Owner to

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inspect electrical installations in the project locality. All inspection certificates must be received before final payment can be made.

C. Refer to General Conditions for additional information.

1.7 INDEPENDENT COMMISSIONING

A. Independent Commissioning of electrical systems meeting local and state codes, and owner requirements shall be provided as part of this project. The independent commissioning authority may be hired by this Contractor, another project Contractor or the Owner, as indicated in the documents. However, this does not absolve the installing Contractor and manufacturer from ensuring full functionality of the systems, and manufacturer commissioning as outlined in the individual sections.

B. The Contractor shall schedule and coordinate shop drawing submissions, systems installation and systems start-up with the commissioning authority as required to allow the commissioning authority to perform their work.

C. Commissioning of the lighting control system shall take place on every project, and shall meet the local currently adopted version of the International Energy Conservation Code. This Contractor shall ensure this takes place, and contract with the applicable party as required.

1.8 MANUFACTURER'S REQUIREMENTS

A. All material shall be new, of the best respective kinds, manufactured by the company or companies mentioned and shall be of domestic manufacture unless specified otherwise.

B. All equipment, material or apparatus of any one system must be the product of one Manufacturer, or system tested products.

C. Manufacturers not listed in the Contract Documents must submit to the Engineer, via a Bidding Contractor, all product information per Division 1 requirements.

1.9 NAMEPLATE DATA

A. Each item of power operated equipment shall be provided with a permanent operational data nameplate on indicating Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliance, and similar essential data. Nameplates shall be located in an accessible location.

1.10 FAMILIARITY WITH PROPOSED WORK

A. All Contracts are with the understanding that the Contractor, prior to submission of his bid, acquainted himself with the requirements of the Drawings and Specifications, including "Conditions of the Contract," conditions of the site, its terrain, soil conditions, all other requirements of the Contract, and that he obtained all information necessary for completion of the work on or before the date specified for receiving of bids.

B. In all cases where a device or part of the equipment is herein referred to in the singular, such reference shall apply to as many such items as are required to complete the installation.

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C. "Existing" information does not necessarily represent "as-built" conditions. The Contractor shall verify all existing conditions. If discrepancies are found the Contractor shall notify the Architect/Engineer for a resolution before proceeding.

1.11 DEFINITIONS

A. The terms "The Contractor" or "This Contractor" mentioned in these Specifications refers to the Electrical Contractor responsible for the work and equipment included in these Specifications.

B. The term Sub-Contractor refers to any reference to, or letting of work contained in these Specifications to any Sub-Contractor or Manufacturer by the Prime Contractor. This does not relieve the Prime Contractor of his responsibility for all work, material and equipment in this Specification.

C. The term "Provide," when used separately, shall mean to "Furnish and Install."

D. The term "Furnish," when used separately, shall mean to obtain and deliver on the job for installation by other trades.

E. The term "Install," when used separately, shall mean to mount in place, connect and make operable.

1.12 INTENT OF THE DRAWINGS AND SPECIFICATIONS

A. The Drawings which accompany the Specifications are for the purposes of illustrating the character and extent of the work, and are subject to such modifications by Architect/Engineer as may be found either necessary or advisable before ordering the prosecution of the work. The Contractor shall conform to and abide by whatever Supplementary Drawings and explanations which may be furnished by the Architect/Engineer for the purpose of illustrating the work. The Architect/Engineer shall decide as to the meaning or intention of any portion of the Specifications and Drawings.

B. Where the work is shown in complete detail on only half or a portion of a Drawing, or there is an indication of continuation, the remainder being shown in outline, the work drawn out in detail shall be understood to apply to other like portions of the structure. All work that may be called for in the Specifications and not shown on the Drawings, or shown on the Drawings and not called for in the Specifications, shall be executed and furnished by the Contractor as described in both.

C. Should any incidental work or materials be required, but not set forth in the Specifications or Drawings, either directly or indirectly, but which is necessary to fulfill the intent thereof, the Contractor is to understand same to be implied and required, and he shall perform all such work and furnish all such materials as fully as if they were particularly delineated or described, without additional cost to Owner. This shall include all materials, devices, methods peculiar to the machinery, equipment, apparatus, or systems as described herein.

1.13 EQUIPMENT ENCLOSURE RATINGS

A. Electrical equipment installed within the building shall carry a NEMA rating 1 or higher if indicated in the specifications or on the drawings.

B. Electrical equipment installed outside the building, or in environmentally wet locations shall carry a NEMA rating 3R or higher if indicated in the specifications or on the drawings.

C. Electrical equipment installed in harsh environments (i.e. natatoriums, greenhouses, etc.) shall carry a NEMA rating 4X, and be manufactured from stainless steel.

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D. Where specifications and drawings conflict (i.e. drawings indicated NEMA 3R, but specifications indicate NEMA 1), the higher rating shall be provided at no additional cost to the project.

1.14 WIRING LAYOUTS

A. Should it become necessary to rearrange any of the circuit or feeder wiring, approval to do so shall first be obtained from the Engineer. The Contractor will be supplied with a spare set of Drawings on which all such approved changes shall be noted. Upon completion of all work under this Contract, these Drawings shall be returned to the Architect/Engineer, who will issue a receipt for same.

1.15 FIELD MEASUREMENTS

A. Before ordering any materials or doing any work, Contractor shall verify all measurements at the building site, and shall be responsible for correctness of same. At no time shall the Contractor scale Drawings for the purpose of installation.

B. No extra compensation will be allowed on account of differences between actual dimensions and those indicated on the Drawings. Any difference which may be found shall be submitted to the Architect/Engineer for consideration before proceeding with the work.

1.16 COORDINATION

A. The Contractor shall cooperate with the other Contractors and shall arrange to eliminate conflicts with the equipment and work of the Contractors.

B. The Contractor shall be responsible for coordinating all electrical devices/equipment with the casework before rough-in. Any conflicts with casework and electrical devices/equipment shall be brought to the attention of the Architect/Engineer before rough-in. Any electrical device/equipment installed in conflict with casework shall be removed and reinstalled at the Contractor's expense.

1.17 CHASES AND OPENINGS

A. The Contractor shall determine, in advance, the locations and sizes of all chases and openings necessary for the proper installation of his work and have same provided during construction. Any chase or opening not made during construction, due to the Contractor's failure to determine same in advance, shall be done by the Contractor at his own expense. Any unnecessary cutting shall be repaired to match the original conditions of the area disturbed at the Contractor's expense.

1.18 AIR PLENUMS

A. The Contractor shall use a conduit system or approved plenum rated wiring for all wiring located above ceilings.

1.19 RECORD DOCUMENTS

A. Refer to Division 1 for Record Document requirements. The following requirements supplement the requirements of Division 1.

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B. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned from column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; work performed via Change Orders; concealed control system devices.

C. Mark Specifications to indicate changes by addendum or Change Orders; actual equipment and materials used.

D. All new underground utilities shall be marked and dimensioned on site plan as-built drawings.

1.20 OPERATION AND MAINTENANCE DATA

A. Refer to Division 1 for Operation and Maintenance Manual requirements.

B. Contractor shall provide Operation and Maintenance data listed in individual section in addition to requirements listed in Division 1.

C. Included with operation and maintenance data, under a separate tab or volume, complied into a single place, shall be manufacturer recommended preventative maintenance measures for each piece of equipment installed as part of this project.

1.21 WARRANTIES

A. Division 1 warranties shall be considered minimum warranties. Any warranties listed in the individual sections that are longer than Division 1 warranties shall be honored.

B. Refer to individual sections for warranty requirements beyond those as specified in Division 1.

1.22 TEST AND ADJUST

A. All systems installed under this Contract shall be tested and adjusted to ensure that all equipment and systems meet or exceed the specified requirements.

1.23 PHASE LOAD BALANCE

A. A reasonable balance shall be secured on the phases of all main distribution feeders and bus bars.

B. Following installation and with the system in operation, the Electrical Contractor shall check the balance and rearrange connections so that the ampacity on any of the two single-phase phases of the main bus shall not vary more than 10% of each other.

1.24 PAINTING

A. Refer to the Division 1 for general painting requirements.

B. The Contractor shall be responsible for all touch up painting on this project for electrical work.

C. The Contractor shall be responsible for painting of all conduits that is installed after general painting has been completed. In areas where the General Trades Contractor is not painting, this Contractor shall be responsible for painting conduits and boxes to match adjacent surfaces.

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1.25 CLEANING

A. Refer to Division 1 Section, "Project Closeout" or "Final Cleaning" for general requirements for final cleaning.

B. The Contractor shall keep the building free of rubbish and material during the course of construction insofar as the work under this Contract is concerned.

C. Upon completion of the project, the Contractor shall remove all rubbish, surplus equipment and shipping labels and have all areas broom clean. The Contractor shall thoroughly clean all fixtures, and other electrical equipment, leaving same in first-class working condition.

1.26 INSTRUCTION OF OWNER'S PERSONNEL

A. The Contractor shall provide instruction of the owner's personnel as outlined in Division 1. The following requirements shall be included in addition to Division 1 requirements.

B. The Contractor shall provide the services of competent personnel and/or Manufacturer trained personnel to instruct employees designated by the Owner in the proper operation, care and maintenance of the equipment and system installed under the Contract.

C. A letter of certification itemizing the equipment, system, instructor, and bearing signatures of the employees instructed shall be delivered to the Engineer and the Owner upon completion of the project. The letter of certification shall note the number of hours spent in explanation and actual operation of system with maintenance personnel. If the Contractor cannot turn over this letter of certification with employee signatures, the Contractor shall be prepared to provide additional owner training, meeting the specification requirements, at no additional cost to the owner.

1. The Contractor shall keep notes of all of the training sessions, list discussion topics, questions and answers. The contractor shall provide these typed meeting minutes of the training sessions to all of the attendees and owner's representative. A final copy of these minutes shall also be provided with the O and M manuals for the applicable product.

D. The Contractor shall be responsible to video record each trained presentation session with the owner and the manufacturer and turn over the recordings to owner after completion of training session. The recordings may be turned over on DVD or Thumb drive. The Contractor shall obtain a signed receipt for the recordings proving the owner received them. If a copy of the receipt cannot be turned over and validated when requested, the contractor shall be responsible to provide additional training sessions as requested. A generic training video shall be acceptable in lieu of recording the owner's training session; however, this does not absolve the contractor of providing a private training session with the owner.

1.27 DELIVERY AND STORAGE OF MATERIALS

A. Refer to the Division 1 for delivery and storage of materials requirements.

B. The Contractor shall provide for, or secure use of, suitable-dry storage space for the safe delivery and storage of his materials. The Contractor shall be responsible for providing their own storage trailers on site. The use of Owner's inside-building storage will not be permitted, unless specifically noted otherwise.

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1.28 PROTECTION OF EQUIPMENT AND MATERIALS

A. Responsibility for care and protection of electrical work rests with the Contractor until it has been tested and accepted by the Owner. After delivery, before and after installation, protect equipment and materials against theft, injury, or damage in all cases.

B. Protect equipment outlets, and pipe openings with temporary plugs, caps, or burlap. Electrical conduit openings shall be covered with capped bushing or fiber disks and bushings.

C. The contractor shall be responsible to protect all existing electrical or communications equipment to remain from construction dirt and debris, whether created from this contractor or another contractor. The contractor shall determine the method needed to protect each piece of equipment to remain. Should existing equipment be damaged during demolition it will be the responsibility of the contractor to provide necessary repairs or replacement of the damaged equipment.

1.29 PROTECTION OF SENSITIVE ELECTRONICS

A. During construction activities, the Contractor shall protect all newly installed and existing sensitive electronics, including, but not limited to Data equipment (network electronics, servers, etc.), intercommunications equipment, telephone equipment, CATV equipment, security equipment and CCTV equipment with a method that will keep all construction dirt and debris from the equipment filters, whether generated by this contractor or other contractors.

