



Building knowledge

Job Order Contract Technical Specifications

Book 1 CSI Divisions 01 - 09 June 2018

County of San Mateo,
Painting



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SECTION 01 22 16 00 - NO SPECIFICATION REQUIRED

1.1 GENERAL

- A. A separate specification is not required for this item. The description given in the line item of the Construction Task Catalog completely defines the item.

1.2 PRODUCTS - (Not Used)

1.3 EXECUTION - (Not Used)

END OF SECTION 01 22 16 00



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Task	Specification	Specification Description
01 22 20 00	01 22 16 00	No Specification Required
01 22 23 00	01 22 16 00	No Specification Required



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SECTION 01 32 33 00 - SCHEDULE OF VALUES**1.1 GENERAL****A. Description Of Work**

1. This specification covers the preparation, content and submittal of the schedule of values. The Schedule of Values is an itemized list that establishes the value or cost of each part of the Work. It shall be used as the basis for preparing progress payments.

B. Preparation

1. Schedule shall show breakdown of labor, materials equipment and other costs as directed by the Owner.
2. Costs shall be in sufficient detail to indicate separate amounts for each major subsection of the Work. The Contractor may include an item for bond, insurance, temporary facilities and job mobilization.
3. Schedule of Values shall be prepared on 8-1/2-inch by 11-inch white paper.
4. Use the major subsections of the Detailed Scope of Work as the basis for Schedule format. List sub-items of major products or systems as appropriate or when requested by the Owner.
5. When requested by the Owner, support values with data that will substantiate their correctness.
6. The sum of the individual values shown on the Schedule of Values must equal the total Job Order Price.
7. Schedule shall show the purchase and delivery costs for materials and equipment that the Contractor anticipates it shall request payment for prior to their installation.

- C. Submittal: Submit two copies of Schedule, or any other number of copies as directed by the Owner, to the Owner for approval at least 20 days prior to submitting first application for a progress payment. After review by the Owner, revise and resubmit Schedule as required until it is approved.

1.2 PRODUCTS (Not Used)**1.3 EXECUTION (Not Used)**

END OF SECTION 01 32 33 00



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**SECTION 01 32 33 00a - SPECIAL PROCEDURES FOR HISTORIC TREATMENT**

1.1 GENERAL

A. Summary

1. This Section includes special procedures for historic treatment on Project including, but not limited to, the following:
 - a. Storage and protection of existing historic materials.
 - b. Temporary protection of historic materials during construction.
 - c. Protection during application of chemicals.
 - d. Protection during use of heat-generating equipment.
 - e. Historic treatment procedures.
 - f. Removal of bird excrement.
2. This specification applies to all tasks in the Construction Task Catalog® when they are used on Historic Buildings or Historic Sites.

B. Definitions

1. "Preservation": To apply measures necessary to sustain the existing form, integrity, and materials of a historic property. Work may include preliminary measures to protect and stabilize the property.
2. "Rehabilitation": To make possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features that convey its historical, cultural, or architectural values.
3. "Restoration": To accurately depict the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and the reconstruction of missing features from the restoration period.
4. "Reconstruction": To reproduce in the exact form and detail a building, structure, or artifact as it appeared at a specific period in time.
5. "Stabilize": To apply measures designed to reestablish a weather-resistant enclosure and the structural reinforcement of an item or portion of the building while maintaining the essential form as it exists at present.
6. "Protect and Maintain": To remove deteriorating corrosion, reapply protective coatings, and install protective measures such as temporary guards; to provide the least degree of intervention.
7. "Repair": To stabilize, consolidate, or conserve; to retain existing materials and features while employing as little new material as possible. Repair includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials. Within restoration, repair also includes limited replacement in kind, rehabilitation, and reconstruction, with compatible substitute materials for deteriorated or missing parts of features when there are surviving prototypes.
8. "Replace": To duplicate and replace entire features with new material in kind. Replacement includes the following conditions:
 - a. Duplication: Includes replacing elements damaged beyond repair or missing. Original material is indicated as the pattern for creating new duplicated elements.
 - b. Replacement with New Materials: Includes replacement with new material when original material is not available as patterns for creating new duplicated elements.
 - c. Replacement with Substitute Materials: Includes replacement with compatible substitute materials. Substitute materials are not allowed, unless otherwise indicated.
9. "Remove": To detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
10. "Remove and Salvage": To detach items from existing construction and deliver them to the Owner ready for reuse.
11. "Remove and Reinstall": To detach items from existing construction, repair and clean them for reuse, and reinstall them where indicated.
12. "Existing to Remain" or "Retain": Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled.



13. "Material in Kind": Material that matches existing materials, as much as possible, in species, cut, color, grain, and finish.

C. Submittals

1. Historic Treatment Program: Submit a written plan for each phase or process including protection of surrounding materials during operations. Describe in detail materials, methods, and equipment to be used for each phase of work.
2. Alternative Methods and Materials: If alternative methods and materials to those indicated are proposed for any phase of work, provide a written description including evidence of successful use on other, comparable projects, and program of testing to demonstrate effectiveness for use on this Project.
3. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by historic treatment operations. Submit before work begins.

D. Quality Assurance

1. Historic Treatment Specialist Qualifications: A firm that employs personnel, including supervisory personnel, experienced and skilled in the processes and operations indicated.
2. Historic Treatment Preconstruction Conference: Conduct conference at Project site.

E. Storage And Protection Of Historic Materials

1. Removed and Salvaged Historic Materials:
 - a. Clean salvaged historic items.
 - b. Pack or crate items after cleaning. Identify contents of containers.
 - c. Store items in a secure area until delivery to the Owner.
 - d. Transport items to the Owner's storage area on-site **OR** off-site **OR** designated by the Owner **OR** indicated on Drawings, **as directed**.
 - e. Protect items from damage during transport and storage.
 - f. Do not dispose of items removed from existing construction without prior written consent of the Owner.
2. Removed and Reinstalled Historic Materials:
 - a. Clean and repair historic items to functional condition adequate for intended reuse.
 - b. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - c. Protect items from damage during transport and storage.
 - d. 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.
3. Existing Historic Materials to Remain: Protect construction indicated to remain against damage and soiling during historic treatment. When permitted, items may be removed to a suitable, protected storage location during historic treatment and cleaned and reinstalled in their original locations after historic treatment operations are complete.
4. Storage and Protection: When removed from their existing location, store historic materials within a weathertight enclosure where they are protected from wetting by rain, snow, or ground water, and temperature variations. Secure stored materials to protect from theft.
 - a. Identify removed items with an inconspicuous mark indicating their original location.

F. Project-Site Conditions

1. Exterior Cleaning and Repairing:
 - a. Proceed with the work only when forecasted weather conditions are favorable.
 - 1) Wet Weather: Do not attempt repairs during rainy or foggy weather. Do not apply primer, paint, putty, or epoxy when the relative humidity is above 80 percent. Do not remove exterior elements of structures when rain is forecast or in progress.
 - 2) Do not perform exterior wet work when the air temperature is below 40 deg F (5 deg C).



- 3) Do not begin cleaning, patching, or repairing when there is any likelihood of frost or freezing.
- 4) Do not begin cleaning when either the air or the surface temperature is below 45 deg F (7 deg C) unless approved means are provided for maintaining a 45 deg F (7 deg C) temperature of the air and materials during, and for 48 hours subsequent to, cleaning.
 - b. Perform cleaning and rinsing of the exterior only during daylight hours.
2. the Owner will occupy portions of building immediately adjacent to historic treatment area. Conduct historic treatment so the Owner's operations will not be disrupted. Provide not less than 72 hours' notice to the Owner of activities that will affect the Owner's operations.

1.2 PRODUCTS (Not Used)

1.3 EXECUTION

A. Protection, General

1. Comply with manufacturer's written instructions for precautions and effects of products and procedures on adjacent building materials, components, and vegetation.
2. Ensure that supervisory personnel are present when work begins and during its progress.
3. Temporary Protection of Historic Materials during Construction:
 - a. Protect existing materials during installation of temporary protections and construction. Do not deface or remove existing materials.
 - b. Attachments of temporary protection to existing construction shall be approved prior to installation.
4. Protect landscape work adjacent to or within work areas as follows:
 - a. Provide barriers to protect tree trunks.
 - b. Bind spreading shrubs.
 - c. Use coverings that allow plants to breathe and remove coverings at the end of each day. Do not cover plant material with a waterproof membrane for more than 8 hours at a time.
 - d. Set scaffolding and ladder legs away from plants.
5. Existing Drains: Prior to the start of work or any cleaning operations, test drains and other water removal systems to ensure that drains and systems are functioning properly. Notify the Owner immediately of drains or systems that are stopped or blocked. Do not begin Work of this Section until the drains are in working order.
 - a. Provide a method to prevent solids including stone or mortar residue from entering the drains or drain lines. Clean out drains and drain lines that become blocked or filled by sand or any other solids because of work performed under this Contract.
 - b. Protect storm drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

B. Protection During Application Of Chemicals

1. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm or damage resulting from applications of chemical cleaners and paint removers.
2. Comply with requirements in Division 01 Section "Temporary Facilities And Controls".
3. Cover adjacent surfaces with materials that are proven to resist chemical cleaners selected for Project unless chemicals being used will not damage adjacent surfaces. Use covering materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
4. Do not clean surfaces during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
5. Neutralize and collect alkaline and acid wastes and dispose of off the Owner's property.



6. Dispose of runoff from chemical operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

C. Protection During Use Of Heat-Generating Equipment

1. Comply with the following procedures while performing work with heat-generating equipment, including welding, cutting, soldering, brazing, paint removal with heat, and other operations where open flames or implements utilizing heat are used:
 - a. Obtain the Owner's approval for operations involving use of open-flame or welding equipment.
 - 1) Notification shall be given for each occurrence and location of work with heat-generating equipment.
 - b. As far as practical, use heat-generating equipment in shop areas or outside the building.
 - c. Before work with heat-generating equipment commences, furnish personnel to serve as a fire watch (or watches) for location(s) where work is to be performed.
 - d. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
 - e. Remove and keep the area free of combustibles, including, rubbish, paper, waste, etc., within area of operations.
 - 1) If combustible material cannot be removed, provide fireproof blankets to cover such materials.
 - f. Where possible, furnish and use baffles of metal or gypsum board to prevent the spraying of sparks or hot slag into surrounding combustible material.
 - g. Prevent the extension of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
 - h. Inspect each location of the day's work not sooner than 30 minutes after completion of operations to detect hidden or smoldering fires and to ensure that proper housekeeping is maintained.
2. Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to automatic sprinkler heads, shield the individual heads temporarily with guards.

D. Historic Treatment Procedures

1. The principal aim of preservation work is to halt the process of deterioration and stabilize the item's condition, unless otherwise indicated. Repair is required where specifically indicated. The following procedures shall be followed:
 - a. Retain as much existing material as possible; repair and consolidate rather than replace.
 - b. Use additional material or structure to reinforce, strengthen, prop, tie, and support existing material or structure.
 - c. Use reversible processes wherever possible.
 - d. Use traditional replacement materials and techniques. New work shall be distinguishable to the trained eye, on close inspection, from old work.
 - e. Record the work before the procedure with preconstruction photos and during the work with periodic construction photos.
2. Prohibit smoking by personnel performing work on or near historic structures.
3. Obtain review and written approval in the form of a Constructive Change Directive or Supplemental Instruction before making changes or additions to construction or removing historic materials.
4. Notify the Owner of visible changes in the integrity of material or components whether due to environmental causes including biological attack, UV degradation, freezing, or thawing; or due to structural defects including cracks, movement, or distortion.
 - a. Do not proceed with the work in question until directed.



5. Where missing features are indicated to be repaired or replaced, provide features whose designs are based on accurate duplications rather than on conjectural designs, subject to the approval of the Owner and Historic Treatment Specialist.
 6. Where Work requires existing features to be removed, cleaned, and reused, perform these operations without damage to the material itself, to adjacent materials, or to the substrate.
 7. Identify new or replacement materials and features with inconspicuous, permanent marks to distinguish them from original materials. Record the legend of identification marks and the locations of these marks on Record Drawings.
 8. When cleaning, match samples of existing materials that have been cleaned and identified for acceptable cleaning levels. Avoid overcleaning to prevent damage to existing materials during cleaning.
- E. Removal Of Bird Excrement
1. General: Before disturbing accumulated bird excrement, consult with an occupational medicine physician, industrial hygienist, and authorities having jurisdiction to determine acceptable removal procedures and appropriate protective measures for personnel.
 2. Removing Bird Excrement: Treat bird excrement before its removal as required by authorities having jurisdiction.
 - a. Prior to removal, dampen excrement to prevent it from becoming airborne.
 - b. Use only nonmetallic tools (plastic spatulas and brushes with natural fiber or nylon bristles, or their equivalent) to remove excrement.
 - c. Collect removed excrement and legally disposed of off site.
 - d. Perform bird excrement removal work from the outside of the building with windows and other openings in the building closed.

END OF SECTION 01 32 33 00a



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SECTION 01 32 33 00b - LEED REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED-Certified **OR** Silver **OR** Gold **OR** Platinum, **as directed**, certification based on USGBC's "LEED 2009 for New Construction & Major Renovations," "LEED 2009 for Commercial Interiors," "LEED 2009 for Core and Shell Development," or "LEED 2009 for Schools New Construction and Major Renovations."
1. Other LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
 2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
 3. A copy of the LEED Project checklist is attached at the end of this Section for information only.
 4. Specific requirements for LEED are included in greater detail in other Sections.

1.2 DEFINITIONS

- A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value. Manufacturing refers to the final assembly of components into the building product that is installed at Project site.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Respond to questions and requests from the Owner and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend



on Contractor's procedures until the USGBC has made its determination on the project's LEED certification application. Document responses as informational submittals.

1.4 ACTION SUBMITTALS

- A. General: Submit additional LEED submittals required by other Specification Sections.
- B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
- C. LEED Documentation Submittals:
 - 1. FOR CONSTRUCTION AND MAJOR RENOVATIONS:
 - a. Credit EA 5: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over time **OR** a period of time of not less than one year of postconstruction occupancy, **as directed**.
 - b. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
 - c. Credit MR 3: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
 - d. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material cost for each product having recycled content.
 - e. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - f. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - g. Credit IEQ 3.1:
 - 1) Construction indoor-air-quality management plan.
 - 2) Product data for temporary filtration media.
 - 3) Product data for filtration media used during occupancy.
 - 4) Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - h. Credit IEQ 3.2:
 - 1) Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 - 2) Product data for filtration media used during flush-out and during occupancy.
 - 3) Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
 - i. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
 - j. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
 - k. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.
 - 2. FOR COMMERCIAL INTERIORS:



- a. Credit EA 3: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over time **OR** a period of time of not less than one year of postconstruction occupancy, **as directed**.
 - b. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
 - c. Credit MR 3.1 and Credit MR 3.2: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
 - d. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material costs for each product having recycled content.
 - e. Credit MR 5: Product data indicating location of material manufacturer for regionally manufactured materials. Include statement indicating cost for each regionally manufactured material and for each regionally extracted and manufactured material.
 - 1) Include statement indicating distance from manufacturer to Project for each regionally manufactured material.
 - 2) Include statement indicating location of and distance from Project to point of extraction, harvest, or recovery for each raw material used in regionally extracted and manufactured materials.
 - f. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - g. Credit IEQ 3.1:
 - 1) Construction indoor-air-quality management plan.
 - 2) Product data for temporary filtration media.
 - 3) Product data for filtration media used during occupancy.
 - 4) Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - h. Credit IEQ 3.2:
 - 1) Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 - 2) Product data for filtration media used during flush-out and during occupancy.
 - 3) Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
 - i. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
 - j. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
 - k. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.
3. FOR CORE AND SHELL DEVELOPMENT:
- a. Credit EA 5.1 and 5.2: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over time **OR** a period of time of not less than one year of postconstruction occupancy, **as directed**.
 - b. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
 - c. Credit MR 3: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
 - d. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products



- having recycled content. Include statement indicating material costs for each product having recycled content.
- e. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - f. Credit MR 6: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - g. Credit IEQ 3:
 - 1) Construction indoor-air-quality management plan.
 - 2) Product data for temporary filtration media.
 - 3) Product data for filtration media used during occupancy.
 - 4) Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - h. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
 - i. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
 - j. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.
4. FOR SCHOOLS:
- a. Credit EA 5: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over time **OR** a period of time of not less than one year of postconstruction occupancy, **as directed**.
 - b. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
 - c. Credit MR 3: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
 - d. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material costs for each product having recycled content.
 - e. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - f. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - g. Credit IEQ 3.1:
 - 1) Construction indoor-air-quality management plan.
 - 2) Product data for temporary filtration media.
 - 3) Product data for filtration media used during occupancy.
 - 4) Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - h. Credit IEQ 3.2:
 - 1) Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 - 2) Product data for filtration media used during flush-out and during occupancy.



- 3) Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
- i. Credit IEQ 4: Laboratory test reports for the following products and systems installed inside the weatherproofing system indicating that they meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 1) Adhesives and sealants.
 - 2) Paints and coatings.
 - 3) Composite wood and agrifiber products.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For LEED coordinator.
- B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
 1. Furniture.
 2. Plumbing.
 3. Mechanical.
 4. Electrical.
 5. Specialty items such as elevators and equipment.
 6. Wood-based construction materials.
- C. LEED Action Plans: Provide preliminary submittals within seven **OR 14 OR 30 OR 60, as directed**, days of date established for commencement of the Work **OR** the Notice to Proceed **OR** the Notice of Award, **as directed**, indicating how the following requirements will be met:
 1. FOR CONSTRUCTION AND MAJOR RENOVATIONS:
 - a. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: List of proposed salvaged, refurbished, and reused materials. Identify each material that will be salvaged, refurbished, or reused, including its source, cost, and replacement cost if the item was to be purchased new.
 - c. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 - d. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
 - e. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 - f. Credit IEQ 3.1: Construction indoor-air-quality management plan.
 2. FOR COMMERCIAL INTERIORS:
 - a. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3.1 and Credit MR 3.2: List of proposed salvaged, refurbished, and reused materials. Identify each material that will be salvaged, refurbished, or reused, including its source, cost, and replacement cost if the item was to be purchased new.
 - c. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 - d. Credit MR 5: List of proposed regionally manufactured materials and regionally extracted and manufactured materials.
 - 1) Identify each regionally manufactured material, including its source and cost.



- 2) Identify each regionally extracted and manufactured material, including its source and cost.
 - e. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 - f. Credit IEQ 3.1: Construction indoor-air-quality management plan.
 3. FOR CORE AND SHELL DEVELOPMENT:
 - a. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: List of proposed salvaged, refurbished, and reused materials. Identify each material that will be salvaged, refurbished, or reused, including its source, cost, and replacement cost if the item was to be purchased new.
 - c. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 - d. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
 - e. Credit MR 6: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 - f. Credit IEQ 3: Construction indoor-air-quality management plan.
 4. FOR SCHOOLS:
 - a. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: List of proposed salvaged, refurbished, and reused materials. Identify each material that will be salvaged, refurbished, or reused, including its source, cost, and replacement cost if the item was to be purchased new.
 - c. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 - d. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
 - e. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 - f. Credit IEQ 3.1: Construction indoor-air-quality management plan.
- D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
1. FOR CONSTRUCTION AND MAJOR RENOVATIONS:
 - a. Credit MR 2: Waste reduction progress reports complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: Salvaged, refurbished, and reused materials.
 - c. Credit MR 4: Recycled content.
 - d. Credit MR 5: Regional materials.
 - e. Credit MR 7: Certified wood products.
 2. FOR COMMERCIAL INTERIORS:
 - a. Credit MR 2: Waste reduction progress reports complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3.1 and Credit MR 3.2: Salvaged, refurbished, and reused materials.
 - c. Credit MR 4: Recycled content.
 - d. Credit MR 5: Regionally manufactured materials and regionally extracted and manufactured materials.
 - e. Credit MR 7: Certified wood products.
 3. FOR CORE AND SHELL DEVELOPMENT:
 - a. Credit MR 2: Waste reduction progress reports complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: Salvaged, refurbished, and reused materials.



- c. Credit MR 4: Recycled content.
- d. Credit MR 5: Regional materials.
- e. Credit MR 6: Certified wood products.
- 4. FOR SCHOOLS:
 - a. Credit MR 2: Waste reduction progress reports complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: Salvaged, refurbished, and reused materials.
 - c. Credit MR 4: Recycled content.
 - d. Credit MR 5: Regional materials.
 - e. Credit MR 7: Certified wood products.

1.6 QUALITY ASSURANCE

- A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.

2.2 SALVAGED, REFURBISHED, OR REUSED MATERIALS

- A. FOR CONSTRUCTION AND MAJOR RENOVATIONS
 - 1. Credit MR 3: Not less than 5 **OR** 10 percent, **as directed**, of building materials (by cost) shall be salvaged, refurbished, or reused materials. Certain materials may be salvaged, refurbished, or reused materials **as directed**.
- B. FOR COMMERCIAL INTERIORS
 - 1. Credit MR 3.1 and Credit MR 3.2: Not less than 5 **OR** 10 percent, **as directed**, of building materials (by cost) shall be salvaged, refurbished, or reused materials.
- C. FOR CORE AND SHELL DEVELOPMENT
 - 1. Credit MR 3: Not less than 5 percent of building materials (by cost) shall be salvaged, refurbished, or reused materials.
- D. FOR SCHOOLS
 - 1. Credit MR 3: Not less than 1 percent of building materials (by cost) shall be salvaged, refurbished, or reused materials.

2.3 RECYCLED CONTENT OF MATERIALS

- A. Credit MR 4: Building materials shall have recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content for Project constitutes a minimum of 10 **OR** 20, **as directed**, percent of cost of materials used for Project.



1. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
2. Do not include furniture, plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation.

2.4 REGIONAL MATERIALS

- A. FOR CONSTRUCTION AND MAJOR RENOVATIONS, CORE AND SHELL DEVELOPMENT, and SCHOOLS
 1. Credit MR 5: Not less than 10 **OR** 20 percent, **as directed**, of building materials (by cost) shall be regional materials.
- B. FOR COMMERCIAL INTERIORS
 1. Credit MR 5, Option 1: Not less than 20 percent of materials (by cost) shall be regionally manufactured materials.
 2. Credit MR 5, Option 2: Not less than 10 percent of materials (by cost) shall be regionally extracted and manufactured materials.

2.5 CERTIFIED WOOD

- A. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
 1. Rough carpentry.
 2. Miscellaneous carpentry.
 3. Heavy timber construction.
 4. Wood decking.
 5. Metal-plate-connected wood trusses.
 6. Structural glued-laminated timber.
 7. Finish carpentry.
 8. Architectural woodwork.
 9. Wood paneling.
 10. Wood veneer wall covering.
 11. Wood flooring.
 12. Wood lockers.
 13. Wood cabinets.
 14. Furniture
- B. FOR CONSTRUCTION AND MAJOR RENOVATIONS, COMMERCIAL INTERIORS , and SCHOOLS
 1. Credit MR 7: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- C. FOR CORE AND SHELL DEVELOPMENT
 1. Credit MR 6: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."



2.6 LOW-EMITTING MATERIALS

A. FOR CONSTRUCTION AND MAJOR RENOVATIONS, COMMERCIAL INTERIORS, and CORE AND SHELL DEVELOPMENT

1. Credit IEQ 4.1: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Wood Glues: 30 g/L.
 - b. Metal-to-Metal Adhesives: 30 g/L.
 - c. Adhesives for Porous Materials (Except Wood): 50 g/L.
 - d. Subfloor Adhesives: 50 g/L.
 - e. Plastic Foam Adhesives: 50 g/L.
 - f. Carpet Adhesives: 50 g/L.
 - g. Carpet Pad Adhesives: 50 g/L.
 - h. VCT and Asphalt Tile Adhesives: 50 g/L.
 - i. Cove Base Adhesives: 50 g/L.
 - j. Gypsum Board and Panel Adhesives: 50 g/L.
 - k. Rubber Floor Adhesives: 60 g/L.
 - l. Ceramic Tile Adhesives: 65 g/L.
 - m. Multipurpose Construction Adhesives: 70 g/L.
 - n. Fiberglass Adhesives: 80 g/L.
 - o. Contact Adhesive: 80 g/L.
 - p. Structural Glazing Adhesives: 100 g/L.
 - q. Wood Flooring Adhesive: 100 g/L.
 - r. Structural Wood Member Adhesive: 140 g/L.
 - s. Single-Ply Roof Membrane Adhesive: 250 g/L.
 - t. Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine-covered board, metal, unsupported vinyl, rubber, or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
 - u. Top and Trim Adhesive: 250 g/L.
 - v. Plastic Cement Welding Compounds: 250 g/L.
 - w. ABS Welding Compounds: 325 g/L.
 - x. CPVC Welding Compounds: 490 g/L.
 - y. PVC Welding Compounds: 510 g/L.
 - z. Adhesive Primer for Plastic: 550 g/L.
 - aa. Sheet-Applied Rubber Lining Adhesive: 850 g/L.
 - bb. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
 - cc. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
 - dd. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
 - ee. Other Adhesives: 250 g/L.
 - ff. Architectural Sealants: 250 g/L.
 - gg. Nonmembrane Roof Sealants: 300 g/L.
 - hh. Single-Ply Roof Membrane Sealants: 450 g/L.
 - ii. Other Sealants: 420 g/L.
 - jj. Sealant Primers for Nonporous Substrates: 250 g/L.
 - kk. Sealant Primers for Porous Substrates: 775 g/L.
 - ll. Modified Bituminous Sealant Primers: 500 g/L.
 - mm. Other Sealant Primers: 750 g/L.
2. Credit IEQ 4.2: For field applications that are inside the weatherproofing system, paints and coatings shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Flat Paints and Coatings: VOC not more than 50 g/L.
 - b. Nonflat Paints and Coatings: VOC not more than 150 g/L.
 - c. Dry-Fog Coatings: VOC not more than 400 g/L.
 - d. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
 - e. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.