B. At a minimum, the Contractor shall build wood frames around all equipment housed in freestanding and wall mounted racks when construction occurs within the vicinity of the equipment. Cover housing with minimum 6mil thick reinforced clear plastic sheeting. The enclosure shall include removable access panels to work on equipment and shall be sized to provide sufficient air flow around equipment to avoid excessive heat buildup. The contractor shall provide an exhaust fan at one end and a similar sized framed inlet opening at the other end with a removable MERV 8 filter. Filters shall be replaced within sufficient intervals to avoid excessive heat buildup.

C. The Contractor may propose an alternate protection method prior to construction; however, the Contractor shall be prepared to provide the enclosure if their method is rejected.

D. Should the equipment be damaged during construction, the contractor shall replace the equipment with the same piece at no additional cost to the owner.

1.30 SCAFFOLDING AND HOISTING

A. The Contractor shall provide all lumber and other material required for the erection of all staging, scaffolding, shoring, protective platforms, railings and ladders. Scaffolding shall be removed at the completion of the work.

B. The Contractor shall protect any flooring that is to remain. The Contractor shall inspect the flooring before the scaffolding is installed and report any damage that exists before the start of construction. The Contractor shall be responsible to repair any damage to the flooring after the scaffolding is removed to the acceptance of the owner at no additional cost to the owner.

1.31 PERMITS AND FEES

A. Refer to the Division 1 for Permits and Fee requirements.

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B. Unless noted otherwise, all electrical work permits, certificates, tests, and inspection fees required for the electrical work provided under this contract shall be paid by the Contractor, including any electrical licenses required to work on the project.

1.32 UTILITY COMPANY FEES OR CHARGES

A. Unless noted otherwise, all utility company (Electric, Telephone, Cable Television, Leased Fiber) fees or charges will be paid by the Owner directly to the utility companies.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment Specifications in Divisions-2 through -25 for rough-in requirements.

3.2 CUTTING AND PATCHING

A. Perform cutting and patching in accordance with Division 1. In addition to the requirements specified in Division 1, the following requirements apply. The Contractor shall be responsible for providing all cutting and patching required to perform his work unless noted otherwise.

B. Perform cutting, fitting, and patching of electrical equipment and materials required to:

1. Uncover work to provide for installation of ill-timed work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect, uncover and restore work to provide for Architect observation of concealed work.

C. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

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3.3 PROTECTION OF INSTALLED WORK

A. During construction activities, including cutting and patching operations, protect adjacent installations.

B. Patch existing finished surfaces and building components using new materials matching existing materials and experienced installers. For installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.4 ELECTRICAL INSTALLATION

A. Coordinate electrical equipment and material installation with other building components. Verify all dimensions by field measurements. If no dimensions are given, Contractor shall verify with Architect or Engineer before starting work. At no time shall the Contractor scale Drawings for the purpose of locating items.

B. Provide for chases, slots, and openings in other building components to allow for electrical installations. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

C. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

D. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible, or to meet current local, national and ADA codes.

E. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

F. Install systems, materials, and equipment to conform with submittal data, including Coordination Drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect/Engineer.

G. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

H. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

1. Contractor shall also take care to leave access to other systems located behind electrical components being installed as part of this project. Should it be found that access has been blocked to other equipment requiring access (i.e. filters, valves, etc.), the offending system will be required to be removed and reinstalled at no additional cost to the owner.

I. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

J. Where exterior conduits, duct banks, equipment and pads are installed by this contractor, the contractor shall follow all NEC requirements, as well as those requirements listed on the drawings and in the specifications. Where excavation, both interior and exterior, is indicated to be performed by this contractor, backfill shall also be performed, meeting all requirements of the applicable drawing notes and specifications. Backfill shall include clean earth and/or stone, as specified in the applicable specifications,

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placed and tamped as indicated in the specifications. Provide all testing as outlined in the applicable specifications.

K. Electrical component installation in spaces where abuse may occur (i.e. gymnasiums, locker areas, exterior areas) shall be provided with vandal covers. Covers shall be provided with a means to be locked. System components include, but are not limited to light switches/dimmers, occupancy sensors, sound system controls, fire alarm devices, clocks, wireless access points, etc.

L. Seal all places where conduits or wiring pass through walls and floors.

3.5 LOW VOLTAGE WIRING INSTALLATION

A. All low voltage wiring, installed above ceilings, must be plenum rated, unless noted otherwise. Wiring shall be installed perpendicular to steel, located in j-hooks and/or cable tray as available and allowed. Refer to individual specification and drawings for allowance if cable installation in cable trays.

B. All low voltage wiring, installed in spaces without ceilings, must be installed within conduit or other approved raceway. This requirement shall apply to finished spaces (i.e. gymnasium, etc.) and unfinished spaces (i.e. mechanical rooms, electrical rooms, etc.) Under no circumstances is exposed wiring acceptable.

C. The contractor shall be responsible to provide surge protection for all low voltage systems where copper lines leave and/or enter a building. System shall include, but not be limited to, voice, fire alarm, CCTV, television and security. All surge protection for low voltage systems shall be solid state, unless otherwise noted.

3.6 EXISTING INSTALLED EQUIPMENT

A. Where existing installed equipment (including, but not limited to gymnasium equipment (batting cage, divider nets, etc.), free hanging projection screens, theatrical equipment, etc.) is in the way of construction, the Contractor shall move equipment as required to accommodate their work.

B. During relocation, and work, the Contractor shall take care to no damage the equipment. Should the equipment be damaged prior to work commencing, they shall take photographic evidence, and report, in writing to the Owner, Architect and Engineer, the existing observed damage.

C. Should the existing equipment be damaged during construction activities, the contractor shall repair at no additional cost to the Owner.

3.7 ELECTRICAL REQUIREMENTS FOR EQUIPMENT INSTALLATION

A. Conduit and power wiring of required size and voltage, from a panelboard or similar source, shall be furnished and installed by this Contractor, to the equipment furnished by another Contractor. A junction box or means of disconnect (as required) shall be furnished and installed at the equipment by this Contractor meeting the National Electric Code.

B. Unless noted otherwise, a full complement of electrical control components, required for the intended use and/or operation of specified equipment, including variable frequency controllers, speed controllers and/or other control devices required, whether integral or remote, shall be furnished by the Contractor furnishing the equipment. These control devices as well as power wiring (where required) through these devices shall be installed by this Contractor.

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3.8 CONTROL WIRING FOR EQUIPMENT INSTALLED BY ANOTHER CONTRACTOR

A. This Contractor shall be responsible for providing all required control wiring, (except HVAC system control wiring) for any equipment provided by another Contractor which shall include, but not be limited to, motorized backboards, screens, partitions, curtains, motor operated doors, etc, unless noted otherwise.

B. The Contractor shall provide all boxes and conduit required for any equipment provided by another Contractor. Control wiring shall also include any wiring of motion or occupancy sensors for doors, curtains, etc.

C. Coordinate all required work for a complete and functional system with the Contractor supplying the equipment. Make all required connections.

D. Prior to installing any control wiring to any equipment, acquire control wiring diagrams and direction from the installing contractor.

3.9 TEMPORARY ELECTRIC/TELEPHONE

A. Refer to Division 1 "General Conditions."

B. Temporary Electric for Building Construction: Refer to Temporary Facilities for requirements.

C. Temporary Electric for Construction Trailers: Refer to Temporary Facilities for requirements.

D. Temporary Telephone for Construction Trailers: Refer to Temporary Facilities for requirements.

E. Lighting: Provide temporary lighting in accordance with OSHA, (5-footcandles) with local switching to fulfill security requirements and provide illumination for construction operations and traffic conditions.

1. Lamps and Light Fixtures: Provide general service lamps. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.

3.10 ELECTRICAL DEMOLITION

A. The Electrical Contractor shall be responsible for all electrical demolition.

B. The Contractor shall be responsible for disconnecting and removing from the site all conduit, wiring, light fixtures, devices, panelboards, switchboards, transformers, disconnect switches, emergency generators, data, intercom, clock, sound, fire alarm, card access, security, CCTV, etc. The Owner shall tag or notify the Contractor as to any devices, equipment or systems which they wish to salvage before start of each phase of construction. See paragraph, "Salvage" for additional information.

C. The Electrical Contractor shall review all demolition drawings, including from other trades, and remove from the site all power wiring and associated electrical equipment, including, but not limited to wire, conduit, boxes, disconnecting means, supports, etc. feeding equipment that is being removed by other trades. This includes within the building, on the roof, attached to the building, and on the site.

D. Where fastened equipment is removed, the contractor shall be responsible to remove the associated lags or bolts that fastened the equipment down. Grind lags or bolts to below exiting surface and patch surface to match existing condition.

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3.11 ELECTRICAL EQUIPMENT IN AND ABOVE CEILINGS

A. Where ceilings are being removed to accommodate phasing, the contractor shall tie up all low and line voltage wiring that is resting on the ceiling grid scheduled to remain or feeding a later phase until that wire can be removed.

B. Any wire that is scheduled to remain shall be independently supported from the structure or walls per the applicable specification sections. Low voltage wire shall be installed in cable tray or j-hooks and line voltage wire shall be installed in conduit and supported per NEC.

C. Where ceilings are being removed to accommodate phasing, the contractor shall tie up all lighting, fire alarm equipment (smoke detectors, annunciation devices, etc.), intercom speakers, and other electrical equipment until the new ceiling is installed. Electrical devices shall be removed or reinstalled as scheduled on the documents.

D. All existing MC cable encountered above the ceiling, not supported per the NEC, shall be tied up and supported per NEC requirements when encountered.

E. All wire, conduit, electrical systems or electrical devices, including, but not limited to lighting, power wiring, receptacles, data, fire alarm, security, CCTV, access control, intercom, phone, etc. above or in the ceiling that is abandoned prior to construction or being abandoned as part of the construction shall be removed at no additional cost to the owner. At the completion of the project, there shall be no abandoned wire, conduit, electrical systems or electrical devices in or above the ceiling.

3.12 SALVAGE

A. The Owner reserves the right to salvage any electrical equipment prior to the start of each phase of construction.

B. It shall be the contractor's responsibility to verify all N.E.C. clearance requirements prior to installation, including, but not limited to ductwork, piping, or other equipment above electrical equipment, as well as all horizontal requirements.

END OF SECTION 26 00 10

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SECTION 26 05 00 – COMMON REQUIREMENTS – ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials and methods that are common to various Electrical Systems.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Fireproofing
2. Access Doors

1.3 COORDINATION

A. Arrange for conduit spaces, chases and openings in building structure during progress of construction to allow for electrical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are construction as applicable.

C. Coordinate requirements for access panels and doors for electrical items requiring access that are concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 FIRESTOPPING

A. The Contractor shall be responsible for providing permanent, UL approved firestopping systems for all penetrations through fire rated floor or fire rated wall assemblies. For areas that will require future access for the installation of additional cables, repair, or retrofit, the firestopping system shall consist of re-usable intumescent pillows or putty. All firestopping shall meet the requirements of ASTM E-814 and UL 1479.

1. Subject to compliance with project requirements, firestopping materials may be provided by one of the following Manufacturers.

a. Specified Technologies Inc. (STI) Somerville, NJ (800) 992-1180
b. Tremco, Beechwood, OH (800) 321-7906
c. 3M, St. Paul, MN (800) 328-1687

2. Submit for review the following product data.

a. Product data sheets.
b. UL System Drawings for each firestopping application.
c. Manufacturer’s Certificates of Conformance for their products.