- f. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
 - g. Pretreatment Wash Primers: VOC not more than 420 g/L.
 - h. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - i. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - j. Floor Coatings: VOC not more than 100 g/L.
 - k. Shellacs, Clear: VOC not more than 730 g/L.
 - l. Shellacs, Pigmented: VOC not more than 550 g/L.
 - m. Stains: VOC not more than 250 g/L.
3. Credit IEQ 4.4: Composite wood, agrifiber products, and adhesives shall not contain urea-formaldehyde resin.

B. FOR SCHOOLS

- 1. Credit IEQ 4: The following products and systems, where installed inside the weatherproofing system, shall meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - a. Adhesives and sealants.
 - b. Paints and coatings.
 - c. Flooring systems.
 - d. Composite wood and agrifiber products.
 - e. Ceilings and wall systems.

PART 3 - EXECUTION

3.1 REFRIGERANT AND CLEAN-AGENT FIRE-EXTINGUISHING-AGENT REMOVAL

- A. Prerequisite EA 3: Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in HVAC Sections.
- B. Credit EA 4: Remove clean-agent fire-extinguishing agents that contain HCFCs or halons and replace with agent that does not contain HCFCs or halons. See Section 212200 "Clean-Agent Fire-Extinguishing Systems" for additional requirements.

3.2 MEASUREMENT AND VERIFICATION

A. FOR CONSTRUCTION AND MAJOR RENOVATIONS and SCHOOLS

- 1. Credit EA 5: Implement measurement and verification plan consistent with Option B: Energy Conservation Measure Isolation **OR** Option D: Calibrated Simulation, Savings Estimation Method 2, **as directed**, in the EVO's "International Performance Measurement and Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction," and **as directed**.

B. FOR COMMERCIAL INTERIORS

- 1. Credit EA 3: Implement measurement and verification plan consistent with Option B: Energy Conservation Measure Isolation **OR** Option D: Calibrated Simulation, Savings Estimation Method 2, **as directed**, in the EVO's "International Performance Measurement and Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction," and **as directed**.

C. FOR CORE AND SHELL DEVELOPMENT



1. Credit EA 5.1 and 5.2: Implement measurement and verification plan consistent with Option B: Energy Conservation Measure Isolation **OR** Option D: Calibrated Simulation, Savings Estimation Method 2, **as directed**, in the EVO's "International Performance Measurement and Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction," and **as directed**.
 - D. If not already in place, install metering equipment to measure energy usage. Monitor, record, and trend log measurements.
 - E. Evaluate energy performance and efficiency by comparing actual to predicted performance.
 - F. Measurement and verification period shall cover at least one year of postconstruction occupancy.
- 3.3 CONSTRUCTION WASTE MANAGEMENT
- A. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
- 3.4 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT
- A. Credit IEQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
 1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 015000 "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 2. Replace all air filters immediately prior to occupancy.
 - B. Credit IEQ 3.2: Comply with one of the following requirements, **as directed**:
 1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. (4 300 000 L) of outdoor air per sq. ft. (sq. m) of floor area while maintaining an internal temperature of at least 60 deg F (16 deg C) and a relative humidity no higher than 60 percent.
 2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. (1 070 000 L) of outdoor air per sq. ft. (sq. m) of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. (1.52 L/s per sq. m) of outside air or the design minimum outside air rate determined in Prerequisite IEQ 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. (4 300 000 L/sq. m) of outside air has been delivered to the space.
 3. Air-Quality Testing:
 - a. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "Green Building Design and Construction Reference Guide."
 - b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
 - 1) Formaldehyde: 27 ppb.
 - 2) Particulates (PM10): 50 micrograms/cu. m.



- 3) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
 - 4) 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
 - 5) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
- c. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from same locations as in the first test.
- d. Air-sample testing shall be conducted as follows:
- 1) All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
 - 2) Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
 - 3) Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. (2300 sq. m) or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
 - 4) Air samples shall be collected between 3 and 6 feet (0.9 and 1.8 m) from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION01 32 33 00b.13

**SECTION 01 32 33 00c - REFERENCES**

1.1 GENERAL

A. Definitions

1. General: Basic Contract definitions are included in the Conditions of the Contract.
2. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
3. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
4. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
5. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
6. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
7. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
8. "Provide": Furnish and install, complete and ready for the intended use.
9. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

B. Industry Standards

1. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
2. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
3. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - a. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

C. Abbreviations And Acronyms

1. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202



AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	ACI International (American Concrete Institute) www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association (Now part of CPA)	
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction	(303) 792-9559



	www.aitc-glulam.org	
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)	
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association)	
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International)	(610) 832-9585



	www.astm.org	
AWCI	AWCI International (Association of the Wall and Ceiling Industry International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCSC)	
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood-Preservers' Association www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	Building Industry Consulting Service International www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462



CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	Canadian Standards Association	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Cast Stone Institute www.caststone.org	(717) 272-3744
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000



EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association www.esda.org	(315) 339-6937
FIBA	Federation Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM Approvals	FM Approvals www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FMRC	Factory Mutual Research (Now FM Global)	
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridarroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GRI	(Now GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200



HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
IBF	International Badminton Federation www.internationalbadminton.org	(6-03) 9283-7155
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek Testing Service NA www.intertek.com	(972) 238-5591
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11



KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, ext. 453
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848



NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (303) 697-8441
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.com	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400



NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWWDA	National Wood Window and Door Association (Now WDMA)	
OPL	Omega Point Laboratories, Inc. (Now ITS)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America) www.landcarenetwork.org	(800) 395-2522 (703) 736-9666
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute	(440) 899-0010



	www.steeldoor.org	
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974



TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrassod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tilerroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(202) 828-7422
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association (Now WCSC)	
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 297-2109
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of	(916) 372-9943



	California) www.wicnet.org	
WIC	Woodwork Institute of California (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930
2.	Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.	
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
IBC	International Building Code (See ICC)	
ICBO	International Conference of Building Officials (See ICC)	
ICBO ES	ICBO Evaluation Service, Inc. (See ICC-ES)	
ICC	International Code Council www.iccsafe.org	(888) 422-7233 (703) 931-4533
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
SBCCI	Southern Building Code Congress International, Inc. (See ICC)	
3.	Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.	
CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000



DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791



list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CCR	California Code of Regulations www.calregs.com	(916) 323-6815
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Resource Development http://txforests-service.tamu.edu	(979) 458-6650

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 33 00c

**SECTION 01 32 33 00d - ABBREVIATIONS, ACRONYMS, DEFINITIONS, AND SYMBOLS**

1.1 GENERAL

A. Description Of Work

1. This specification covers abbreviations, acronyms, definitions, and symbols used in the Contract Documents.

B. Unit of Measure Definitions

1. Following is a list of Industry Standard abbreviations.

A	Area Square Feet; Ampere	B&W	Black and White
AB	Anchor Bolt	BC	Between Centers
ABC	Aggregate Base Course	BCY	Bank Cubic Yard
ABS	Acrylonitrile Butadiene Styrene	BDL	Bundle
AC	Alternating Current; Air-Conditioning; Asphaltic Concrete; Plywood Grade A & C	BD FT	Board Feet
ACFM	Actual Cubic Feet Per Minute	BEV	Bevel/Beveled
ACM	Asbestos Containing Material	BF	Board Feet
ACP	Asphaltic Concrete Paving	BFP	Boiler Feed Pump
ACR	Acre	BHN	Brinell Hardness Number
ACZA	Ammoniacal Copper Zinc Arsenate	BHP	Boiler Horsepower; Brake Horsepower
AD	Plywood, Grade A & D	BI	Black Iron
ADDL	Additional	Bit.	Bituminous
ADJ	Adjustable	Bitum.	Bituminous
ADMIN	Administer; Administration	Bk.	Backed
AGG	Aggregate	Brkrs.	Breakers
AH	Ampere Hours	Bldg.	Building
AHM	Ampere-Hour Meter	BLK	Black; Block
AHU	Air Handling Unit	BM	Bank Measure; Beam
AIC	Amperes Interrupting Capacity	BOD	Biochemical Oxygen Demand
AL	Aluminum	BOX	Box (each)
ALT	Alternate	BR	Bedroom
AMP	Ampere	Brg.	Bearing
AMT	Amount	BRK	Brick
AOT	Adjusted Oxygen Transfer	BTFLY VLV	Butterfly Valve
APP	Attactic Polypropylene	BTR	Better (Lumber)
APPROX	Approximate	BTU	British Thermal Units
Apt.	Apartment	BTU/HR	British Thermal Units per Hour
ART	Articulated	BUR	Built Up Roof
ASB	Asbestos	BW	Butt Weld
ASJ	All Surface Jacketing	BWG	Birmingham Wire Gauge
Avg.	Average	BX	Interlocked Armored Cable
AWG	American Wire Gauge	C	Centigrade; Conductance; Conductivity, Hundred
BAG	Bag	CA	Corrosion Allowance
BBL	Barrel	Cab.	Cabinet
B&B	Grade B and Better; Balled & Burlapped	CAP	Capacity
B&S	Bell and Spigot	CB	Circuit Breaker
		CC	Center to Center
		CCA	Chromate Copper Arsenate
		CCF	Hundred Cubic Feet



CCY	Compacted Cubic Yard	Dis.	Discharge
cd	Candela	Disch.	Discharge
cd/sf	Candela per Square Foot	DB	Dry Bulb; Decibel
CF	Cubic Foot (Feet)	DBL	Double
CFM	Cubic Feet per Minute	DC	Direct Current
CHG	Charge	DCS	Distributed Control System
CHW	Chilled Water; Commercial Hot Water	DDC	Direct Digital Control
CI	Cast Iron	Demob	Demobilization
CIP	Cast in Place; Cast Iron Pipe	DF	Douglas Fir
CIRC	Circulating; Circuit	DFT	Dry Film Thickness
CLF	Hundred Linear Feet; Current Limiting Fuse	DH	Double Hung
CLP	Cross Linked Polyethylene	DHW	Domestic Hot Water
cm	Centimeter	DI	Ductile Iron
CMP	Corrugated Metal Pipe	D/P	Differential Pressure
CMPA	Corrugated Metal Pipe - Arched	DIA	Diameter
CMU	Concrete Masonry Unit	Diam	Diameter
CO	Carbon Monoxide	Diag.	Diagonal
CO2	Carbon Dioxide	Distrib.	Distribution
COL	Column	DL	Dead Load; Diesel
Comb	Combination	DLH	Deep Long Span Bar Joist
Compr	Compressor	DPST	Double Pole, Single Throw
CONC	Concrete	DS	Double Strength
CONSTR	Construction	DSA	Double Strength A Quality Glass
Cont	Continuous; Continued	DSB	Double Strength B Quality Glass
Corr	Corrugated	DWV	Drain, Waste, Vent Piping
CP	Chrome Plated	DX	Deluxe White, Direct Expansion
CPE	Chlorinated Polyethylene	dyn	Dyne
Cplg.	Coupling	e	Eccentricity
CPM	Cycles per Minute	E	Electrical Grade (Fiberglass Construction)
CPM	Critical Path Method	EA	Each
CPS	Centipoise	Econ.	Economy
CPRSR	Compressor	ECR	Electrical Grade, Corrosion Resistant (Fiberglass Construction)
CPVC	Chlorinated Polyvinyl Chloride	EDP	Electronic Data Processing
CS	Carbon Steel	EDR	Equiv. Direct Radiation
CSF	Hundred Square Feet	EG	Electro Galvanized
CSPE	ChloroSulphinated Polyethylene	EIFS	Exterior Insulation Finish System
CSS	Cast Semi Steel	ELEC	Electric; Electrical
CT	Current Transformer	Elev.	Elevator; Elevating
CTB	Cement Treated Base	EM	Electron Microscopy
CTR	Center	EMT	Electric Metallic Tubing; Thin Wall Conduit
CU FT	Cubic Foot	Eng.	Engine, Engineered
CU IN	Cubic Inch	EPDM	Ethylene Propylene Diene Monomer
CU YD	Cubic Yard	EPS	Expanded Polystyrene
CW	Chilled Water; Cold Water	EQL	Equally
CWR	Chilled Water Return	Equip.	Equipment
CWS	Chilled Water Supply	ERW	Electrical Resistance Welded
CWT	Hundred Weight	EROPS	Enclosed Roll Over Protection System
CY	Cubic Yard (27 cu. ft.); Cycle	ES	Energy Saver
CYH	Cubic Yards Per Hour	Est.	Estimated
Cyl	Cylinder	EW	Each Way
d	Penny (nail size)	EWT	Entering Water Temperature
D	Deep; Depth; Discharge		