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2.2 ACCESS DOORS

A. Refer to Division 8, “Access Doors and Frames” for additional requirements. Access doors furnished and installed under this contractor shall comply with Division 8 requirements in addition to the following.

B. Manufacturers: Subject to review, provide access doors manufactured by Milcor, Inc or equal.

C. Description: Steel access doors and frames for installation in masonry and/or drywall/gypsum board assemblies. Provide fire rated access doors when doors are installed in a fire rated assembly.

D. Frames: minimum 16 gage steel with exposed nominal 1” flange around the perimeter of the unit. Where doors are to be installed in drywall/gypsum board assemblies provide frames with a drywall bead. Doors to be installed in masonry shall be furnished with adjustable metal masonry anchors.

E. Flush Panel Doors: minimum 14 gage steel with concealed spring or piano hinge(s) with a minimum swing of 175 degrees. Finish to be a factory-applied primer, suitable for field painting. Provide flush cylinder lock with key. Key all locks alike. Verify keying with owner prior to ordering.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment Specifications in Divisions-2 through -25 for rough-in requirements.

3.2 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

A. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

B. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

3.3 FIRESTOPPING

A. Comply with manufacturer’s written instructions for install fire stopping. When mechanical system is used, set securely in place in accessible locations.

B. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

C. Firestopping shall be installed in all fire rated walls. Review all drawings, including architectural, and site conditions to determine where fire rated walls are located.

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D. Preparation

1. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

    a. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
    b. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
    c. Remove laitance and form-release agents from concrete.

E. Installation

1. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
2. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

    a. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

3. Install fill materials by proven techniques to produce the following results:

    a. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
    b. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
    c. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

F. Identification

1. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
2. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

G. Cleaning and Protection

1. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
2. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

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3.4 ACCESS DOORS

A. Comply with manufacturer's written instructions for installing access doors and frames. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces. Install doors flush with adjacent finished surfaces or recessed to receive finish material.

B. Adjust doors and hardware after installation for proper operation. Remove and replace doors and frames that are warped, bowed or otherwise damaged.

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SECTION 26 05 19 – WIRES AND CABLES – 600V AND BELOW

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of the wire and cable work is indicated by Drawings and by requirements or other sections of the Specifications for cables used for power, lighting, signal, control and related system rated 600 volts or less. See below article “CABLES” for permitted use of Type MC Cables on this project.

1.2 CODES AND STANDARDS

A. NEC Compliance: Comply with applicable requirements of NEC for construction and installation of wires/cables and connectors.

B. UL Compliance: Comply with UL Stds 44, 83 and 486A, B and C. Provide wiring/cabling and connector products which are UL-listed and labeled consistent with their uses.

C. ICEA Compliance: Insulated Cable Engineers Association Inc., Standard WC-5-86.

D. IEEE Compliance: Institute of Electrical and Electronic Engineers, Standard 82-83.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all wires and cables of sizes indicated on the Drawings and suitable for the temperature, conditions and location where installed. Install all wire in raceway.

2.2 CONDUCTOR MATERIAL

A. Use copper conductors of 98% conductivity and rated at 600V for all wires and cables, unless otherwise noted.

2.3 INSULATION

A. No conductors smaller than No. 12 AWG shall be used unless noted elsewhere. All wires No. 8 AWG or larger shall be stranded. Wire sizes No. 12 and No. 10 AWG. shall be solid (stranded wire used for No. 12 AND 10 will not be permitted unless otherwise noted).

B. All conductors shall be provided with type THHN/THWN insulation, unless noted otherwise.

C. All switchboard, transformer and panelboard feeder insulation shall be type XHHW-2.

D. Each circuit shall be provided with a dedicated neutral wire. Sharing of neutral wire for multiple circuits shall not be permitted, unless otherwise noted.

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2.4 CABLES

A. Provide the following in NEC approved locations and project applications where indicated.

B. Type MC Cable: Provide Metal Clad Cable wiring using two No. 12 or 10 AWG with separate insulated copper ground wire (unless noted otherwise). Where AC (armored cable without separate neutral) is installed, Contractor will be required to remove cable and reinstall with approved cable type at no additional cost to the owner. Metal Clad cable may be used on this project only as follows:

1. For lighting and receptacle branch circuits from panel to device(s) or light fixture(s).
2. Connection to motors (2 feet maximum).
3. Fishing existing walls.
4. Branch circuits in stud walls.
5. Mechanical equipment/miscellaneous branch circuits inside of the building (less than 50amps) where condition warrants.

C. Where MC cables are run in parallel (i.e., down corridors), the Contractor shall bundle the cables and zip tie them together.

D. The Contractor shall bear all costs related for removing MC cable not pre-approved. Support and secure type MC cable at intervals not exceeding 6'-0". In addition, type MC cable must be supported within 12" of every fitting, junction box or outlet box that the cable enters.

E. All other wiring shall be installed in conduit as specified in Division 26 “Raceways,” unless approved otherwise by the Engineer prior to installation.

F. All switchboard, transformer and panelboard feeder wiring shall be run in conduit.

2.5 CONNECTORS FOR CONDUCTORS

A. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

PART 3 - EXECUTION

3.1 WIRES AND CABLES

A. General: Install electrical cables, wires, and connectors in compliance with NEC. Coordinate cable installation with other work. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.

B. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.

C. While installing cables, care shall be taken to protect outer coating. If outer coating is damaged, contractor shall remove and reinstall cables.

D. Conceal all cable in finished spaces. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible. Keep conductor splices to minimum.

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E. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. Use splice and tap connectors which are compatible with conductor material.

F. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Make terminations so there is no bare conductor at the terminal. Provide wire ties and neatly train and rack wires in all boxes, panels, and other areas as required.

G. Tighten electrical connectors and terminals, including screws and bolts, in accordance with Manufacturer's published torque tightening values. Where Manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

H. Each branch circuit shall be provided with a dedicated neutral wire, unless noted otherwise.

I. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.2 FIELD QUALITY CONTROL

A. Prior to energizing, provide the following tests to all cables, 600 Volt or less and size no. 3 AWG or larger:

1. Inspect exposed sections of Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
2. Test bolted connections for high resistance using one of the following:

    a. A low-resistance ohmmeter.
    b. Calibrated torque wrench.
    c. Thermographic survey.

3. Inspect compression-applied connectors for correct cable match and indentation.
4. Inspect for correct identification.
5. Inspect cable jacket and condition.
6. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration. Use an industry approved meter for all tests.
7. Continuity test on each conductor and cable.
8. Uniform resistance of parallel conductors.
9. All inspection, cleaning and testing procedures shall be in compliance with the recommendations and standards outlined in the "maintenance testing specifications for electrical power distribution equipment and systems", latest edition, published by International Electrical Testing Association (NETA).

B. Prepare test and inspection reports and locate in the O&M manuals at the completion of the project. Test and inspection reports shall be provided to record the following:

1. Procedures used.
2. Results of above tests that comply with requirements.
3. Results that do not apply, corrective action taken, and retesting showing that they comply with the above requirements.

C. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

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D. Color-Coding for Phase Identification:

1. Color-code secondary service, feeder, and branch circuit conductors with factory-applied color as follows:

Phase	120/208 Volts	120/240 Volts	277/480 Volts
A	Black	Black	Brown
B	Red	Orange (High-Leg)	Orange
C	Blue	Blue	Yellow
Traveler	Yellow	Yellow	Yellow w/ “T” tag
Neutral	White	White	Gray
Ground	Green	Green	Green w/ Yellow stripe

2. Switch legs shall include an additional “S” tag.
3. Provide visible colored taped as listed above at all termination points for No. 8 and larger wires.

END OF SECTION 26 05 19

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SECTION 26 05 26 – GROUNDING

PART 1 - GENERAL

1.1 SUMMARY

A. Extent of electrical grounding and bonding work is indicated by Drawings and Schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

B. Type of electrical grounding and bonding work specified in this section includes the following:

1. Solidly grounded.

1.2 CODES AND STANDARDS

A. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.

B. UL Compliance: Comply with applicable requirements of UL 467, 486A, and 869, pertaining to grounding and bonding of systems, circuits and equipment. Provide grounding and bonding products which are UL-listed and labeled for their intended usage.

C. NRTL: Connectors shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General: Except as otherwise indicated, provide electrical grounding and bonding system assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sizes according to NEC.

C. Bonding Plates, connectors, Terminals, and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp Manufacturers for indicated applications.

D. Electrical Grounding connection Accessories: Provide electrical insulating tape, heat shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories Manufacturers for type service indicated.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Architect/Engineer in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEM

A. General: Install electrical grounding and bonding system as indicated, in accordance with Manufacturer's instructions and applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements.

B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

C. Branch Circuits: Install a minimum 12 AWG ground wire in each 20A circuit and conduit run and to connect to each device. Size larger circuit ground wires as per NEC Table 250-122.

D. Ground each separately-derived system neutral to separate grounding electrode.

E. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

F. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.

G. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with Manufacturer's published torque tightening values for connectors and bolts. Where Manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

H. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible to minimize transient voltage rises.

I. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory-applied protective coatings have been destroyed, which are subjected to corrosive action.

J. Install clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.

K. Provide ground wire connection to all electrical boxes and wiring devices.

L. The contractor shall be responsible to provide grounding connection on gas piping where an appliance or mechanical piece of equipment has gas and electric circuit run to it. The ground conductor size shall be the same size as the electrical branch circuit run to the appliance or equipment to meet the NEC. article 250.

M. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct

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electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping. Connect with same size ground as ground feeding circuit.

N. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance of each separately derived system with ground resistance tester. Where tests show resistance-to-ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms, or less, by driving additional ground rods; then retest to demonstrate compliance.

1. Provide type-written report in O&M manual documenting test results.

B. Contractor shall coordinate with local inspector to provide tests as required, and provide additional tests as required.

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SECTION 26 05 29 – SUPPORTING DEVICES

PART 1 - GENERAL

1.1 CODES AND STANDARDS

A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical supporting devices.

B. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

C. UL Compliance: Provide electrical components and devices which are UL-listed and labeled.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide supporting devices which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one (1) type of device fulfills indicated requirements, selection is Installer's option.

2.2 SUPPORTS

A. Provide supporting devices of types, sizes and materials indicated; and having the following construction features:

1. Clevis Hangers: For supporting up to 2" rigid metal conduit; galvanized steel; with 2" diameter hole for round steel rod; approximately 54 pounds per 100 units.
2. Riser Clamps: For supporting up to 5" rigid metal conduit; black steel; with 2 bolts and nuts, and 4" ears; approximately 510 pounds per 100 units.
3. Reducing Couplings: Steel rod reducing coupling, 2" x 5/8", black steel; approximately 16 pounds per 100 units.
4. C-Clamps: Black malleable iron; 2"rod size; approximately 70 pounds per 100 units.
5. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flanges width 2"; approximately 52 pounds per 100 units.
6. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approximately 7 pounds per 100 units.
7. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.
8. Hexagon Nuts: For 2" rod size; galvanized steel; approximately 4 pounds per 100 units.
9. Round Steel Rod: Black steel; 2" diameter; approximately 67 pounds per 100 feet.
10. Offset conduit clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.

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2.3 ANCHORS

A. Provide anchors of types, sizes and materials indicated; and having the following construction features:

1. Lead Expansion Anchors: 2”; approximately 38 pounds per 100 units.
2. Toggle Bolts: Spring head; 3/16" x 4"; approximately 5 pounds per 100 units.
3. Manufacturers: Provide anchors of one of the following (for each type of anchor):

a. Ackerman Johnson Fastening Systems, Inc.
b. Ideal Industries, Inc.
c. Joslyn Manufacturing and Supply Co.
d. McGraw Edison Co.