Excav.	Excavation	Gen.	General
EXH	Exhaust	GFCI	Ground Fault Circuit Interrupter
Exp.	Expansion; Exposure	GFR	Ground Fault Relay
EXP JT	Expansion Joint	GPD	Gallons per Day
Ext.	Exterior	GPH	Gallon per Hour
		GPM	Gallon per Minute
F	Fahrenheit; Female; Fill	GR	Grade
f	Fiber stress	Grnd.	Ground
f _c	Compressive Stress in Concrete	GSF	Ground Square Foot
f _y	Minimum Yield Stress of Steel	GVW	Gross Vehicle Weight
f _m	Compressive Strength of Masonry		
F&D	Flanged-and-Dished	H	High, Height; High Strength Bar Joist
F&I	Furnished and Installed	HC	Handicapped; High Capacity
Fab.	Fabricated	HD	High Density; Heavy Duty
FAD	Free Air Delivery	HDO	High Density Overlay
FBGS	Fiberglass	HDPE	High Density Polyethylene
FC	Footcandles	Hdr.	Header
FCXP	Fan Cooled Explosion Proof	Hdw.	Hardware
FDA	Food and Drug Administration	HEPA	High Efficiency Particulate Air
FEP	Fluorinated Ethylene Propylene (Teflon)	Hg	Mercury
FF	Flat Face	HIC	High Interrupting Capacity
Fig.	Figure	HM	Hollow Metal
Fin.	Finished	HNDL	Handle
FL	Full Load	HO	High Output; Heel Outlet
FLDG	Folding	Horiz.	Horizontal
Fl. Oz.	Fluid Ounces	HP	High Pressure; Horse Power
Flr.	Floor	HPF	High Pressure Factor
FM	Frequency Modulation; Factory Mutual	HPL	High Pressure Laminate
Frmg.	Framing	HR	Hour
Fndtn.	Foundation	HRS	Hot-Rolled Steel
FT	Foot, Feet	HS	High Speed; High Strength
FTNG(S)	Fitting(s)	HSC	High Short Circuit
FLG	Flange	HSLA	High Strength Low Alloy
FOB	Freight on Board	HT	Hospital Tips; Height
Fount.	Fountain	Htg.	Heating
FPM	Feet Per Minute	Htrs.	Heaters
FPS	Feet Per Second	HVAC	Heating, Ventilating & Air Conditioning
FPT	Female Pipe Thread	Hvy.	Heavy
FRP	Fiberglass Reinforced Plastic	HW	Hot Water
FS	Forged Steel	HWR	Hot Water Return
FSC	Cast Body, Cast Switch Box	HWS	Hot Water Supply
Ftg.	Footing	HWT	Hundred Carton Weight
Ft. Lb.	Foot Pound	Hyd.	Hydraulic
Furn.	Furniture	Hydr.	Hydraulic
FVNR	Full Voltage Non-Reversing	HZ	Hertz (cycles)
FXM	Female by Male		
		I	Moment of Inertia
G	Gravity	IC	Interrupt Capacity
g	Gram	ICFM	Inlet Cubic Feet per Minute
GA	Gauge or Gage	ID	Inside Diameter
G & A	General and Administrative	I.D.	Identification; Inside Dimension
GAL	Gallon	IF	Inside Frosted
Gal./Min.	Gallon per Minute	IMC	Intermediate Metal Conduit
GALV	Galvanized	IN	Inch
GBSD	Gear Box Sheave Diameter	IN LB	Inch Pound
		IN WC	Inches Water Column



Incan.	Incandescent	LE	Leading Edge; Lead Equivalent
Incl.	Include, Including	LED	Light Emitting Diode
Inst.	Install, Installation	LEL	Lower Explosive Limit
Insul.	Insulation, Insulated	LF	Linear Foot
Int.	Interior	LFD	Linear Feet Per Day
INTSCT	Intersect	LFTL	Lineal Feet Tube Length
IP	Iron Pipe	Lge.	Large; Long
IPS	International Pipe Standard	LH	Labor Hours; Long Span Bar Joist
	Iron Pipe Size	LIN	Linear
	Inches per Second	LL	Live Load
IPT	Iron Pipe Threaded	LLD	Lamp Lumen Depreciation
ISP	Inlet Steam Pressure	LNG	Liquid Natural Gas
IW	Indirect Waste	LOA	Length Over All
		L-O-L	Lateraloleet
J	Joule	LP(G)	Liquid Propane (Gas)
JOB	Job	LS	Low Speed; Lump Sum
JOC	Job Order Contracting	Lt	Light
JT	Joint	Lt Ga	Light Gauge
		LTL	Less than Truck Load
K	Thousand; Thousand Pounds; Heavy Wall Copper Tubing; Kelvin	Lt Wt	Light Weight
KAH	Thousand Amp Hours	LV	Low Voltage
KD	Kiln Dried; Knocked Down	lm	Lumen
KDAT	Kiln Dried After Treatment	lm/sf	Lumen per square foot
Kip	1000 Pounds	lm/W	Lumen per Watt
KO	Knockout	m	Meter
Km	Kilometer	m ³ /H	Cubic Meters per Hour
KLF	Kips per Linear Foot	mA	Milliampere
KSF	Kips per Square Foot	m/S	Meters per Second
KSI	Kips per Square Inch	M	Thousand; Male; Light Wall Copper Tubing
kA	KiloAmp	MATL	Material
kg	Kilogram	MAX	Maximum
kHz	Kilohertz	Mach	Machine
kJ	Kilojoule	Mag. Str.	Magnetic Starter
kV	Kilovolt	Maint.	Maintenance
kVA	Kilovolt Ampere (1,000 volt amps)	Mat	Material
KVAR	Kilovar (Reactance)	Mat'l;	Material
kW	Kilowatt	Max.	Maximum
kWh	Kilowatt Hour	Mb	Million Bytes (characters)
		MBF	Thousand Board Feet
L	Length; Long; Medium Wall Copper Tubing	MBH	Thousand BTU per Hour
L&E	Labor and Equipment	MBtu	Thousand British Thermal Units
LAB	Labor	MC	Metal Clad Cable
LAN	Lane	MCF	Thousand Cubic Feet
LAT	Latitude	MCM	Thousand Circular Mills
LAV	Lavatory	MCP	Motor Circuit Protector
L.B.	Load Bearing; L Conduit Body	MD	Medium Duty
LB	Pound (Force or Mass)	MDO	Medium Density Overlaid
LB/HR	Pounds per Hour	Med.	Medium
LBS	Pounds	MF	Thousand Feet
LBSF	Pounds per Square Foot	MF3	Thousand Cubic Feet
LCD	Liquid Crystal Display	Mfg.	Manufacturing
LCL	Less Than Carload Lot	Mfrs.	Manufacturers
LCY	Loose Cubic Yard	Mg	Milligram



MG	Market Grade	nW	Nanowatt
MGD	Million Gallons per Day	OAL	Overall Length
MGPH	Thousand Gallons per Hour	OB	Opposing Blade
MH	Manhole; Manhour; Metal Halide	OC	On Center
MHz	MegaHertz	OD	Outside Diameter
Mi	Mile	O.D.	Outside Dimension
MI	Malleable Iron; Mineral Insulated	ODP	Open Drip Roof
MIN	Minimum; Minute	ODS	Overhead Distribution System
MISC	Miscellaneous	OEM	Original Equipment Manufacturer
ml	Milliliter; Mainline	OG	Ogee
MLF	Thousand Linear Feet	OH	Overhead
mm	Millimeter	OH&P	Overhead and Profit
MO	Month	OHL	Over Hung Load
Mobil.	Mobilization	Oper.	Operator
Mog.	Mogul Base	Opng.	Opening
MPH	Miles Per Hour	OPR	Operating
MPT	Male Pipe Thread	Orna.	Ornamental
MRT	Mile Round Trip	OSA	Outside Air
ms	Millisecond	OSB	Oriented Strand Board
MSD	Motor Sheave Diameter	OS & Y	Outside Screw and Yoke
MSF	Thousand Square Feet	OUT	Outlet or Output (each)
MSY	Thousand Square Yards	Ovhd.	Overhead
MT	Mount	OWG	Oil, Water or Gas
MTD	Mounted	OWSJ	Open Web Steel Joist
MTG	Mounting	OZ	Ounce
MTR	Mill Test Report	P	Pole; Applied Load; Projection
MVA	Million Volt Ampere	p	Page
MVAR	Million Volt Amperes Reactance	pp	Pages
MV	Megavolt	PAPR	Powered Air Purifying Respirator
MW	Megawatt	PAR	Weatherproof Reflector
MXM	Male by Male	PB	Push Button
MYD	Thousand Yards	PC	Personal Computer; Piece;
N	Natural; North	PCs	Pieces
nA	Nanoampere	P.C.	Portland Cement; Power Connector
NA	Not Applicable	PCF	Pounds per Cubic Foot
NC	Normally Closed	PCM	Phase Contrast Microscopy
NEHB	Bolted Circuit Breaker to 600V	PE	Professional Engineer; Plain End Porcelain Enamel; Polyethylene;
NDT	Non Destructive Testing	PERF	Perforated
NIOSH	National Alloy	PH	Phase
NLB	Non-Load Bearing	PI	Pressure Injected
NM	Non-Metallic Cable	PID	Programmable Integral Derivative Con- troller
nm	Nanometer	PKG	Package
NO	Normally Open	PL	Plate
No.	Number	PLC	Programmable Loop Controller
NOM	Nominal	PLM	Polarized Light Microscopy
NQOD	Combination Plug-on/Bolt-on Circuit Breaker to 240V	PLTC	Power Limited Tray Cable
NRC	Noise Reduction Coefficient	PLY	Plywood
NPT	National Pipe Thread	PNEU	Pneumatic
NPS	Nominal Pipe Size	PNTD	Painted
NRP	Non-Removable Pins	POA	Priced On Application/Priced On Approv- al
NRS	Non-Rising Stem	PESB	Pre-engineered Steel Building
ns	Nanosecond		
NTE	Note		
NTP	National Taper Pipe (Thread)		



PPD	Pounds Per Day	ROM	Room
PP; PPL	Polypropylene	ROPS	Roll Over Protection System
PPM	Parts Per Million	ROW	Row
PPS	Polyphenylene Sulfide	R.O.W.	Right of Way
PR	Pair	RPM	Revolutions Per Minute
Prefab.	Prefabricated	RR	Direct Burial Feeder Conduit
Prefin.	Prefinished	RS	Rapid Start
PROGEN®	Proposal Generator Software for Job Order Contracting	RSC	Rigid Steel Conduit
PROP	Propelled; Propeller	RSR	Riser (Per Rise)
PSF	Pounds Per Square Foot	RT	Round Trip
PSI	Pounds Per Square Inch	RTD	Resistance Temperature Detector
PSIA	Pounds Per Square Inch Atmosphere	RTJ	Ring Type Joint
PSIG	Pounds Per Square Inch Gauge	RTRP	Reinforced Thermoset Resin Piping
PSP	Plastic Sewer Pipe	RVT	Reinforced Vinyl Tile
PT	Power or Potential Transformer	S	Suction; Single Entrance; South
Pt.	Pint	S1S2E	Surfaced 1 side, 2 Edges
Ptns.	Partitions	S2S	Surfaced 2 Sides
P&T	Pressure & Temperature	S4S	Surfaced 4 Sides
PTFE	Polytetrafluoroethylene	Sa	Sack
Pu	Ultimate Load	SA	Supply Air
PV	Photovoltaic	SBS	Styrene Butyl Styrene
PVA	Polyvinyl Acrylate	Scaf.	Scaffolding
PVC	Polyvinyl Chloride	SCFH	Standard Cubic Foot Per Hour
PVDC	Polyvinylidene Chloride	SCFM	Standard Cubic Foot per Minute
PVDF	Polyvinylidene Fluoride	SCH	Schedule
PVF	Polyvinyl Fluoride	SCR	Modular Brick
Pvmt.	Pavement	SCRD	Screwed
PVQ	Pressure Vessel Quality	SD	Sound Deadening
Pwr.	Power	SDR	Standard Dimension Brick; Size To Diameter Ratio
Q	Quantity Heat Flow	SE	Surfaced Edge; Semi-Elliptical
QA	Quality Assurance	SEA	Seat
QC	Quality Control; Quick Coupling	SER	Service Entrance Cable
QT	Quart	SEU	Service Entrance Cable
Quan.	Quantity	SET	Set
Qty.	Quantity	SF	Square Foot/Feet
R	Thermal Resistance	SFCA	Square Feet of Form in Contact with Concrete
R/L	Random Lengths	SHTS	Sheets
R/W/L	Random Widths and Lengths	SI	Square Inch
RA	Return Air; Registered Architect	SIS	Synthetic Heat-Resistant
RCP	Reinforced Concrete Pipe	SLDR	Solder
Rect.	Rectangle	SLH	Super Long Span Bar Joist
REINF	Reinforced/Reinforcing	SN	Solid Neutral
Req'd	Required	S-O-L	Socketolet
RF	Raised Face	SP	Self-Propelled; Single Pole; Space; Standpipe Static Pressure (measured in inches of water);
RGH	Rough	SPDT	Single Pole, Double Throw
RGS	Rigid Galvanized Steel	SPGR	Specific Gravity
RH	Relative Humidity	SPWG	Static Pressure Water Gauge
RHW	Rubber, Heat & Water Resistant; Residential Hot Water	SQ	Square; Hundred Square Feet (10' x 10' area)
rms	Root Mean Square		
RND	Round		
ROL	Roll (each)		



SQ FT	Square Foot/Square Feet	UA	Unequal Angle
SQ IN	Square Inch	UCI	Uniform Construction Index
SQ YD	Square Yard	UF	Underground Feeder
SS	Stainless Steel; Single Strength	UHF	Ultra High Frequency
SSB	Single Strength B Quality Glass	UI	United Inch
SSL	Self Sealing Lap	UNC	Unified Coarse (Threads)
STC	Sound Transmission Class	USP	United States Primed
STD	Standard	UTP	Unshielded Twisted Pair
STK	Select Tight Knot	UV	Under Voltage
STP	Stop (each); Standard Temperature & Pressure	V	Volt
SURF	Surface	VA	Volt Amperes
STL	Steel	VAV	Variable Air Volume
SURF	Surface	VCT	Vinyl Composition Tile
SW	Seam Weld	Vert.	Vertical
SW	Switch	VF	Vinyl Faced
SWBD	Switchboard	VHF	Very High Frequency
SWS	Segmentally Welded Steel	VLF	Vertical Linear Foot
SWSI	Single Width, Single Inlet	VLV	Valve
SY	Square Yard	Vol.	Volume
SYN	Synthetic	VRP	Vinyl Reinforced Polyester
SYP	Southern Yellow Pine	w/	With
SYS	System	W	Watt; Width; Wire; West
T	Thick; Temperature; Ton	WB	Wet Bulb
T&C	Threaded and Coupled	WC	Water Column; Water Closet
T&G	Tongue and Groove	WF	Wide Flange
TBC	Tensile Bolt Cloth	WG	Water Gauge
TBE	Threaded Both Ends	WHM	Watthour Meter
TC	Terra Cotta	WK	Week
TCLP	Toxicity Characteristic Leaching Procedure	Wldg.	Welding
TDS	Total Dissolved Solids	WOG	Water, Oil, Gas
TEAO	Totally Enclosed Air Over	W-O-L	Weldolet
TEFC	Totally Enclosed Fan Cooled	WP	Weather Protected
TETC	Totally Enclosed Tube Cooled	WR	Water Resistant
TFE	Tetrafluoroethylene (Teflon)	WSP	Water, Steam, Petroleum
THHN	Nylon Jacketed Wire	WT	Weight
THK	Thick	WWF	Welded Wire Fabric
THKNS	Thickness	X or x	By or Times
THW	Insulated Strand Wire	XFER	Transfer
THWN	Nylon Jacketed Wire	XFMR	Transformer
TI	Titanium	XHD	Extra Heavy Duty
TL	Truckload	XHHW; XLPE	Cross-Linked Polyethylene Wire Insulation
TM	Track Mounted	XLP	Cross-Linked Polyethylene
T-O-L	Threadolet	XP	Explosion Proof
TON	Ton	XRF	X-Ray Fluorescence
Tot.	Total	Y	Wye
TPH	Tons Per Hour	YD	Yard
Transf.	Transformer	YR	Year
TSHP	Total Shaft Horse Power		
T'STAT	Thermostat		
TV	Television		
TW	Thermoplastic Water Resistant Wire		

2. Symbols



Δ	Delta	∅	Diameter or Phase
/	per	'	feet
-	through or to	"	inches
@	at	#	pound or number
%	per 100 or percent	°	degree
\$	U.S. dollars	<	Less Than
~	Approximate	>	Greater Than

3. Explanation Of Terms

BTU: Stands for British Thermal Unit. The BTU number indicates the amount of heat required to raise one pound of water by one degree Fahrenheit. What this means is the higher the BTU rating, the higher the heating capacity of a product.

MBH: Equal to 1000 BTUs.

Tons (In Reference To Cooling): Unit of measurement for determining cooling capacity. One ton equals 12,000 BTUH.

SEER: Stands for Seasonal Energy Efficiency Ratio. This measures the cooling efficiency in air conditioners or heat pumps. The higher the SEER rating, the more energy-efficient the unit. The government's minimum SEER rating is 10.

4. Calculation Of Board Feet

a. All Lumber Grades Are Presumed To Be 75 Percent Construction And 25 Percent Standard Or Equivalent Grade Unless Otherwise Listed. Dimensions Are Nominal. Board Foot Is Defined As 1" x 12" x 1' Long; To Calculate BF/LF, Multiply The Size Of The Board Height x Width/12.

- 1) 1"x2" = 0.167 BF/LF
- 2) 1"x3" = 0.25 BF/LF
- 3) 2"x3" = 0.5 BF/LF
- 4) 2"x4" = 0.667 BF/LF
- 5) 2"x6" = 1.0 BF/LF
- 6) 2"x8" = 1.333 BF/LF
- 7) 2"x10" = 1.667 BF/LF
- 8) 2"x12" = 2.0 BF/LF
- 9) 4"x4" = 1.333 BF/LF
- 10) 6"x4" = 2.0 BF/LF
- 11) 6"x6" = 3.0 BF/LF
- 12) 8"x8" = 5.333 BF/LF
- 13) etc.

b. To Calculate Board Feet;

- 1) For most lumber: Thickness (inches) x width (inches) x length (feet) divided by 12 = board feet.
- 2) For small pieces: Thickness (inches) x width (inches) x length (inches) divided by 144 = board feet.

5. Conversion Tables

ENGLISH TO METRIC CONVERSION TABLE					
MULTIPLY	BY	TO GET	MULTIPLY	BY	TO GET
acres	0.404 687 3	Hectares	ounce(force)	0.278 013 9	newtons=N
board feet	0.002 359 74	cubic meter	pint(liq.)	0.473 176	liters=l



ENGLISH TO METRIC CONVERSION TABLE					
cubic ft.	0.028 316 85	cubic meter	pint(dry)	0.550 61	liters=l
cubic yd.	0.764 554 9	cubic meter	pound(wt.)	0.453 592 37	kilogram
feet	0.304 8	Meters	pound(force)	4.448 222	newtons=N
footcandles	10.763 91	lux=lumens/m ²	pound/sq.ft	47.880 26	pascal=N/m ²
ft.-lb _f	1.355 818	N□m=joule	pound/sq.in	6.894 757	kilopascals
gallon (US)	3.785 412	Liters	quart(liq.)	0.946 352 9	liters
horsepower [*]	745.699 9	watt=J/sec	sq. feet	0.092 903 04	sq. meter
* horsepower=550 ft-lb _f /sec			sq. in.	645.16	sq. mm
inch	25.4	Millimeters	sq. mile	258.998 8	hectares
inch-pound _f	0.112 984 8	N□m=joule	sq. mile	2.589 988	sq. km
kips	4.448 222	Kilonewton	sq. yard	0.836 127 4	sq. meter
kips/in ²	6.894 757	megapascal	ton(short)	0.907 184 7	metric ton
miles (US)	1.609 347	Kilometer	ton(short)	907.184 7	kilogram=kg
ounce (wt.)	28.349 52	Grams	ton(short)	8896.444	newtons=N
ounce(liq.)	29.573 53	MI	yards	0.914 4	meters=m

FOR TEMPERATURE CONVERSION USE °C= 5/9(°F - 32)



METRIC TO ENGLISH CONVERSION TABLE					
MULTIPLY	BY	TO GET	MULTIPLY	BY	TO GET
cubic meter	1.308 0	cubic yard	liter	0.264 17	gallon
	35.314 7	cubic foot		1.056 7	quart
	61,024	cubic inch		2.113 4	pint
	264.172	Gallon		33.814	fl.ounce
gram	0.035 274	ounce(wt)	milliliter	0.033 814	fl.ounce
	0.002 204 6	pound(wt)	liter/m	0.080 52	gal/ft
kilogram	35.274	ounce(wt)	liter/m ²	0.220 88	gal/sq.yd
	2.204 623	pound(wt)	lux	0.092 902	ft-candle
	0.002 204 6	Kip	meter	1.093 6	yard
	0.001 102 3	Ton		3.280 84	foot
megagram (metric ton)	1.102 3	ton	millimeter	0.039 370	inch
			kilometer	0.621 37	mile
hectare	2.471 04	Acre	micrometer	0.039 370 1	mil
	107,639	square feet	Newton	0.224 81	pound(f)
	11,959.9	square yard	kilonewton	0.224 81	kip(f)
	0.003 861 02	square mile	Pascal	0.020 885	lb/sq. feet
microare	0.155 00	square inch	kilopascal	0.145 04	lb/sq. inch
joule	0.737 56	foot pound	megapascal	0.145 04	kips/sq. inch
	8.849 5	inch pound	square meter	1.195 99	square yard
kg/m³	1.685 55	lbs./cubic yards		10.763 9	square feet
	0.062 428	lbs./cubic feet	square millimeter	0.001 55	square inch
km/hr	0.621 37	miles per hour	square kilometer	0.386 102	square mile
			watt (J/second)	0.001 341	horsepower
				0.737 56	ft-lb/second

FOR TEMPERATURE CONVERSION USE °F = 9/5 °C + 32



C. Material Weights/Engineering Values

1. The following engineering values are guidelines for establishing shrink/swell factors and shall be used unless otherwise directed by the Owner. The Owner has final authority in establishing unit weights that are appropriate for all material and may change the stated values.

a. Material weights (Lbs Per CY) for In-place (Bank) [BCY], Loose (Excavated Materials) [LCY], and Compacted [CCY]

<u>MATERIALS</u>	<u>BCY</u>	<u>LCY</u>	<u>CCY</u>
Earth, Common (Average)	3170	2536	3520
Sand (Dry)	2880	2590	3240
Sand (Wet)	3090	2940	3460
Earth, Dry	3030	2070	3520
Earth, Damp	3370	2360	3520
Earth, Wet	2940	2940	3520
Earth, Rock Mixture (75% E/ 25% R)	3380	2370	3720
Earth, Rock Mixture (50% E/ 50% R)	3750	2710	4000
Earth, Rock Mixture (25% E/ 75% R)	4120	3140	3680
Gravel (Average)	3280	2730	3570
Limestone	4380	2690	3220
Riprap Rock (Average)	4500	2610	3150
Granite	4540	2640	3170
Basalt	4950	3020	3640
Clay	3220	2150	3570
Gneiss	4550	2720	3180

D. Reclaimed Asphalt Pavement (RAP)

1. Origin

a. Reclaimed asphalt pavement (RAP) is the term given to removed and/or reprocessed pavement materials containing asphalt and aggregates. These materials are generated when asphalt pavements are removed for reconstruction, resurfacing, or to obtain access to buried utilities. When properly crushed and screened, RAP consists of high-quality, well-graded aggregates coated by asphalt cement.

b. Asphalt pavement is generally removed either by milling or full-depth removal. Milling entails removal of the pavement surface using a milling machine, which can remove up to 50 mm (2 in) thickness in a single pass. Full-depth removal involves ripping and breaking the pavement using a rhino horn on a bulldozer and/or pneumatic pavement breakers. In most instances, the broken material is picked up and loaded into haul trucks by a front-end loader and transported to a central facility for processing. At this facility, the RAP is processed using a series of operations, including crushing, screening, conveying, and stacking.

c. Although the majority of old asphalt pavements are recycled at central processing plants, asphalt pavements may be pulverized in place and incorporated into granular or stabilized base courses using a self-propelled pulverizing machine. Hot in-place and cold in-place recycling processes have evolved into continuous train operations that include partial depth removal of the pavement surface, mixing the reclaimed material with beneficiating additives (such as virgin aggregate, binder, and/or softening or rejuvenating agents to improve binder properties), and placing and compacting the resultant mix in a single pass.

2. Physical Properties

a. The properties of RAP are largely dependent on the properties of the constituent materials and the type of asphalt concrete mix (wearing surface, binder course, etc.). There can be substantial differences between asphalt concrete mixes in aggregate quality, size, and consistency. Since the aggregates in surface course (wearing course) asphalt concrete must have high resistance to wear/abrasion (polishing) to contribute to acceptable friction



- resistance properties, these aggregates may be of higher quality than the aggregates in binder course applications, where polishing resistance is not of concern.
- b. Both milling and crushing can cause some aggregate degradation. The gradation of milled RAP is generally finer and more dense than that of the virgin aggregates. Crushing does not cause as much degradation as milling; consequently, the gradation of crushed RAP is generally not as fine as milled RAP, but finer than virgin aggregates crushed with the same type of equipment.
 - c. The particle size distribution of milled or crushed RAP may vary to some extent, depending on the type of equipment used to produce the RAP, the type of aggregate in the pavement, and whether any underlying base or subbase aggregate has been mixed in with the reclaimed asphalt pavement material during the pavement removal.
 - d. During processing, virtually all RAP produced is milled or crushed down to 38 mm (1.5 in) or less, with a maximum allowable top size of either 51 mm (2 in) or 63 mm (2.5 in). Table 13-1 lists the typical range of particle size distribution that normally results from the milling or crushing of RAP. Milled RAP is generally finer than crushed RAP. The pavement fraction passing a 2.36 mm (No. 8) sieve can be expected to increase from a premilled range of 41 to 69 percent to a postmilled range of 52 to 72 percent. The fraction passing a 0.075 mm (No. 200) sieve can be expected to increase from approximately 6 to 10 percent to a range of 8 to 12 percent. Most sources of RAP will be a well-graded coarse aggregate, comparable to, or perhaps slightly finer and more variable than, crushed natural aggregates.
 - e. The unit weight of milled or processed RAP depends on the type of aggregate in the reclaimed pavement and the moisture content of the stockpiled material. The unit weight of milled or processed RAP has been found to range from 1940 to 2300 kg/m³ (120 to 140 lb/ft³), which is slightly lower than that of natural aggregates.
 - f. Moisture content of the RAP will increase while in storage. Crushed or milled RAP can pick up a considerable amount of water if exposed to rain. Moisture contents up to 5 percent or higher have been measured for stored crushed RAP. As noted earlier, during periods of extensive precipitation, the moisture content of some RAP stockpiles may be as high as 7 to 8 percent. Lengthy stockpiling of crushed or milled RAP should, therefore, be kept to a minimum.
 - g. The asphalt cement content of RAP typically ranges between 3 and 7 percent by weight. The asphalt cement adhering to the aggregate is somewhat harder than new asphalt cement. This is due primarily to exposure of the pavement to atmospheric oxygen (oxidation) during use and weathering. The degree of hardening depends on several factors, including the intrinsic properties of the asphalt cement, the mixing temperature/time (increases with increasing high temperature exposure), the degree of asphalt concrete compaction (increases if not well compacted), asphalt cement/air voids content (increases with lower asphalt/higher air voids content), and age in service (increases with age).