2.4 SLEEVES AND SEALS

A. Provide sleeves and seals, including armored cable seals, of types, sizes, and materials indicated, with the following construction features:

1. Sleeve Seals: Provide sleeves for piping which penetrated foundation walls below grade, or exterior walls. Caulk between sleeve and pipe with non-toxic, UL-classified caulking material to ensure watertight seal.
2. Wall and Floor Seals: Provide watertight wall and floor seals, or types and sizes indicated; suitable for sealing around conduit, pipe, of tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

B. Fire-Rated Walls and Floors: At all locations where conduits, cables, or ducts penetrate a fire-rated wall or floor, a special fire-retardant caulking compound or other approved device as specified in Division 26 “Common Requirements - Electrical” shall be used.

2.5 CONDUIT CABLE SUPPORTS

A. Provide cable supports with insulating wedging plug for non-armored type electrical cables in risers; construct for 2” rigid metal conduit; 3-wires, type wire as indicated; construct body of malleable-iron casting with hot-dip galvanized finish.

2.6 U-CHANNEL STRUT SYSTEMS

A. Provide U-channel strut system for supporting equipment supplied under this contract, 12-ga hot-dip galvanized steel, or types and sizes indicated; construct with 9/16” diameter holes, 8” on center on top surface, with standard finish, and with the fittings which mate and match with U-channel. The Contractor is responsible to size and install strut to meet properly support its intended load.

B. Auxiliary Steel Supports: Provide all required auxiliary steel to install any equipment supplied under this contract. The design and gauge of steel used shall be as required by the manufacturer's specifications. The Contractor is responsible to size and install auxiliary steel to properly support its intended load.

C. Drop Cords: At Drop Cord locations provide miscellaneous threaded rod, unistrut, steel plates, etc. to vertically and laterally support Drop Cord. Where drop cord is located in ceilings provide proper support to prevent movement and damage to ceiling tile.

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D. Manufacturers: Provide U-channel strut systems of one of the following (for each type system):

1. Allied Tube and Conduit Corp.
2. Midland-Ross Corp.
3. OZ/Gedney Div; General Signal Corp.
4. Power-Strut Div; Van Huffel Tube Corp.
5. Unistrut Div; GTE Products Corp.

PART 3 - EXECUTION

3.1 GENERAL

A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices. Comply with installation requirements of NECA and NEC pertaining to supporting devices.

B. Coordinate with other mechanical and electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Where supports or anchors are installed after the spray on insulation and/or firestopping is installed, patch the spray on insulation and/or firestopping to match surrounding area.

D. Hangers and anchors shall **NOT** be fastened to roof decking. Additional support steel shall be provided, as required, to bridge budling structural components.

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SECTION 26 05 33 – RACEWAYS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of the raceway and work required by this section is indicated by Drawings and requirements of other sections of this Specification.

B. Provide metal and nonmetallic conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated on plans. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements and comply with applicable portions of NEC for raceways.

C. It is the intent of these Specifications and Drawings that all feeder wiring be run in a continuous conduit system. Type MC cables are permitted for lighting and power, branch circuits above ceilings and in stud walls, fishing existing walls, and connection to equipment/motors (2 feet max). In areas of exposed structure all wiring shall be run in conduit. At all locations where MC cable cannot be fished in an existing wall, surface (nonmetallic or metallic as specified) raceway shall be used. Finish of raceway shall be verified with the Architect before ordering. Surface raceway shall be screwed into the surface being installed at both ends and every 24” minimum along raceway. All surface raceway shall be run parallel and perpendicular to wall surfaces and run to blend in with surrounding equipment.

D. Refer to Division 26, “Wires and Cables – 600V and Below” for acceptable uses of MC cables.

1.2 CODES AND STANDARDS

A. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.

B. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to electrical raceway systems; provide products and components which have been UL-listed and labeled.

C. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of raceway systems.

PART 2 - PRODUCTS

2.1 CONDUITS

A. Rigid Steel Conduit: Provide rigid steel, zinc-coated, threaded type conforming to FS WW-C-581, ANSI C80.1 and UL 6. Provide zinc-coating fused to inside and outside walls.

B. Rigid Aluminum Conduit: Provide rigid aluminum, threaded type conforming to ANSI and UL standards.

C. Intermediate Steel Conduit: Provide rigid intermediate grade (IMC) hot-dip galvanized threaded conforming to FS WW-C-581 and UL 1242.

D. Electrical Metallic Tubing (EMT): FSW-C-563, ANSI C80.3, and UL 797.

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E. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).

F. Flexible Metal Conduit: FS WW-C-566 and UL 1. Formed from continuous length of spirally wound, interlocked zinc-coated strip steel.

G. PVC Heavy Wall Conduit: Schedule 40, 90C, UL-rated, constructed of polyvinyl chloride and conforming to NEMA TC-2, for direct burial, UL-listed and in conformity with NEC Article 347. PVC conduit may only be installed above finished grade, where specifically indicated on the drawings or within the specifications.

H. PVC Light Wall Conduit shall not be acceptable under any circumstances. PVC Heavy Wall conduit shall be used when encased in concrete.

I. No other type of conduit shall be used, unless otherwise noted, or prior approval granted by the engineer.

2.2 CONDUIT FITTINGS

A. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.

B. Straight Terminal Connectors: Contractor shall provide one-piece body, with female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

C. 45-Deg or 90-Deg Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

D. Rigid Metal Conduit Fittings: Cast-malleable-iron, galvanized or cadmium plated, conforming to FS W-F-408. Use Type 1 fittings for raintight connections, Type 2 fittings for concrete tight connections, and Type 3 fittings for other miscellaneous connections.

E. Rigid Aluminum Conduit Fittings: Provide cast-aluminum conduit fittings and mounting hardware conforming to ANSI and UL standards of types required for the application.

F. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G. Provide cadmium-plated, malleable-iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.

G. EMT Fittings: All couplings and connectors shall be of the compression type.

H. PVC Heavy Wall Conduit and Tubing Fittings: Mate and match to conduit or tubing type and material.

I. Conduit and Tubing Accessories: Provide conduit, tubing and duct accessories of types, sizes, and materials, complying with Manufacturers' published product information, which mate and match conduit and tubing.

J. Conduit Bodies: Provide galvanized cast-metal conduit bodies of types, shapes, and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded-conduit entrance ends, removable covers, either cast or galvanized steel, and corrosion-resistant screws.

K. MC Fittings: The Snap2It connector with insulated throat as manufactured by Arlington may be used for MC cable connectors in lieu of the traditional cast fitting. However, these fittings may not be used for any other application.

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L. All raceway conduit and fittings above a ceiling shall be plenum rated.

M. Press type fittings may not be used unless specifically specified to be acceptable elsewhere in the specifications or on the drawings.

2.3 WIREWAYS

A. General: Provide electrical wireways of types, grades, sizes, and number of channels for each type of service as indicated. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other components and accessories as required for complete system.

B. Lay-In Wireways: Provide lay-in wireways with hinged covers, in accordance with UL 870 and with components UL-listed, including lengths, connectors and fittings. Design units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireways with knockouts.

C. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached that removal is not necessary to utilize the lay-in feature.

D. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.

E. Raintight Troughs: Construct in accordance with UL 870, with components UL listed.

F. Construction: 16-ga galvanized sheet metal parts for 4" x 4" to 6" x 6" sections, and 14-ga parts for 8" x 8" and larger sections. Provide knockouts only in bottom of troughs, with suitable adapters to facilitate or tear during installation, or would compromise raintight capability of the trough. Do not use cover screws that will protrude into the trough area and damage wire insulation.

G. Finish: Provide 14-ga and 16-ga galvanized sheet metal parts with corrosion-resistant phosphate primer and baked enamel finish. Plate hardware to prevent corrosion.

2.4 SURFACE RACEWAY

A. Provide single or dual channel surface raceway as specified on the drawings. Unless noted otherwise, raceway finish shall be selected at shop drawings from full list of standard and premium finishes.

B. Device plates matching the raceway system shall be utilized. Standard wall mounted device plates shall not be acceptable.

PART 3 - EXECUTION

3.1 GENERAL

A. Low voltage wiring in walls must be run in conduit system rated for 600V, as specified above. the use of flexible innerduct material in walls shall not be acceptable, unless specifically specified elsewhere. **In new construction, conduits shall be rigid of appropriate type for the installation**. In existing construction, flexible metallic conduit shall be used.

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B. Unless noted otherwise, all conduit shall be installed concealed in walls, under slabs, or above ceilings.

C. Type MC cables shall be permitted only as noted.

D. Unless noted otherwise, raceways and cables shall be installed near the structure and be supported independently from the structure. Support systems for other building systems (i.e. ductwork, HVAC equipment, system piping, ceiling supports, etc.) shall not be used to support conduits and cables. When routed from light fixtures and other system connections, raceways and cables shall be routed directly vertical to structure and across. Drop wire supports shall not be used on any ceiling support wires under any circumstances.

E. Use PVC Schedule 40 conduit where circuits, feeders and service conductors are embedded in concrete, masonry, or earth, and use rigid galvanized steel elbows with large sweep elbows wherever turns are needed **(do not use PVC elbows)**. Where PVC conduit is installed below finished floor level within the building pad, contractor shall transition to IMC or rigid galvanized steel at the elbow and rise to above floor slab. Where PVC conduit is used exterior to the building under finished grade, contractor shall transition to galvanized rigid steel conduit at the elbow up, and continue using galvanized rigid steel along the riser to above finished grade.

F. PVC Schedule 40 conduit may be run in CMU wall cavities when originating from below finished grade and terminating at a recessed box no higher than 48” above finished floor or grade. For all other installations within wall cavities, PVC conduit shall not be used.

G. Use rigid aluminum conduit where installed exposed outdoors.

H. Use EMT conduit in mechanical equipment rooms, electrical equipment rooms, penthouses, crawl spaces, walls, and areas above ceiling.

I. Use flexible metal conduit in moveable partitions and from outlet boxes to recessed lighting fixtures, and final 24" of connection to motors, or control items subject to movement or vibration, and in cells of precast concrete panels. Conduit size shall be increased as required to fit wiring per NEC.

J. Use liquid-tight flexible metal conduit in mechanical spaces. Conduit size shall be increased as required to fit wiring per NEC.

K. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.

L. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameters.

M. Size conduits to meet NEC, except no conduit shall be smaller than 3/4" on this project.

N. Fasten conduit terminations in sheet metal enclosures by two locknuts, and terminate with bushing. Install locknuts inside and outside enclosure. **Metallic insulating conduit bushings shall be used on all power conduits.** Split bushings shall **not** be acceptable.

O. Conduits are not to cross pipe shafts or ventilating duct openings.

P. Keep conduits a minimum distance of 6" from parallel runs of hot water pipes or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.

Q. Support riser conduit at each floor level with clamp hangers.

R. Use of running threads at conduit joints and terminations is prohibited.

S. Where required, use 3-piece union or split coupling.

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T. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

U. For concrete floors-on-grade, install PVC Schedule 40 conduits under concrete slabs.

V. Install underground conduits minimum of 24" below finished grade.

W. Install conduits so as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.

X. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings, and in crawl spaces.

Y. EMT conduits shall not be installed against roof deck. Allow minimum 3" space between top conduit and roof deck for the possible penetration of roof nails to protrude without damaging conduit.

1. Where conduits are indicated to be installed against roof deck, or where required by construction, IMC or GRS conduits may be used. Unless specifically stated on the documents, prior written approval shall be requested of the Architect/Engineer prior to installation.
2. Where boxes and conduit bodies are installed to accommodate conduits against the roof deck, they shall be cast type.