Table 1. Typical range of particle size distribution for reclaimed asphalt pavement (RAP) (percent by weight passing).

Screen Size (mesh)	Percent Finer After Processing or Milling
37.5 mm (1.5 in)	100
25 mm (1.0 in)	95 - 100
19 mm (3/4 in)	84 - 100
12.5 mm (1/2 in)	70 - 100
9.5 mm (3/8 in)	58 - 95
75 mm (No. 4)	38 - 75
2.36 mm (No. 8)	25 - 60
1.18 mm (No. 16)	17 - 40
0.60 mm (No. 30)	10 - 35 ^a
0.30 mm (No. 50)	5 - 25 ^b
0.15 mm (No. 100)	3 - 20 ^c
0.075 mm (No. 200)	2 - 15 ^d
a. Usually less than 30 percent b. Usually less than 20 percent c. Usually less than 15 percent d. Usually less than 10 percent	

- h. The RAP obtained from most wearing surface mixes will usually have an asphalt content in the 4.5 to 6 percent range. The recovered asphalt from RAP usually exhibits low penetration and relatively high viscosity values, depending on the amount of time the original pavement has been in service. Penetration values at 25°C (77°F) are likely to range from 10 to 80 while the absolute viscosity values at 60°C (140°F) may range from as low as 2,000 poises (equivalent to AC-20) up to as high as 50,000 poises or greater, depending on the extent of aging. Viscosity ranges from 4,000 to 25,000 poises can normally be expected from the asphalt cement that is recovered from RAP material. Table 2 provides a summary of the typical ranges of physical properties of RAP, other than gradation.

**Table 2. Physical and mechanical properties of reclaimed asphalt pavement (RAP).**

Type of Property	RAP Property	Typical Range of Values
Physical Properties	Unit Weight	1940 - 2300 kg/m ³ (120-140 lb/ft ³)
	Moisture Content	Normal: up to 5% Maximum: 7-8%
	Asphalt Content	Normal: 4.5-6% Maximum Range: 3-7%
	Asphalt Penetration	Normal: 10-80 at 25°C (77°F)
	Absolute Viscosity or Recovered Asphalt Cement	Normal: 4,000 - 25,000 poises at 60°C (140°F)
Mechanical Properties	Compacted Unit Weight	1600 - 2000 kg/m ³ (100-125 lb/ft ³)
	California Bearing Ratio (CBR)	100% RAP: 20-25% 40% RAP and 60% Natural Aggregate: 150% or higher

3. Chemical Properties

- a. Mineral aggregates constitute the overwhelming majority (93 to 97 percent by weight) of RAP. Only a minor percentage (3 to 7 percent) of RAP consists of hardened asphalt cement. Consequently, the overall chemical composition of RAP is essentially similar to that of the naturally occurring aggregate that is its principal constituent.
- b. Asphalt cement is made up of mainly high molecular weight aliphatic hydrocarbon compounds, but also small concentrations of other materials such as sulfur, nitrogen, and polycyclic hydrocarbons (aromatic and/or naphthenic) of very low chemical reactivity. Asphalt cement is a combination of asphaltenes and maltenes (resins and oils). Asphaltenes are more viscous than either resins or oils and play a major role in determining asphalt viscosity. Oxidation of aged asphalt causes the oils to convert to resins and the resins to convert to asphaltenes, resulting in age hardening and a higher viscosity binder.

4. Mechanical Properties

- a. The mechanical properties of RAP depend on the original asphalt pavement type, the method(s) utilized to recover the material, and the degree of processing necessary to prepare the RAP for a particular application. Since most RAP is recycled back into pavements, there is a general lack of data pertaining to the mechanical properties for RAP in other possible applications.
- b. The compacted unit weight of RAP will decrease with increasing unit weight, with maximum dry density values reported to range from 1600 kg/m³ (100 lb/ft³) to 2000 kg/m³ (125 lb/ft³). California Bearing Ratio (CBR) values for RAP material containing trap rock aggregate have been reported in the 20 to 25 percent range. However, when RAP is blended with natural aggregates for use in granular base, the asphalt cement in the RAP has a significant strengthening effect over time, such that specimens containing 40 percent RAP have produced CBR values exceeding 150 after 1 week.
- c. Table 2 provides a summary of the mechanical properties of RAP discussed in the preceding paragraphs.

1.2 PRODUCTS (Not Used)



1.3 EXECUTION (Not Used)

END OF SECTION 01 32 33 00d



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**SECTION 01 51 13 00 - PANELBOARDS**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for panelboards. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Distribution panelboards.
 - b. Lighting and appliance branch-circuit panelboards.
 - c. Load centers.
 - d. Electronic-grade panelboards.

C. Definitions

1. SVR: Suppressed voltage rating.
2. TVSS: Transient voltage surge suppressor.

D. Performance Requirements

1. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For each panelboard and related equipment.
 - a. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - b. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - c. Detail bus configuration, current, and voltage ratings.
 - d. Short-circuit current rating of panelboards and overcurrent protective devices.
 - e. Include evidence of NRTL listing for series rating of installed devices.
 - f. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - g. Include wiring diagrams for power, signal, and control wiring.
 - h. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.
3. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Panelboard Schedules: For installation in panelboards.
5. Operation and maintenance data

F. Quality Assurance

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



- G. Delivery, Storage, And Handling
 - 1. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
 - 2. Handle and prepare panelboards for installation according to NECA 407 **OR** NEMA PB 1.
- H. Project Conditions
 - 1. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of electric service.
 - b. Do not proceed with interruption of electric service without the Owner's written permission.
 - c. Comply with NFPA 70E.
- I. Warranty
 - 1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

- A. General Requirements For Panelboards
 - 1. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 - 2. Enclosures: Flush **OR** Surface **OR** Flush- and surface, **as directed**, -mounted cabinets.
 - a. Rated for environmental conditions at installed location.
 - 1) Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2) Outdoor Locations: NEMA 250, Type 3R.
 - 3) Kitchen or Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - 4) Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 5) Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5 **OR** Type 12, **as directed**.
 - b. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - c. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - d. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - e. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - f. Finishes:
 - 1) Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - 2) Back Boxes: Galvanized steel **OR** Same finish as panels and trim, **as directed**.
 - 3) Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
 - g. Directory Card: Inside panelboard door, mounted in transparent card holder **OR** metal frame with transparent protective cover, **as directed**.
 - 3. Incoming Mains Location: Top **OR** Bottom **OR** Top and bottom, **as directed**.
 - 4. Phase, Neutral, and Ground Buses:
 - a. Material: Tin-plated aluminum **OR** Hard-drawn copper, 98 percent conductivity, **as directed**.



- b. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - c. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 - d. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
 - e. Split Bus: Vertical buses divided into individual vertical sections.
 5. Conductor Connectors: Suitable for use with conductor material and sizes.
 - a. Material: Tin-plated aluminum **OR** Hard-drawn copper, 98 percent conductivity, **as directed**.
 - b. Main and Neutral Lugs: Compression **OR** Mechanical, **as directed**, type.
 - c. Ground Lugs and Bus-Configured Terminators: Compression **OR** Mechanical, **as directed**, type.
 - d. Feed-Through Lugs: Compression **OR** Mechanical, **as directed**, type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - e. Subfeed (Double) Lugs: Compression **OR** Mechanical, **as directed**, type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - f. Gutter-Tap Lugs: Compression **OR** Mechanical, **as directed**, type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - g. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
 6. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
 7. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 8. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
 9. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
- B. Distribution Panelboards
1. Panelboards: NEMA PB 1, power and feeder distribution type.
 2. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - a. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
 3. Mains: Circuit breaker **OR** Fused switch **OR** Lugs only, **as directed**.
 4. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in **OR** Bolt-on, **as directed**, circuit breakers.
 5. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
 6. Branch Overcurrent Protective Devices: Fused switches.
 7. Contactors in Main Bus: NEMA ICS 2, Class A, electrically **OR** mechanically, **as directed**, held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
 - a. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
 - b. External Control-Power Source: 120-V branch circuit **OR** 24-V control circuit, **as directed**.
- C. Lighting And Appliance Branch-Circuit Panelboards
1. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
 2. Mains: Circuit breaker **OR** Lugs only, **as directed**.
 3. Branch Overcurrent Protective Devices: Plug-in **OR** Bolt-on, **as directed**, circuit breakers, replaceable without disturbing adjacent units.
 4. Contactors in Main Bus: NEMA ICS 2, Class A, electrically **OR** mechanically, **as directed**, held, general-purpose controller, with same short-circuit interrupting rating as panelboard.



- a. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
- b. External Control-Power Source: 120-V branch circuit **OR** 24-V control circuit, **as directed**.
5. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
6. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

D. Load Centers

1. Load Centers: Comply with UL 67.
2. Mains: Circuit breaker **OR** Lugs only, **as directed**.
3. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
4. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

E. Electronic-Grade Panelboards

1. Panelboards: NEMA PB 1; with factory-installed, integral TVSS; labeled by an NRTL for compliance with UL 67 after installing TVSS.
2. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
3. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
4. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
5. Buses:
 - a. Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
 - b. Copper equipment and isolated ground buses.
6. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, plug-in **OR** wired-in **OR** bolt-on, **as directed**, solid-state, parallel-connected, modular (with field-replaceable modules) **OR** non-modular, **as directed**, type, with sine-wave tracking suppression and filtering modules, short-circuit current rating complying with UL 1449, second edition, and matching or exceeding the panelboard short-circuit rating, redundant suppression circuits, with individually fused metal-oxide varistors.
 - a. Accessories:
 - 1) Fuses rated at 200-kA interrupting capacity.
 - 2) Fabrication using bolted compression lugs for internal wiring.
 - 3) Integral disconnect switch.
 - 4) Redundant suppression circuits.
 - 5) Redundant replaceable modules.
 - 6) Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - 7) LED indicator lights for power and protection status.
 - 8) Audible alarm, with silencing switch, to indicate when protection has failed.
 - 9) Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - 10) Four **OR** Six, **as directed**,-digit, transient-event counter set to totalize transient surges.
 - b. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase **OR** 120 kA per mode/240 kA per phase **OR** 80 kA per mode/160 kA per phase, **as directed**.
 - c. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
 - 1) Line to Neutral: 70,000 A.
 - 2) Line to Ground: 70,000 A.
 - 3) Neutral to Ground: 50,000 A.
 - d. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
 - e. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 **OR** 208Y/120 **OR** 600Y/347, **as directed**,-V, three-phase, four-wire circuits shall be as follows:



- 1) Line to Neutral: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - 2) Line to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - 3) Neutral to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
- f. Protection modes and UL 1449 SVR for 240/120-V, single-phase, three-wire circuits shall be as follows:
- 1) Line to Neutral: 400 V.
 - 2) Line to Ground: 400 V.
 - 3) Neutral to Ground: 400 V.
- g. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:
- 1) Line to Neutral: 400 V, 800 V from high leg.
 - 2) Line to Ground: 400 V.
 - 3) Neutral to Ground: 400 V.
- h. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:
- 1) Line to Line: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.
 - 2) Line to Ground: 1500 V for 480 V **OR** 800 V for 240 V **OR** 2500 V for 600 V, **as directed**.
- F. Disconnecting And Overcurrent Protective Devices
1. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating **OR** interrupting capacity, **as directed**, to meet available fault currents.
 - a. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - b. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - c. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and 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^2t response.
 - d. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - e. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - f. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - g. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 - h. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - 1) Standard frame sizes, trip ratings, and number of poles.
 - 2) Lugs: Compression **OR** Mechanical, **as directed**, style, suitable for number, size, trip ratings, and conductor materials.
 - 3) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - 4) Ground-Fault Protection: Integrally mounted **OR** Remote-mounted, **as directed**, relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.