Z. In finished spaces without ceilings (i.e. gymnasiums, natatoriums, etc.), conduits shall be installed as high as possible, while meeting other requirements within these specifications. Conduits along bottom cord of open joists shall not be acceptable. Where conduits need to be installed along bottom of joists or beams, they shall be installed against walls.

AA. Provide fish wire or pull string in all spare conduits.

BB. Cap all spare conduits installed for future use.

CC. Install surface metal raceways in corners or walls or conceal as much as possible.

DD. There shall be no more than three (3) 20A branch circuits installed in a single 3/4" conduit. Each circuit shall be provided with a dedicated neutral wire. Sharing of neutral wire for multiple circuits will not be permitted.

EE. At locations where conduits are installed after painting is done, the contractor shall be responsible to go back and paint conduit and boxes same color to match. At locations where there is no General Trades painting, this Contractor shall be responsible to paint conduit and boxes to match adjacent surfaces.

FF. Metallic and non-metallic raceway shall be mechanically fastened to surfaces at intervals as recommended by the manufacturer. Under no circumstances shall glue, two-sided tape, or other type of adhesive be the only means of attachment.

GG. For exterior wall or foundation penetrations, seal around conduits/sleeves and annular space between sleeve and conduits to limit water migration.

1. Select seal material to fit the installation location, and ensures no degradation of the sealing material over time due to environmental conditions including, but not limited to continuous ground or rain water, solar impact, temperature changes, freezing, etc. Where exposed, sealing compound shall match adjacent surfaces in texture and color.

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HH. Installation through walls:

1. Where conduits are installed to pass through existing walls, the wall shall be cored to allow the conduit to be installed through the wall, and fire calk installed around the conduit.
2. Where MC cable is installed through a wall, an EMT sleeve of sufficient size to fit all of the MC cables shall be installed through a core in the wall, fire calk installed around the sleeve, and fire putty installed around the MC cables.
3. Should the contractor break out blocks, or cut an opening in the wall, not using a properly sized hole saw, he shall provide an appropriately sized lintel to maintain structural integrity of the wall, patch the wall by toothing in new block, new drywall sheet, or other means matching the wall material, and provide fire calk around the conduit or sleeve in the opening.

3.2 CONDUITS IN CONCRETE SLABS

A. Conduits installed in concrete slabs will not be permitted. PVC conduits shall be installed under concrete slabs in stone base minimum 4” below to top of conduit.

B. Conduits installed in elevated slabs will not be permitted. Conduits shall be installed in ceiling plenum spaces below elevated slabs.

3.3 EXPOSED CONDUITS

A. Unless noted otherwise on the documents, or expressly permitted by the Architect/Engineer in writing, Exposed conduits may only be run in open structure, and surface to walls in unfinished spaces (i.e. crawl spaces, mechanical equipment rooms, electrical equipment rooms, etc.) All conduits in finished spaces (i.e. offices, conference rooms, corridors, classrooms, gymnasium, storage, etc.) shall be recessed in the walls, and concealed.

B. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.

C. Install exposed conduit work as not to interfere with ceiling inserts, lights, or ventilation ducts or outlets.

D. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed following: Up to 1": 6'-0"; 1-1/4" and over: 8'-0".

E. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.

F. Cap all spare and active conduits stubbed up from the floor with secure PVC caps. Caps used for active conduits shall be notched to accommodate the quantity and size of cables installed in each conduit.

G. Where possible, exposed conduits shall be run along walls and at 3” from roof deck. Care shall be given to avoid creating a ledge of conduits along bottom of steel.

H. Where exposed conduits are installed outside of spaces labeled as electrical or mechanical, they shall be prepped and painted with appropriate products to match adjacent surfaces, unless specifically stated, in writing, by the architect/engineer/owner that they may remain unfinished.

3.4 NON-METALLIC CONDUITS

A. Make solvent cemented joints in accordance with recommendations of Manufacturer.

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B. Install PVC conduits in accordance with NEC and in compliance with local utility practices. Provide expansion joints as required by Manufacturer and NEC.

3.5 CONDUIT FITTINGS

A. Construct locknuts for securing conduit to metal enclosure with sharp edges for digging into metal, and ridged outside circumference for proper fastening.

B. Bushings for terminating conduits smaller than 1-1/4" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.

C. Install insulated type bushings for terminating conduits 1-1/4" and larger.

D. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.

E. Bushing of standard or insulated type to have screw type grounding terminal.

F. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs to be specifically designed for their particular application.

3.6 RACEWAYS AND WIREWAYS

A. Avoid use of dissimilar metals through system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.

B. Install expansion fittings in all raceways/wireways wherever structural expansion joints are crossed.

C. Make changes in direction to raceway/wireway run with proper fittings, supplied by raceway Manufacturer. No field bends of raceway/wireway sections will be permitted.

D. Properly support and anchor raceways/wireways for their entire length by structural materials. Raceways are not to span any space unsupported.

E. Use boxes as supplied by Manufacturer wherever junction, pull or device boxes are required. Standard electrical "handy" boxes, etc., shall not be permitted for use with surface installations.

END OF SECTION 26 05 33

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SECTION 26 05 35 – ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of electrical box and associated fittings work is indicated by Drawings and Schedules.

1.2 CODES AND STANDARDS

A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.

B. UL Compliance: Comply with UL Std No.'s 50, 514-series and 886. Provide electrical boxes and fittings which are UL-listed and labeled.

C. NEMA Compliance: Comply with applicable requirements of NEMA Stds/Pub No.'s OS1, OS2 and Pub 250.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS

A. Outlet Boxes: Provide galvanized coated flat-rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated (or as required), suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding. Flush boxes must be mounted flush with finished wall surface.

B. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliant option.

C. Device Boxes: Provide galvanized coated flat-rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated (or as required), suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cables clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding. Flush boxes must be mounted flush with finished wall plate.

D. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's codes-compliant option.

E. Surface-Mounted Device and Outlet Boxes: Provide a minimum depth galvanized-coated steel box where indicated on the Drawings, without pre-punched knockouts.

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F. Raintight Outlet Boxes: Provide corrosion-resistant cast-metal raintight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, including face plate gaskets and corrosion-resistant plugs and fasteners. Provide raintight outlet boxes where installed outside, and within moisture rich environments (showers, locker areas, natatoriums, etc.)

G. Junction and Pull Boxes: Provide galvanized code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers. Provide handles on covers over 4 square feet.

H. Floor Boxes: Provide floor boxes at locations shown on plans. Unless noted otherwise, provide two (2) 1 1/4" conduits from floor boxes to above accessible ceilings for communications cables. Provide duplex receptacles (quantities as shown). Ground level boxes shall be cast type or with on grade finish, elevated slabs shall be stamped steel. Refer to Electrical legend on plans for catalog numbers. All floor boxes must meet mop-tight requirements.

1. Unless noted otherwise, floor boxes shall be recessed type, similar to Wiremold RFBA4 series with 4 gangs. Cover shall be provided with finish, as selected by the architect at the time of shop drawings, and shall be provided with or without flooring insert as selected. No additional cost shall be assessed for any selection of listed cover option.

I. Where surface or recessed boxes are indicated to be blank or with wire leads for future use, they shall be provided with blank covers per Division 26 “Wiring Devices”.

J. All boxes and conduit bodies shall be metallic. The use of PVC boxes or conduit bodies is prohibited, unless noted otherwise.

K. Under no circumstances shall low voltage rings be used on the project. All outlet boxes used for low voltage system including, but not limited to tele/data, controls, A/V wiring, etc. shall be fully enclosed device boxes, rated for 600V wiring as specified above.

PART 3 - INSTALLATION

3.1 GENERAL

A. Install electrical boxes and fittings as indicated, in accordance with Manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

B. When installed in stud walls (wood or steel), electrical boxes shall be installed in walls, supported from both sides, bridged between studs, the use of cantilevered supports shall be unacceptable.

C. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

D. Provide weathertight outlets for interior and exterior locations exposed to weather or moisture.

E. Provide knockout closures to cap unused knockout holes where blanks have been removed.

F. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.

G. Position recessed outlet boxes accurately to allow for surface finish thickness.

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H. Where devises are shown at casework, contractor shall coordinate exact location and height with casework to ensure usability of devices.

I. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surfaces.

J. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

K. Provide electrical connections for installed boxes.

L. Subsequent to installation of boxes, protect boxes from construction debris and damage.

M. Ground electrical boxes properly upon completion of installation work and demonstrate compliance with requirements. Ground electrical box and wiring device.

N. Floor Boxes:

1. Set floor boxes level and flush with finish flooring material.
2. Verify location of **all** floor boxes with Architect before installation.
3. At locations where floor box depth exceeds floor thickness, contractor shall be responsible to cut floor openings and provide strut or miscellaneous steel to support box flush with top of finished floor. Contractor shall patch concrete around box as required.

O. Where poke-thru's are located, the contractor must core the opening after the floor has been placed to allow the architect/owner exact placement. The use of pre-installation concrete sleeves shall not be acceptable.

P. Where boxes and conduit bodies are installed against roof deck, they shall be cast type.

3.2 INSTALLATION TO MEET ACOUSTICAL PERFORMANCE

A. In order to reduce sound transmission through walls, when back boxes are installed to serve both sides of the wall, they shall be installed in different stud cavities. Where boxes are found to be installed in the same stud cavity, feeding two different sides of the wall, they will be required to be removed and reinstalled at the contractor's expense.

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SECTION 26 05 53 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 CODES AND STANDARDS

A. UL Compliance: Comply with UL Std 969.

B. NEC and NEMA Compliances: Comply with NEC and NEMA WC-1 and WC-2.

C. ANSI Compliance: Comply with ANSI Std A13.1.

PART 2 - PRODUCTS

2.1 GENERAL

A. Except as otherwise indicated, provide Manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is installer's option, but provide single selection for each application.

B. The Electrical Identification, as outlined in this specification, shall be provided in addition to the labeling requirements listed in other specification sections.

2.2 UNDERGROUND-TYPE PLASTIC LINE MARKER

A. Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried cable.

1. Provide line marker with detectable metallic core for installation above primary power, secondary power and communications service ductbanks.
2. Provide standard plastic line markers for all other installations.

2.3 CABLE/CONDUCTOR IDENTIFICATION BANDS

A. Provide Manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type; either pre-numbered plastic-coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.

2.4 SELF-ADHESIVE PLASTIC SIGNS

A. Provide Manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application areas and adequate for visibility, with proper wording for each application (e.g., “EXHAUST FAN FED FROM PANEL PD1”).

B. Colors: Unless otherwise indicated, or required by governing regulations, provide white signs with black lettering.

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2.5 ENGRAVED PLASTIC-LAMINATE SIGNS

A. Provide engraving stock melamine plastic laminate with black face and white core plies (letter color), complying with FS L-P-387, in sizes and thicknesses indicated. Engrave laminate with engraver's standard letter style of sizes and wording indicated, and punch for mechanical fastening except where adhesive mounting is necessary because of substrates.

B. Thickness: 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.6 LETTERING AND GRAPHICS

A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by Manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

2.7 MANUFACTURER

A. Provide electrical identification products of one of the following (for each type marker):

1. Ideal Industries, Inc.
2. LEM Products, Inc.
3. Markal Company
4. National Band and Tag Co.

PART 3 - EXECUTION

3.1 GENERAL

A. Install electrical identification products as indicated, in accordance with Manufacturer's written instructions, and requirements of NEC.

3.2 COORDINATION

A. Where identification is to be applied to surfaces which require finish, install identification after completion of painting.

3.3 REGULATIONS

A. Comply with governing regulations and requests of governing authorities for identification of electrical work.

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3.4 UNDERGROUND CABLE IDENTIFICATION

A. During backfilling/topsoiling of each exterior underground electrical, signal or communication cable, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.

B. Install line marker for every buried cable, regardless of whether direct-buried or protected in conduit.

3.5 CABLE/CONDUCTOR IDENTIFICATION

A. Apply cable-conductor identification where wires of communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, Contract Documents, and similar previously established identification for project's electrical work.

B. Install engraved plastic-laminate tags on new power cables in all manholes and in pullboxes to identify over current device number. Use tie wraps to attach tag to cables. The nameplate shall bear the following information: Building served; voltage, cable size, class of insulation, phase designation.

3.6 CONDUIT IDENTIFICATION

A. Where spare conduits are installed, labels shall be provided at each end clearly identifying destination. Where one end is located in a handhole or manhole, provide label directly above spare conduit.

B. Where spare conduit path includes intermediate pull boxes, conduit bodies, wireways, etc., provide label at each location indicating the next termination point. The label at each end shall identify quantity of intermediate pull boxes, conduit bodies, wireways, etc. as well as location.

C. Where spare conduits are provided above ceilings on either side of an inaccessible area, provide small label on T-bar to indicate location of spare conduit.

D. Where low voltage and conduit sleeves enter floor or below grade, provide label identifying termination point.

3.7 DANGER SIGNS

A. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.

B. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.

C. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

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3.8 ARC FLASH LABELS

A. Provide arc flash labels on equipment per NEC and NFPA. Labels shall be placed in a prominent position that is clearly visible before access to a dangerous area is reached. This includes the front of devices similar to disconnect switches, motor starters, switchboards, etc. and just inside the front cover of panelboards. The labels shall be of sufficient durability to withstand the environment involved.

B. Provide signs for each unit of the following categories of electrical work.

1. Panelboards, electrical cabinets and enclosures.
2. Disconnect switches.

3.9 EQUIPMENT/SYSTEM IDENTIFICATION

A. Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), White lettering in Black field. Provide text matching terminology and numbering of the Contract Documents and shop drawings. Each listed piece of equipment below shall have a sign that has the following: 1. Equipment Name, 2. Where the equipment is fed from. Example: PANEL “PD1" (FED FROM PANEL DPD).

B. Provide signs for each unit of the following categories of electrical work.

1. Panelboards, electrical cabinets and enclosures.
2. Access panel/doors to electrical facilities.
3. Disconnect switches.

C. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.

3.10 DIRECTORIES

A. Provide typed circuit directory cards in all panelboards (both breaker and fuse type) and low voltage lighting control panels indicating the room number or area, and the item or items controlled by each circuit. Provide typed circuit directory cards for all “Existing” panelboards and low voltage lighting control panels where the Contractor has added, deleted or moved circuits with in an “Existing” panelboard.

1. Contractor shall trace existing circuits within existing panelbaords and low voltage lighting control panels to properly identify all circuits within the panelboards and low voltage lighting control panels.

B. Switchboards, unit substations, motor control centers and switchgear shall be provided with plastic-laminate tags similar to those specified in under “Equipment/System Identification”. The tags shall indicate what the circuit feeds and the location of the device.

C. Directories shall use actual room numbers to indicate locations of all devices, including, but not limited to receptacles, lighting, mechanical equipment, etc. When preparing schedule, use a room number schedule generated by the architect and/or the owner, which indicates the actual room numbers that will be used when the building is occupied. If the schedule is not available, request, in writing, a schedule to reflect the proper room numbers.

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D. Provide sufficient information to meet requirements of Article 408 of the National Electric Code. Specifically, location of device fed shall be added to directory cards.

3.11 ADDITIONAL FUSE LABELING

A. At the exterior enclosure of all fused switches, provide additional labeling designating fuse sizes, types and quantity.

3.12 RECEPTACLE CIRCUIT IDENTIFICATION

A. At each receptacle, identify panelboard and circuit number from which receptacle is served. Use machine printed, pressure sensitive, abrasion resistant label tape on **backs and fronts** of the wall plate and durable wire markers or tags within outlet boxes.

END OF SECTION 26 05 53

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SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes receptacles, connectors, switches, dimmers, finish plates and cord reels.

1.2 DEFINITIONS

A. GFCI: Ground fault circuit interrupter.

1.3 SUBMITTALS

A. Product Data: For each product specified.

B. Shop Drawings:

1. Legends for receptacles and switch plates, where indicated on the drawings.
2. Cord Reels.

C. Samples: For devices and device plates for color selection and evaluation of technical features, when requested by the Architect-Engineer and/or Owner.

D. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NEMA WD 1.

C. Comply with NFPA 70.

D. Compliance with Federal Specifications – identified by the federal specifications mark (capital letters ‘F’ and ‘S’ each in a wing on either side of the UL Listing mark):

1. Receptacles and GFCI’s: Federal Specification number WC596.
2. Switches: Federal Specification number WS896.

1.5 COORDINATION

A. Receptacles for Owner Furnished Equipment, or Equipment furnished by other trades: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

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PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers

1. Hubbell HBL1221 Series.
2. Leviton 1221-2 Series.
3. Pass & Seymour PS20AC1 Series.

B. Description: NEMA WD 1, heavy duty industrial grade, binding screw type for back and side wiring, AC only snap switch with grounded mounting strap, and grounding terminal with green screw.

C. Toggle Color: As selected by Architect.

D. Types: Switch shall be single pole, double pole, three-way, or 4-way, as required by the drawings.

E. Voltage Rating: 120/277 volts, AC.

F. Current Rating: 20 amperes.

G. Prewired and plug-in devices shall be acceptable provided device matches specifications and plug-in devices are crimped and welded.

2.2 LIGHTING CONTROLS

A. Manufacturers

1. Hubbell Building Automation by Current.
2. All occupancy sensors on project shall be from one (1) manufacturer.

B. SYSTEM OPERATION

1. Contractor must properly set sensitivity and time delay in the occupancy sensors. Simply changing sensitivity to maximum, unless space requires, shall not be acceptable. The sensitivity shall be set appropriately for the space, to detect half step into room, and detecting people working at a desk at the four (4) corners of the room. See below for time delay settings.

    a. Automatic sensitivity or time delay settings shall NOT be used. All sensitivity and time delay settings shall be actively set.

2. Provide the appropriate occupancy sensor for each room. Simply selecting dual technology sensors for every space shall not be acceptable.

    a. Where dual technology sensors are used, initial occupancy shall require both technologies (PIR and ultrasonic), while either technology will maintain and re-trigger occupancy.

3. Microphonics shall be an acceptable alternative technology to ultrasonic technology.

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4. Occupancy Sensors shall be set as vacancy (lights turn on by button, maintain by sensing individuals, and turn off when an individual is no longer sensed). Lights shall not operate automatically, unless noted otherwise.

    a. Provide compatible low voltage dimmers and wire with sensor. Use digital addressable dimmers to achieve specified operation.

5. Daylight sensors shall be provided as indicated, and control the lighting nearest the daylighting independently from the rest of the room. Lighting control shall be set to dim the lighting based on the amount of light entering the space. The system shall NOT turn off the lights based on daylight, and shall only dim to a minimum level, unless the locally adopted codes dictate otherwise.

C. Occupancy Sensors

1. Listed products by application shall be Watt Stopper product numbers. Should the contractor choose to use an alternate listed manufacturer, they shall provide the sensor that meets the requirements of the specified sensors. Should an alternate manufacturer require additional sensors due to coverage patterns, they shall be provided at no additional cost to the owner.

    a. Instructional and lecture Spaces: Provide, low (24) voltage ceiling mounted dual technology occupancy sensor LMDC-100 series. Provide coverage pattern to accommodate entire room.

        1) Provide isolated relay at all areas for connection to the BAS. This can either be accomplished with the sensor itself, or via relay at the lighting controller.
        2) Where spaces do not have ceilings, provide surface or wall mount version as required.

    b. Open Offices, Restrooms, Storage Rooms and Corridors: Provide, low (24) voltage ceiling mounted ultrasonic occupancy sensor LMUC-100 series. Provide coverage pattern to accommodate entire room.

        1) Provide isolated relay at Open Office areas for connection to the BAS. This can either be accomplished with the sensor itself, or via relay at the lighting controller.
        2) Where spaces do not have ceilings, provide surface or wall mount version as required.

    c. Private Offices, Cafeteria and Conference Rooms: Provide, low (24) voltage ceiling mounted passive infrared occupancy sensor LMPC-100 series. Provide coverage pattern to accommodate entire room.

        1) Provide isolated relay at all areas for connection to the BAS. This can either be accomplished with the sensor itself, or via relay at the lighting controller.
        2) Where spaces do not have ceilings, provide surface or wall mount version as required.

    d. High Ceiling/Structure Spaces (Gymnasiums, Atriums, etc.): Provide, low (24) voltage high ceiling mounted passive infrared occupancy sensor HBL series. provide coverage pattern to accommodate entire space.

        1) Provide isolated relay at all areas for connection to the BAS. This can either be accomplished with the sensor itself, or via relay at the lighting controller.

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e. Wet/damp, Refrigerated, Exterior and Unconditioned Spaces: Provide, low (24) voltage low temperature / wet listed passive infrared occupancy sensor CB-100 series with isolated relay. Provide coverage patter to accommodate entire area.

1) Provide interface as required to interconnect with lighting controller.

f. Provide, where indicated, dual (120/277) voltage passive infrared wall switch occupancy sensor PW-300.
g. Provide, where indicated, dual (120/277) voltage passive infrared 0-10V dimming wall switch occupancy sensor PW-311.
h. Provide, where indicated, dual (120/277) voltage passive infrared 0-10V dimming wall switch occupancy sensor PW-311. Set as vacancy so that manual operation is required to turn lights on.
i. Provide low voltage controls (switches and dimmers), where indicated, compatible with the room zone controller, from the same manufacturer as the occupancy sensor.

1) Dimming stations shall comprise of a minimum three (3) buttons (raise, lower and on/off). Four (4) button stations may also be used (raise, lower, on, off). Buttons must be factory engraved for ease of use.

j. Where no time delay setting is indicated, provide 10-minute time delay.
k. Manufacturer shall be responsible to provide a shop drawing which indicates correct sensor type and location of sensor within each space.

2. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.
3. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180˚ coverage capability.
4. Wall switch products shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
5. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
6. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.
7. Vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.
8. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.
9. Passive infrared sensors shall provide high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line).
10. Passive infrared sensors shall have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.
11. Dual technology sensors shall be either corner mounted or ceiling mounted in such a way as to minimize coverage in unwanted areas.
12. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
13. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
14. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within ± 0.005% tolerance, 32 kHz within ± 0.002% tolerance, or 40 kHz ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
15. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

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16. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
17. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
18. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
19. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
20. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
21. All sensors shall have UL rated, 94V-0 plastic enclosures.

D. Daylight Sensors

1. Provide open-loop or closed-loop basis for daylight sensors as per manufacturer recommendations for the location and type fixture controlled.
2. Stable output over typical interior temperature range.
3. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
4. Provide linear response along entire range of detection.
5. Integral IR receiver for programming as required.
6. Constructed with plastic meeting UL94 HB.

E. Room Zone Controller

1. Provide room controllers as required to control the loads indicated.

    a. Room Controllers shall provide one (1) through four (4) zones of independent control. Provide sufficient quantity of room controllers to control all zones of lighting indicated on the documents.

2. General Requirements:

    a. Delivered and installed in plenum rated enclosure as individual panel, or to attach to an electrical box.
    b. Passively cooled via free-convection, unaided by fans or other means.
    c. Mounting: Surface.
    d. Connection to wired:

        1) Occupancy sensors.
        2) Daylight sensors.
        3) IR receivers for personal control, where required.
        4) Occupant controls.

    e. Contact Closure Input (Where required/specified):

        1) Communicate with input from a dry contact closure or solid-state output. Interface may be performed without or with interface to:

            a) Activate scenes.

                i) Scene activation from momentary or maintained closure.