- 5) Communication Capability: Circuit-breaker-mounted **OR** Universal-mounted **OR** Integral **OR** Din-rail-mounted, **as directed**, communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring And Control".
 - 6) Shunt Trip: 120 **OR** 24, **as directed**, -V trip coil energized from separate circuit, set to trip at 55 **OR** 75, **as directed**, percent of rated voltage.
 - 7) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional **OR** with field-adjustable 0.1- to 0.6-second, **as directed**, time delay.
 - 8) Auxiliary Contacts: One SPDT switch **OR** Two SPDT switches, **as directed**, with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
 - 9) Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
 - 10) Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - 11) Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
 - 12) Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
 - 13) Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on **OR** off, **as directed**, position.
 - 14) Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
2. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- a. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses".
 - b. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
 - c. Auxiliary Contacts: One **OR** Two, **as directed**, normally open and normally closed contact(s) that operate with switch handle operation.

G. Panelboard Suppressors

1. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
 - a. Accessories:
 - 1) LED indicator lights for power and protection status.
 - 2) Audible alarm, with silencing switch, to indicate when protection has failed.
 - 3) One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
2. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, plug-in **OR** wired-in **OR** bolt-on, **as directed**, solid-state, parallel-connected, modular (with field-replaceable modules) **OR** non-modular, **as directed**, type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
 - a. Accessories:
 - 1) Fuses rated at 200-kA interrupting capacity.
 - 2) Fabrication using bolted compression lugs for internal wiring.
 - 3) Integral disconnect switch.
 - 4) Redundant suppression circuits.
 - 5) Redundant replaceable modules.
 - 6) Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - 7) LED indicator lights for power and protection status.
 - 8) Audible alarm, with silencing switch, to indicate when protection has failed.
 - 9) Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position



- on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
- 10) Four **OR** Six, **as directed**, -digit, transient-event counter set to totalize transient surges.
 - b. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase **OR** 120 kA per mode/240 kA per phase **OR** 80 kA per mode/160 kA per phase, **as directed**.
 - c. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
 - 1) Line to Neutral: 70,000 A.
 - 2) Line to Ground: 70,000 A.
 - 3) Neutral to Ground: 50,000 A.
 - d. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
 - e. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 **OR** 208Y/120 **OR** 600Y/347, **as directed**, -V, three-phase, four-wire circuits shall be as follows:
 - 1) Line to Neutral: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - 2) Line to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - 3) Neutral to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - f. Protection modes and UL 1449 SVR for 240/120-V, single-phase, three-wire circuits shall be as follows:
 - 1) Line to Neutral: 400 V.
 - 2) Line to Ground: 400 V.
 - 3) Neutral to Ground: 400 V.
 - g. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:
 - 1) Line to Neutral: 400 V, 800 V from high leg.
 - 2) Line to Ground: 400 V.
 - 3) Neutral to Ground: 400 V.
 - h. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:
 - 1) Line to Line: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.
 - 2) Line to Ground: 1500 V for 480 V **OR** 800 V for 240 V **OR** 2500 V for 600 V, **as directed**.
- H. Accessory Components And Features
1. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
 2. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

1.3 EXECUTION

A. Installation

1. Install panelboards and accessories according to NECA 407 **OR** NEMA PB 1.1, **as directed**.
2. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.



- b. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
- c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- d. Install anchor bolts to elevations required for proper attachment to panelboards.
- e. Attach panelboard to the vertical finished or structural surface behind the panelboard.
3. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
4. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers And Supports For Electrical Systems".
5. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
6. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
7. Install overcurrent protective devices and controllers not already factory installed.
 - a. Set field-adjustable, circuit-breaker trip ranges.
8. Install filler plates in unused spaces.
9. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
10. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing, **as directed**.
11. Comply with NECA 1.

B. Identification

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification For Electrical Systems".
2. Create a directory to indicate installed circuit loads after balancing panelboard loads, **as directed**; incorporate the Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
3. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
4. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".

C. Field Quality Control

1. Perform tests and inspections.
2. Acceptance Testing Preparation:
 - a. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - b. Test continuity of each circuit.
3. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - c. Perform the following infrared scan tests and inspections and prepare reports:
 - 1) Initial Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - 2) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Final Completion.
 - 3) Instruments and Equipment:



- a) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 4. Panelboards will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- D. Adjusting
1. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
 2. Set field-adjustable circuit-breaker trip ranges as indicated **OR** as specified in Division 26 Section "Overcurrent Protective Device Coordination Study", **as directed**.
 3. Load Balancing: After Final Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - a. Measure as directed during period of normal system loading.
 - b. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - c. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - d. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- E. Protection
1. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 01 51 13 00



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SECTION 01 52 13 00 - TEMPORARY FACILITIES AND CONTROLS

1.1 GENERAL

A. Summary

1. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Definitions

1. Permanent Enclosure: As determined by the Owner, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

C. Use Charges

1. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the Owner's construction forces, the Owner, occupants of Project, testing agencies, and authorities having jurisdiction.
2. Water Service: Water from the Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
3. Electric Power Service: Electric power from the Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

D. Submittals

1. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

E. Quality Assurance

1. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
2. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

F. Project Conditions

1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before the Owner's acceptance, regardless of previously assigned responsibilities.

1.2 PRODUCTS

A. Materials

1. Pavement: Comply with Division 32 Section(s) "Asphalt Paving" OR "Concrete Paving", **as directed**.
2. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.76-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails **OR** with galvanized barbed-wire top strand, **as directed**.
3. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-



mm-) OD top and bottom rails. Provide concrete **OR** galvanized steel, **as directed**, bases for supporting posts.

4. Wood Enclosure Fence: Plywood, 6 feet (1.8 m) **OR** 8 feet (2.4 m), **as directed**, high, framed with four 2-by-4-inch (50-by-100-mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.
5. Lumber and Plywood: Comply with requirements in Division 06 Section(s) "Rough Carpentry" **OR** "Miscellaneous Rough Carpentry", **as directed**.
6. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.
7. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
8. Paint: Comply with requirements in Division 09.

B. Temporary Facilities

1. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
2. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:
 - a. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - b. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack board.
 - c. Drinking water and private toilet.
 - d. Coffee machine and supplies.
 - e. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
 - f. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
3. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - a. Store combustible materials apart from building.

C. Equipment

1. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
2. HVAC Equipment: Unless the Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - a. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - b. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - c. Permanent HVAC System: If the Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.

1.3 EXECUTION

A. Installation, General

1. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.



- a. For greenfield sites if reduced site disturbance is required for LEED-NC Credit SS 5.1: Locate facilities to limit site disturbance as specified in General Requirements.
 2. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- B. Temporary Utility Installation
1. General: Install temporary service or connect to existing service.
 - a. Arrange with utility company, the Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - a. Connect temporary sewers to municipal system **OR** private system indicated, **as directed**, as directed by authorities having jurisdiction.
 3. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
OR
Water Service: Use of the Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore these facilities to condition existing before initial use.
 - a. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
 4. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - a. Toilets: Use of the Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore these facilities to condition existing before initial use.
 5. Heating **OR** Heating and Cooling, **as directed**: Provide temporary heating **OR** heating and cooling, **as directed**, required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 6. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 7. Electric Power Service: Use of the Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to the Owner.
OR
Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - a. Install electric power service overhead **OR** underground, **as directed**, unless otherwise indicated.
 - b. Connect temporary service to the Owner's existing power source, as directed by the Owner.
 8. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - a. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - b. Install lighting for Project identification sign.
 9. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line for each field office.
 - a. Provide additional telephone lines for the following:
 - 1) Provide a dedicated telephone line for each facsimile machine and computer in each field office.



- b. At each telephone, post a list of important telephone numbers.
 - 1) Police and fire departments.
 - 2) Ambulance service.
 - 3) Contractor's home office.
 - 4) the Owner's office.
 - 5) the Owner's office.
 - 6) Principal subcontractors' field and home offices.
 - c. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
10. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, in common-use facilities.
- a. Provide DSL **OR** T-1 line, **as directed**, in primary field office.
- C. Support Facilities Installation
- 1. General: Comply with the following:
 - a. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
 - b. Maintain support facilities until near Final Completion. Remove before Final Completion. Personnel remaining after Final Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
 - 2. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated **OR** within construction limits indicated, **as directed**, on Drawings.
 - a. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

OR
 - 3. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - a. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - b. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 Section "Earth Moving".
 - c. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - d. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Final Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section "Asphalt Paving".
 - 4. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - a. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - b. Maintain access for fire-fighting equipment and access to fire hydrants.
 - 5. Parking: Provide temporary **OR** Use designated areas of the Owner's existing, **as directed**, parking areas for construction personnel.
 - 6. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - a. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
 - b. Remove snow and ice as required to minimize accumulations.
 - 7. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on Drawings, **OR as directed**. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - b. Maintain and touchup signs so they are legible at all times.



8. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with General Requirements for progress cleaning requirements.
 9. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - a. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
 10. Temporary Elevator Use: Refer to Division 14 for temporary use of new elevators.
 11. Existing Elevator Use: Use of the Owner's existing elevators will be permitted, as long as elevators are cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
 - a. Do not load elevators beyond their rated weight capacity.
 - b. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
 12. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
 13. Existing Stair Usage: Use of the Owner's existing stairs will be permitted, as long as stairs are cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore stairs to condition existing before initial use.
 - a. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.
 14. Temporary Use of Permanent Stairs: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.
- D. Security And Protection Facilities Installation
1. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 2. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
 - a. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 3. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
 4. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
 5. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Final Completion. Obtain extended warranty for the Owner. Perform control operations lawfully, using environmentally safe materials.
 6. Site Enclosure Fence: Before construction operations begin **OR** When excavation begins, **as directed**, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - a. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations **OR** As indicated on Drawings, **as directed**.
 - b. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide the Owner with one set of keys, **as directed**.



7. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
8. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
9. Covered Walkway: Erect structurally adequate, protective, covered walkway for passage of individuals along adjacent public street(s). Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings, **OR as directed**.
 - a. Construct covered walkways using scaffold or shoring framing.
 - b. Provide wood-plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
 - c. Extend back wall beyond the structure to complete enclosure fence.
 - d. Paint and maintain in a manner approved by the Owner.
10. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - a. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
11. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by the Owner and tenants from fumes and noise.
 - a. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
 - b. If containment of airborne particles and dust generated by construction activities is critical to occupants of other spaces in building, e.g., occupied healthcare facilities: Construct dustproof partitions with 2 layers of 3-mil (0.07-mm) polyethylene sheet on each side. Cover floor with 2 layers of 3-mil (0.07-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
 - 1) Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.
 - c. Insulate partitions to provide noise protection to occupied areas.
 - d. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 - e. Protect air-handling equipment.
 - f. Weather strip openings.
 - g. Provide walk-off mats at each entrance through temporary partition.
12. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
 - a. Prohibit smoking in hazardous fire-exposure **OR** construction, **as directed**, areas.
 - b. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - c. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - d. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

E. Operation, Termination, And Removal

1. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
2. Maintenance: Maintain facilities in good operating condition until removal.



- a. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
3. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
4. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Final Completion.
5. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Final Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - a. Materials and facilities that constitute temporary facilities are property of Contractor. the Owner reserves right to take possession of Project identification signs.
 - b. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - c. At Final Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in General Requirements

END OF SECTION 01 52 13 00



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Task	Specification	Specification Description
01 52 13 00	01 22 16 00	No Specification Required
01 52 19 00	01 22 16 00	No Specification Required
01 52 19 00	01 52 13 00	Temporary Facilities and Controls



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SECTION 01 54 23 00 - SCAFFOLDING TUBULAR STEEL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of scaffolding-tubular steel. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

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

1.2 PRODUCTS

- #### A. Tubular steel or aluminum scaffolding system shall comply with OSHA Safety and Health Standards, Section 29 CFR, 1926/1910.

1.3 EXECUTION - (Section not used.)

END OF SECTION 01 54 23 00



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**SECTION 01 54 23 00a - UNIT MASONRY ASSEMBLIES**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for unit masonry assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes unit masonry assemblies consisting of the following:
 - a. Concrete masonry units (CMUs).
 - b. Decorative concrete masonry units.
 - c. Pre-faced concrete masonry units.
 - d. Concrete brick.
 - e. Face brick.
 - f. Building (common) brick.
 - g. Hollow brick.
 - h. Glazed brick.
 - i. Structural-clay facing tile.
 - j. Firebox brick.
 - k. Clay flue lining units.
 - l. Stone trim units.
 - m. Mortar and grout.
 - n. Reinforcing steel.
 - o. Masonry joint reinforcement.
 - p. Ties and anchors.
 - q. Embedded flashing.
 - r. Miscellaneous masonry accessories.
 - s. Masonry-cell insulation.
 - t. Cavity-wall insulation.

C. Definitions

1. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

D. Performance Requirements

1. Provide structural unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.
2. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602 **OR** Tables 2105.2 in the International Building Code, **as directed.**
OR
Determine net-area compressive strength (f'_m) of masonry by testing masonry prisms according to ASTM C 1314 **OR** IBC Standard, **as directed.**

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For 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. Samples for each type and color of exposed masonry units and colored mortars.



4. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.
5. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - a. For masonry units include material test reports substantiating compliance with requirements.
6. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

F. Quality Assurance

1. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing indicated below.
 - a. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
 - b. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
 - c. Mortar Test (Property Specification): For each mix required, per ASTM C 780 **OR** IBC Standard, **as directed**.
 - d. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019 **OR** IBC Standard, **as directed**.
2. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
3. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.
 - a. Build sample panels for each type of exposed unit masonry construction **OR** typical exterior wall, **as directed**, in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high.