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b) Enable or disable after hours.

i) Automatic sweep to user-specified level after user-specified time has elapsed.
ii) System will provide occupants a visual warning prior to sweeping lights to user-specified level.
iii) Occupant can reset timeout by interacting with the lighting system.

f. Emergency Contact Closure Input (where applicable):

1) Turn all zones to full output during emergency state via direct contact closure input from UL 924 listed emergency lighting interface, security system or fire alarm system.
2) Allow configurable zone response during emergency state.
3) Disable control operation until emergency signal is cleared.

g. Supplies power for control link for keypads and control interfaces.
h. Distributes sensor data among multiple lighting control modules.

3. Provide switching and/or continuous dimming to drivers or load per zone. The room controller shall provide 0-10 Volt, PWM, forward-phase, reverse-phase or 3-wire dimming as required for the application. Provide interface modules as required to accommodate the type of dimming as required.
4. Device Specifications:

a. Provide devices rated for the zone wattage (up to 16 Amp continuous per zone). Less than 16 Amp continuous per zone may be used where the connected zone wattage is less
b. Devices shall be universal voltage rated to operate 120 Volt through 277 Volt lighting. 347 Volt devices shall be available as needed.
c. Memory: Retains all system settings in non-volatile memory.

5. Room controllers shall be located as follows:

a. Where room controllers control fixtures in general public areas (hallways, corridors, etc.), they shall be installed in panelboard closets, dedicated electric rooms or data closets.
b. Where room controllers control fixtures in multiple rooms, they shall be located above accessible ceiling in hallways, directly outside the rooms they control.
c. Where room controllers control fixtures in a single room, they shall be located above accessible ceiling in that room, near the entrance door, directly above the wall station.
d. The final location for all room controllers shall be coordinated with the Owner prior to rough-in.

6. ADDITIONAL EQUIPMENT

a. Provide a programmer of the system, and turn over to the Owner. If the system uses a phone or tablet application, purchase a compatible device, wipe all information from the device but the applicable application, set up and turn over.

2.3 RECEPTACLES

A. Duplex Convenience Receptacle

1. Manufacturers

a. Hubbell HBL5362 Series.

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b. Leviton 5362 Series.
c. Pass & Seymour PS5362 Series.

2. Description: Heavy-Duty Federal Industrial Spec Grade with nylon face (smooth), brass strap, brass contacts for side and back wiring, and nylon base.
3. Provide with WR (weather resistant) label when installed in exterior applications per code.
4. Where indicated on the drawings, or per current version of NEC, provide the tamper resistant version with internal shutter system.
5. Color of receptacles shall be as selected by the Architect.
6. Prewired and plug-in devices shall be acceptable provided device matches specifications and plug-in devices are crimped and welded. Provide similar to Pass & Seymour “Plug Tail” type receptacles.

B. Tamper Resistant Duplex USB Charger Receptacle **[2 type C]**

1. Manufacturers

a. Hubbell USB8300C5 Series.
b. Leviton T5835-HG Series.
c. Pass & Seymour TR20HUSBCC6 Series.

2. Description: **Hospital Grade** tamper resistant with high-impact resistant thermo plastic construction.
3. Provide with WR (weather resistant) label when installed in exterior applications.
4. Provide the tamper resistant with internal shutter system.
5. Provide with two USB type C ports.
6. USB charging shall comply with USB BC1.2 battery charging and 3.0 power delivery specifications.
7. USB charging shall supply minimum 5 amp.
8. Color of receptacles shall be as selected by the Architect.
9. Prewired and plug-in devices shall be acceptable provided device matches specifications and plug-in devices are crimped and welded. Provide similar to Pass & Seymour "Plug Tail" type receptacles.

C. Tamper Resistant Ground Fault Circuit Interrupter (GFCI) Receptacle

1. Manufacturers

a. Hubbell GFTR20 Series.
b. Leviton X7899 Series.
c. Pass & Seymour 2097TR Series.

2. Description: Federal Specification Grade tamper resistant with high-impact-resistant thermoplastic construction, brass contacts for side and back wiring and LED trip indicator light.
3. GFCI receptacles shall not be connected to protect downstream devices, unless noted otherwise on the drawings. Provide unit designed for installation in a 2-3/4" deep outlet box without adapter, grounding type, Class A, Group 1, per UL 943.
4. Device shall comply with Federal Specification WC596. Devices shall have protection so that if critical components are damaged and ground fault protection is lost, power to receptacle shall be disconnected.
5. Provide with WR (weather resistant) label when installed in exterior applications per code.
6. Provide tamper resistant with internal shutter system.
7. Prewired and plug-in devices shall be acceptable provided device matches specifications and plug-in devices are crimped and welded.

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D. Weatherproof Receptacle

1. Consisting of a GFCI receptacle as specified above in an outlet enclosure that is UL listed for wet locations, and meet NEC and OSHA requirements while in use.
2. Exterior-mounted receptacles installed in existing walls and on mechanical units shall have a self-closing weatherproof (in use) cover **with locking hasp** similar to Pass & Seymour WIUCAST series. Exterior-mounted receptacles installed in new walls shall have a self-closing weatherproof (in use) and be mounted over a recessed box similar to Arlington Industries DSBVR1W series. Paint cover to match adjacent surface with appropriate type of paint. Coordinate color with Architect prior to ordering.

2.4 CORD REELS

A. Manufacturers

1. Provide only where indicated to be by the Contractor.
2. Heavy Duty Plastic, Locate within finished spaces (science, STEM, kitchen and other specifically indicated locations): KH industries CRK series with black finish.

    a. Provide at locations with finished ceilings (science, STEM, kitchen, etc.) and where indicated.
    b. Provide cord and plug on reel, and receptacle at ceiling.
    c. Description: Retractable reel with 20’ of wire, rated at 15 amps using #12 AWG wire.
    d. Provide heavy duty thermos plastic reel with strain relief. Provide triple-tap 15 amp receptacle at end of cord. **Modified payout option in lieu of standard.**

2.5 SPECIAL PURPOSE RECEPTACLES

A. Manufacturers

1. Hubbell.
2. Leviton.
3. Pass & Seymour.

B. Description: Polarized, grounding type

C. Device Body: Black nylon

D. Configuration: As required by the amperage and voltage of the equipment to be connected on the drawings.

E. Provide equipment cord and caps as required for equipment.

2.6 WIRING DEVICE ACCESSORIES

A. Wall Plates: Provide wall plates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates.

B. Wall Plates: Provide 302 satin finished stainless steel wall plates throughout the building.

C. Provide galvanized steel wall plates in unfinished spaces.

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D. Floor Service Outlets: Provide duplex receptacles as required and specified under receptacles.

2.7 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber insulated, stranded copper conductors, with type SOW A jacket. Green insulated grounding conductor, and equipment rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable clamping jaws. Match cord and receptacle type for connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.

B. Verify all receptacle mounting heights before roughing in unless noted. If an outlet is installed in such a location as to be out of proper relation to beams, walls, or finish details of the building, its location shall be corrected by and at the expense of the Contractor under direction of the Architect/Engineer.

C. Install devices and assemblies plumb and secure only in electrical boxes which have been cleaned of excess building materials, dirt, and debris. Device to be secure tight against wall box and flush with wall plate.

D. Install switches on latch side of doorways.

E. Install wall plates when painting is complete.

F. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.

G. Do not share neutral conductor on load side of dimmers.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

I. Protect devices and assemblies during painting.

J. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

K. Analog Dimmers: Provide the required low and/or line voltage wiring shall be provided to control the fixture. Any and all additional accessories required, including power packs, shall be provided in their entirety.

L. Install Occupancy Sensors to meet the following requirements. Locations indicated on the plans are diagrammatical, and do not necessary represent the optimal placement of sensors.

1. Sensor is activated within half step into room.
2. If person walks past open door, but not into room, sensor does not activate.
3. Sensor sensitivity shall be set to achieve the above, while allowing operation throughout the entire room with minimal activity.

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4. Sensors shall be placed to avoid interference from HVAC equipment, including diffusers, and other architectural ceiling mounted items. Refer to manufacturer installation manual for additional information to ensure proper coverage of the space.
5. Contractor shall be responsible to reposition any sensor where the above is not accurate.
6. Occupancy Sensors shall be provided with minimum 10’ additional wiring to allow repositioning of the sensor after the fact for poorly positioned sensors. Extra wire shall be coiled and supported adjacent to the sensor.
7. Provide label on ceiling grid for location of occupancy sensor room zone controller above ceiling.

M. Install daylight sensors were directed by the manufacturer.

N. Install room controllers as outlined in part 2.

O. Coord reels shall be installed at structure or in ceiling (where architectural drawings indicate a ceiling). Provide all miscellaneous steel as required to support cord reel, both vertically and laterally. When installed in ceiling:

1. Support cord reel so that ceiling is not impacted from pulling cable.
2. Provide power connection to cord reel at ceiling plane to meet NEC.

3.2 INSTALLATION TO MEET ACOUSTICAL PERFORMANCE

A. In order to reduce sound transmission through walls, when devices boxes are installed to serve both sides of the wall, they shall be installed in different stud cavities. Where boxes are found to be installed in the same stud cavity, feeding two different sides of the wall, they will be required to be removed and reinstalled at the contractor's expense.

3.3 IDENTIFICATION

A. The requirements listed below are in addition to the requirements listed in Division 26 “Electrical Identification”.

B. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

C. Receptacles: Identify panelboard and circuit number from which served. Use machine printed, pressure sensitive, abrasion resistant label tape on backside of the wall faceplate and durable wire markers or tags within outlet boxes.

3.4 CONNECTIONS

A. Connect wiring device grounding terminal to outlet box with bonding jumper.

B. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

C. Tighten electrical connectors and terminals according to manufacturers published torque tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.

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B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

C. Replace damaged or defective components.

3.6 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 26 27 26

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SECTION 26 28 13 – FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes cartridge fuses, rated 600 V and less, for use in switches, panelboards, switchboards, controllers, and motor control centers; and spare fuse cabinets.

1.2 SUBMITTALS

A. Product Data: Include dimensions and Manufacturer's technical data on features, performance, electrical characteristics, and ratings for each fuse type indicated.

1.3 QUALITY ASSURANCE

A. Source Limitations: Provide fuses from a single Manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with NFPA 70.

1.4 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply Manufacturer's ambient temperature adjustment factors to fuse ratings.

1.5 COORDINATION

A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged in original cartons or containers and identified with labels describing contents.

1. Fuses: Quantity equal to one (1) set for every five (5) installed sets, but not fewer than one set of three of each kind.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Eaton Bussmann Series
2. Mersen (Ferraz Shawmut) by Powerfuse.
3. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

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

3.2 FUSE APPLICATIONS

A. Main Service: Class L, time delay (601 to 6000A) or Class J, time delay (0 to 600A).

B. Main Feeders: Class L, time delay (601 to 6000A) or Class J, time delay (0 to 600A).

C. Combination Starter/Disconnect Switches: Class RK1, time delay.

D. Disconnect Switches: Class RK1, time delay (30-600A).

E. Other Branch Circuits: Class J, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. The requirements listed below are in addition to the requirements listed in Division 26 “Electrical Identification”.

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B. Install labels indicating fuse replacement information on inside door of each fused switch.

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SECTION 26 28 16 – DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Disconnect Switches.

B. Molded-Case Circuit Breakers and Switches.

C. Enclosures.

1.2 REFERENCES

A. FS W F 870 Fuse Holders (For Enclosed Cartridge Fuses).

B. FS W S 865 Switch, Box, (Enclosed), Surface Mounted.

C. NEMA KS 1 Enclosed Switches.

1.3 SUBMITTALS

A. Include outline Drawings with dimensions, and equipment ratings for voltage, capacity, horsepower, and short circuit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Square D Company.

B. Siemens.

C. Eaton (Cutler Hammer).

D. General Electric by ABB.

E. No Other Manufacturers will be considered.

2.2 HEAVY DUTY TYPE FUSED AND NON-FUSED DISCONNECT SWITCHES

A. All switches shall have switch blades which are visible when the switch is OFF and the cover is open.

B. Lugs shall be mechanical type, front removable and UL listed for 60°C or 75°C conductors in switches rated 30 through 100 ampere, 75°C conductors in switches rated 200 through 1200 ampere, copper conductors.

C. Switches rated over 1200 amperes shall be provided as switchboard sections, with all applicable accessories.

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D. All current carrying parts shall be plated to resist corrosion.

E. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.

F. Switches shall have provisions for a field installable electrical interlock.

G. Switch operating mechanism shall be quick make, quick break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.

H. The operating handle shall be an integral part of the box, not the cover.

I. The handle position shall travel at least 90 degrees between OFF and ON positions to clearly distinguish and indicate handle position.

J. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

K. The enclosure shall have ON and OFF markings on the cover to clearly identify the position of the switch.

L. All switches shall have provisions to lock the operating handle in the OFF position.

M. Switches shall be horsepower rated for ac and/or dc as indicated on the plans.

N. The UL listed short circuit current rating of the switches shall be: 200,000 rms symmetrical amperes when used with or protected by Class R fuses (30 through 600 ampere switches employing appropriate fuse rejection schemes).

O. Switch Accessories:

1. Provide the following where required/indicated on the documents:

a. Where switches are designated to be used as service entrance, the switch shall be labeled for such use.
b. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
c. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
d. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
e. Where fused switches are designated to have type "R" fuses, the switch shall be provided with rejection clips.
f. Provide fuse clip adaptors as required to accommodate smaller fuses when required.
g. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Provide contact rating as required to accommodate application.

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

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B. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

C. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated.

D. MCCBs shall be equipped with a device for locking in the isolated position.

E. Lugs shall be suitable for 60 deg C 125 ampere circuit breakers and below and 75 deg C over 125 ampere.

F. Switches rated over 1200 amperes shall be provided as switchboard sections, with all applicable accessories.

G. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

H. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I-squared t response, when ground-fault is required or indicated.

I. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip). Provide where indicated or required by code.

J. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip). Provide where indicated.

K. Features and Accessories:

1. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
2. Ground-Fault Protection: Comply with UL 1053; integrally mounted type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
3. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
4. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
5. Electrical Operator: Provide remote control for on, off, and reset operations.

2.4 ENCLOSURES

A. Switch and breaker enclosure shall be NEMA 1 unless otherwise on the Drawings or required by the NEC in accordance with the project conditions.

1. Exterior switches and breakers shall be rated NEMA 3R, unless noted otherwise.
2. Kitchen and wash-down areas shall be provided with NEMA 4X with stainless steel enclosure, unless noted otherwise.

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B. The enclosure shall be finished with Gray baked enamel paint which is electrodeposited on cleaned, phosphate pretreated steel (Type 1), or Gray baked enamel paint which is electrodeposited on cleaned, phosphate pretreated galvannealed steel (Type 3R).

C. Tangential knockouts shall be provided to facilitate ease of conduit entry for switches rated 30 through 200 amperes.

D. Enclosures for Type 3R switches through 200 amperes shall have provisions for interchangeable bolt on hubs in the top end wall.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches to meet N.E.C. working clearance requirements.

B. Install fuses in fusible disconnect switches.

3.2 IDENTIFICATION

A. The requirements listed below are in addition to the requirements listed in Division 26 “Electrical Identification.”

B. Provide labeling on the exterior of each disconnect switch Stating the following:

1. What the piece of equipment is fed from the switch.
2. Where the piece of equipment is fed from the switch.
3. Size, type and quantity of fuses within cabinet.

3.3 FIELD QUALITY CONTROL

A. Subsequent to completion of installation of disconnects, energize circuits and demonstrate capability and compliance with requirements. Demonstrate switch operation through six (6) opening/closing cycles with circuit unloaded. Open each switch enclosure to display interior, mechanical and electrical connections and fuse installation, and for verification of type and rating of fuses installed. Where possible, correct deficiencies at project site, then retest or demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION 26 28 16

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SECTION 26 51 00 – LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes interior LED lighting fixtures, LED lighting fixtures mounted on exterior building surfaces, emergency lighting units, and accessories.

1.2 SUBMITTALS

A. Product Data: For each type of lighting fixture indicated, provide typical cutsheets. Include data on features, accessories, and the following:

1. Light output in lumens, color temperature (CCT), color rendering index (CRI) and energy efficiency data.
2. Lighting fixture accessories.
3. Dimensions of fixtures.

B. Coordination: The electrical contractor shall be responsible to coordinate all light fixtures with ceiling installer before installation of ceiling grid. The electrical contractor shall also coordinate light fixture installation with HVAC and plumbing contractor for installation of piping and ductwork. Should there be any conflicts, they should be brought to the attention of the Architect/Engineer prior to the installation of the ceiling grid. Any conflicts not brought to the attention of the Architect/Engineer before installation of ceiling, the electrical contractor shall bare all costs associated with rework to install light fixtures, piping, ductwork, ceiling grid, etc.

1.3 QUALITY ASSURANCE

A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NFPA 70.

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.4 COORDINATION

A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

B. Lighting Control: Verify compatibility of lighting controls (analog dimmers and digital systems) with lighting fixtures to be installed. Where controls are not compatible with the lighting to be installed, bring to the attention of the Architect/Engineer in writing prior to ordering lighting fixtures or controls.

1.5 FIELD CONDITIONS

A. Mark locations of exterior luminaires for approval by Architect/Engineer prior to the start of luminaire installation.

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B. Where aimable fixtures are specified (i.e. flood lights), fixtures shall be aimed at night, and presented to the Architect/Engineer for review prior to final approval.

1.6 WARRANTY

A. Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within the project specified warranty period.

B. Manufacturer warranty: Contractor shall ensure manufacturer published warranty furnished with the luminaires remain in-tact through the project as well as the project warranty period. Any luminaires that are damaged during the project shall be replaced at no additional cost to the owner in order to ensure maintenance of the product warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide from manufacturers as specified in the Lighting Fixture Schedules or on the drawings.

2.2 LUMINAIRE REQUIREMENTS

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

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

2.3 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.

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3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. Lens Thickness: 0.156 inch minimum, unless greater thickness is indicated.

F. Metal Finishes: Variations in finishes are unacceptable in the same piece, or in adjacent fixtures.

1. Exterior luminaires shall be provided with the same finish, regardless of manufacturer. Custom finishes must be provided were required to ensure same finish.
2. Pole light heads and poles shall match. Color chips and custom finishes shall be applied to ensure they match, regardless of manufacturer.

2.4 LED DRIVERS

A. Provide low-energy LED drivers, capable of operating the LEDs indicated. Drivers shall operate at an input voltage between 120 to 277 VAC at an input frequency of 60 Hz +/- 10%. Light output shall remain constant for line voltage fluctuations within the range described. Drivers shall comply with EMI and RFI limits set by the FCC (CFR 41 Part 18) for non-residential applications and not interfere with normal electrical equipment. Drivers shall meet applicable ANSI standards and must be UL listed with the fixtures. In order to maximize combability, drivers shall provide 0-10V dimming operation, unless noted otherwise.

1. Where fixtures are connected to a switching device on the drawings, the 0-10V terminations shall remain unconnected.

B. Compatibility: Certified by manufacturer for use with specific dimming system indicated for use with each dimming ballast.

2.5 LAMPS

A. LED lamps shall comply with the LM-79 and LM-80 standards and be provided to meet the following minimum specifications:

1. Recessed 1'x4', 2'x2' and 2'x4'fixtures: minimum 50,000 hours at 70% lumen output.
2. Recessed downlights: minimum 50,000 hours at 70% lumen output.
3. Linear pendant fixtures: minimum 70,000 hours at 80% lumen output.
4. Exterior fixtures: minimum 50,000 hours at 70% lumen output.

B. LED lamps shall be rated as follows, unless specified otherwise:

1. Interior luminaires:

a. CCT: 4100K nominal.
b. CRI: 80% minimum.

2. Exterior luminaires:

a. CCT: 4100K nominal.
b. CRI: 70% minimum.

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2.6 FIXTURE SUPPORT COMPONENTS

A. Single-Stem Hangers: ½-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

B. Twin-Stem Hangers: Two, ½-inch steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

C. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.

D. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

E. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

F. Independent Support Anchors: Anchors shall be on every fixture at the four (4) opposite corners. The contractor is required to independently support all recessed 1'x4', 2'x2', 2'x4', 4'x4', 2' diameter or larger fixture from all four corners. Circular fixtures smaller than 2' diameter, linear slot fixtures, etc. shall be support from at least two (2) opposite corners. Provide additional supports as recommended by the manufacturer.

G. Ceiling support steel for light fixtures: Support steel (unistrut) shall be installed to provide additional support for light fixtures from ceiling grid. Unistrut shall be installed above ceiling grid T-bars where the weight of the light fixtures require additional ceiling supports. Unistrut shall be supported independently from ceiling system.

2.7 FINISHES

A. Fixtures: Manufacturer's standard, unless otherwise indicated.

B. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.

C. Metallic Finish: Corrosion resistant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

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

3.2 TEMPORARY LIGHTING

A. The use of permanent lighting shall not be used for temporary lighting, unless approved, in writing, by the Architect/Engineer.

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3.3 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials.

B. Support for Fixtures in or on Grid-Type Suspended Ceilings. Fixtures shall be independently supported from building structure from all four corners of recessed fixtures including 2x4, 1x4, 2x2, 4x4, etc. and from opposite corners from recessed downlight and 1x1 fixtures to building steel. Wire shall be galvanized steel and rated for fixture, but not less than 14 gauge. Braided wire shall be acceptable.

1. Fixtures must be tied to structure so that failure of a single wire does NOT constitute failure of the independent support (i.e. at least two (2) wires must be tied to structure independently).

C. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.

D. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

E. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Chain Hung: Suspend with jack chain from structure.
4. Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions and details on Drawings.
5. Do no support suspended fixtures from grid. Fixtures must be supported from building structure.

F. Light fixtures shall be installed over junction boxes so they can be removed at a later date to access the wiring in the junction box.

G. Undercabinet Lighting: When installing undercabinet lighting, take care to hide all wiring. If there is a valance under the cabinet, wiring may exit the wall below the cabinet, and be run tight to the backside of the valance. If there is no valance, wiring shall exit the wall within the cabinet at a lower corner, run along the edge of the bottom shelf to the front of the cabinet to feed the end of the undercabinet light fixture. All exposed wiring shall be MC cable, and be tightly trained using straps and mechanical fasteners.

H. Where digital or analog dimming devices are indicated to control light fixtures, the required low and/or line voltage wiring shall be provided to control the fixture. Any and all additional accessories required shall be provided in their entirety.

3.4 CONNECTIONS

A. Ground equipment.

B. Furnish and install code compliant fixture disconnecting devices.

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

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3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Tests: As follows:

1. Verify normal operation of each fixture after installation.

a. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

C. Corrosive Fixtures: Replace during warranty period.

3.6 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities. Inform Architect/Engineer when aiming fixtures.

END OF SECTION 26 51 00

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