G. Delivery, Storage, And Handling

1. 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.
2. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
3. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
4. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
5. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

H. Project Conditions

1. 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. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 **OR** Section 2104.3 in the International Building Code, **as directed**.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.



1.2 PRODUCTS

A. Concrete Masonry Units (CMUs)

1. Shapes: Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength for exposed units and where indicated.
3. Concrete Masonry Units: ASTM C 90 **OR** IBC Standard, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) **OR** 2150 psi (14.8 MPa) **OR** 2800 psi (19.3 MPa) **OR** 3050 psi (21.0 MPa), **as directed**.
 - b. Weight Classification: Lightweight **OR** Medium weight **OR** Normal weight, **as directed**.
4. Decorative Concrete Masonry Units: ASTM C 90 **OR** IBC Standard, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) **OR** 2150 psi (14.8 MPa) **OR** 2800 psi (19.3 MPa) **OR** 3050 psi (21.0 MPa), **as directed**.
 - b. Weight Classification: Lightweight **OR** Medium weight **OR** Normal weight, **as directed**.
 - c. Pattern and Texture:
 - 1) Standard pattern, ground finish.
 - 2) Standard pattern, split-face finish.
 - 3) Standard pattern, split-ribbed finish.
 - 4) Scored vertically, standard finish.
 - 5) Triple scored vertically, standard finish.
5. Pre-faced Concrete Masonry Units: Lightweight hollow **OR** solid, **as directed**, concrete units complying with ASTM C 90 **OR** IBC Standard, **as directed**, with manufacturer's standard smooth resinous facing complying with ASTM C 744.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) **OR** 2150 psi (14.8 MPa) **OR** 2800 psi (19.3 MPa) **OR** 3050 psi (21.0 MPa), **as directed**.
 - b. Size: Manufactured with pre-faced surfaces having 1/16-inch- (1.5-mm-) wide returns of facing to create 1/4-inch- (6.5-mm-) wide mortar joints with modular coursing.
6. Concrete Building Brick: ASTM C 55 **OR** IBC Standard, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi (17.3 MPa) **OR** 3500 psi (24.1 MPa), **as directed**.
 - b. Weight Classification: Lightweight **OR** Medium weight **OR** Normal weight, **as directed**.

B. Concrete And Masonry Lintels

1. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.
2. Concrete Lintels:
 - a. Precast units matching concrete masonry units and with reinforcing bars indicated or required to support loads indicated.
OR
Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-place Concrete".
3. Masonry Lintels: Made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.

C. Brick

1. General: Provide shapes indicated and as follows:
 - a. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - b. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.



2. Face Brick: ASTM C 216 **OR** IBC Standard, **as directed**, Grade SW **OR** MW or SW, **as directed**, Type FBX **OR** FBS **OR** FBA, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa) **OR** 4400 psi (30.3 MPa) **OR** 5500 psi (37.9 MPa) **OR** 6400 psi (44.1 MPa) **OR** 8000 psi (55.2 MPa) **OR** 8400 psi (57.9 MPa), **as directed**.
 - b. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
 - c. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - d. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
 - e. Size: **As directed**.
3. Building (Common) Brick: ASTM C 62 **OR** IBC Standard, **as directed**, Grade SW **OR** MW or SW **OR** NW, MW, or SW, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa) **OR** 4400 psi (30.3 MPa) **OR** 5500 psi (37.9 MPa) **OR** 6400 psi (44.1 MPa) **OR** 8000 psi (55.2 MPa) **OR** 8400 psi (57.9 MPa), **as directed**.
 - b. Size: Match size of face brick.
4. Hollow Brick: ASTM C 652 **OR** IBC Standard, **as directed**, Grade SW **OR** MW or SW, **as directed**, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area) **OR** H60V (void areas between 40 and 60 percent of gross cross-sectional area) , **as directed**, Type HBX **OR** HBS **OR** HBA **OR** HBB, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa) **OR** 4400 psi (30.3 MPa) **OR** 5500 psi (37.9 MPa) **OR** 6400 psi (44.1 MPa) **OR** 8000 psi (55.2 MPa) **OR** 8400 psi (57.9 MPa), **as directed**.
 - b. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - c. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
 - d. Size: **As directed**.
5. Glazed Face Brick: ASTM C 216 **OR** IBC Standard, **as directed**, Grade SW **OR** MW or SW, **as directed**, Type FBX **OR** FBS **OR** FBA, **as directed**; with glaze complying with ASTM C 126.
6. Glazed Face Brick: ASTM C 1405, Class Exterior **OR** Interior, **as directed**, Grade S (Select) **OR** SS (Select Sized or Ground Edge), **as directed**.
7. Glazed Face Brick: Either ASTM C 1405, Class Exterior **OR** Interior, **as directed**, Grade S (Select) or ASTM C 216 **OR** IBC Standard, **as directed**, Grade SW **OR** MW or SW, **as directed**, Type FBX; with glaze complying with ASTM C 126.
8. Glazed Hollow Brick: Hollow brick complying with ASTM C 652 **OR** IBC , **as directed**, Grade SW **OR** MW or SW, **as directed**, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area) **OR** H60V (void areas between 40 and 60 percent of gross cross-sectional area), **as directed**, Type HBX **OR** HBS **OR** HBA, **as directed**; with glaze complying with ASTM C 126.
 - a. Size: **As directed**.
 - b. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.

D. Structural-Clay Facing Tile

1. General:
 - a. Provide solid, multicored, or hollow units, with shape and direction of cores optional, unless otherwise indicated.
 - b. Provide multicored units designed for use in reinforced, grouted masonry.
 - c. Provide special shapes where required for corners, jambs, coved bases, sills, and other special conditions indicated that cannot be produced by sawing standard units.



2. Glazed Structural-Clay Facing Tile: ASTM C 126, Grade S (Select) **OR** SS (Select Sized or Ground Edged), **as directed**.
 - a. Size: **As directed**.
 - b. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.
 3. Unglazed Structural-Clay Facing Tile: ASTM C 212, Type FTX **OR** FTS, **as directed**, Standard **OR** Special-Duty, **as directed**, class.
 - a. Number of Faces: Single faced where only one finished face is exposed when units are installed **OR** Double faced where both finished faces are exposed when units are installed, **as directed**.
- E. Fireplace And Chimney Lining Units
1. Firebox Brick: ASTM C 1261, size required to produce lining thickness indicated.
 2. Clay Flue Lining Units: ASTM C 315.
- F. Stone Trim Units
1. Granite: ASTM C 615.
 - a. Description: Fine **OR** Medium, **as directed**,-grained, white **OR** pink **OR** gray **OR** black, **as directed**, stone. Uniform pattern, without veining.
 2. Limestone: ASTM C 568, Classification I Low **OR** II Medium **OR** III High, **as directed**,-Density.
 3. Marble: ASTM C 503, Classification I Calcite **OR** II Dolomite **OR** III Serpentine **OR** IV Travertine, **as directed**.
 - a. Description: Uniform, fine- to medium-grained, white stone with only slight veining.
 4. Quartz-Based Stone: ASTM C 616, Classification I Sandstone **OR** II Quartzitic Sandstone **OR** III Quartzite, **as directed**.
 5. Finish: Polished **OR** Honed **OR** Smooth **OR** Machine tooled, 4 bats per 1 inch (25 mm) **OR** Machine tooled, 6 bats per 1 inch (25 mm) **OR** Machine tooled, 8 bats per 1 inch (25 mm) **OR** Chat sawed **OR** Split face **OR** Rock face (pitched face), **as directed**.
 - a. Finish for Tops of Sills and Soffits of Lintels: Sand rubbed **OR** Split face, **as directed**.
 6. Provide stone units accurately shaped, with exposed faces dressed true, and with beds and joints at right angles to faces.
 - a. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 - b. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
 - c. For marble, comply with recommendations in MIA's "Dimensional Stone--Design Manual IV."
- G. Mortar And Grout Materials
1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.
 2. Hydrated Lime: ASTM C 207 **OR** IBC Standard, **as directed**, Type S.
 3. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
 4. Masonry Cement: ASTM C 91 **OR** IBC Standard, **as directed**.
 5. Mortar Cement: ASTM C 1329 **OR** IBC Standard, **as directed**.
 6. Mortar Pigments: Iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
 7. Colored Cement Product: Packaged blend made from portland cement and lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - a. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 - b. Pigments shall not exceed 10 percent of portland cement by weight.
 - c. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 8. Aggregate for Mortar: ASTM C 144.



- a. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
 - b. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
 - c. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - d. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
9. Aggregate for Grout: ASTM C 404.
 10. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units.
 11. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C 199 test; or an equivalent product acceptable to authorities having jurisdiction.
 12. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 13. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
 14. Water: Potable.

H. Reinforcement

1. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
2. Masonry Joint Reinforcement, General: ASTM A 951 **OR** IBC Standard, **as directed**.
 - a. Interior Walls: Mill- **OR** Hot-dip, **as directed**, galvanized, carbon steel.
 - b. Exterior Walls: Hot-dip galvanized, carbon **OR** Stainless, **as directed**, steel.
 - c. Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) **OR** W2.8 or 0.188-inch (4.8-mm), **as directed**, diameter.
 - d. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) **OR** W2.8 or 0.188-inch (4.8-mm), **as directed** diameter.
 - e. Wire Size for Veneer Ties: W1.7 or 0.148-inch (3.8-mm) **OR** W2.8 or 0.188-inch (4.8-mm), **as directed** diameter.
 - f. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
 - g. Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
 - h. Multiwythe Masonry:
 - 1) Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod at each wythe of masonry 4 inches (100 mm) or less in width.
 - 2) Tab type, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
 - 3) Adjustable (two-piece) type, with one side rod at each face shell of backing wythe and with ties that extend into facing wythe. Ties engage eyes or slots in reinforcement and extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. Ties have hooks or clips to engage a continuous wire in the facing wythe.
 - i. Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized, carbon-steel continuous wire.

I. Ties And Anchors

1. Materials:
 - a. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
 - b. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.



- c. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 **OR** 316, **as directed**.
 - d. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.
 - e. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
 - f. Stainless-Steel Sheet: ASTM A 666, Type 304 **OR** 316, **as directed**.
 - g. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - h. Stainless Steel bars: ASTM A 276 or ASTM a 666, Type 304.
2. Corrugated Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from steel sheet, galvanized after fabrication **OR** stainless-steel sheet, **as directed**, not less than 0.043 inch (1.1 mm) **OR** 0.053 inch (1.3 mm) **OR** 0.067 inch (1.7 mm) **OR** 0.097 inch (2.5 mm), **as directed**, thick. Ties made from galvanized steel sheet may be used in interior walls, unless otherwise indicated.
 3. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
 4. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
 - a. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
 - b. Where wythes do not align **OR** are of different materials, **as directed**, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
 - c. Wire: Fabricate from 3/16-inch- (4.8-mm-) **OR** 1/4-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed**, wire. Mill-galvanized wire ties may be used in interior walls, unless otherwise indicated.
 5. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - a. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed**, wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
 - b. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.188-inch- (4.8-mm-) **OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed** wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
 - c. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.053-inch- (1.3-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.062-inch- (1.6-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**. 0.064-inch- (1.6-mm-) **OR** 0.108-inch- (2.7-mm-), **as directed**, thick, galvanized sheet may be used at interior walls, unless otherwise indicated.
 - d. Tie Section for Concrete: Corrugated metal ties with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch (25 mm) of masonry face.
 6. Partition Top anchors: 0.097-inch- (2.5-mm-) thick metal plate with 3/8-inch- (10-mm-) diameter metal rod 6 inches (150 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication **OR** stainless-steel, **as directed**.
 7. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (600 mm) long, with ends turned up 2 inches (50 mm) or with cross pins.
 - a. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M **OR** Epoxy coating 0.020 inch (0.51 mm) thick **OR** Rust-inhibitive paint, **as directed**.
 8. Stone Anchors: Fabricate dowels, cramps, and other stone anchors from stainless steel.
 9. Adjustable Masonry-Veneer Anchors



- a. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - 1) Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
- b. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - 1) Anchor Section:
 - a) Rib-stiffened, sheet metal plate with screw holes top and bottom, and slotted holes for inserting wire tie.
 - b) Sheet metal plate with screw holes top and bottom and with raised rib-stiffened strap, stamped into center to provide a slot between strap and plate for inserting wire tie.
 - c) Gasketed sheet metal plate with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - 2) Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**.
 - 3) Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch- (4.8-mm-) **OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed**, wire.
- c. Slip-in, Masonry-Veneer Anchors: Units consisting of a wire tie section and an anchor section designed to interlock with metal studs and be slipped into place as sheathing is installed.
 - 1) Wire-Type Anchor: Bent wire anchor section with an eye to receive the wire tie. Wire tie has a vertical leg that slips into the eye of anchor section and allows vertical adjustment. Both sections are made from 3/16-inch (4.8-mm), hot-dip galvanized wire.
 - 2) Strap-and-Wire Type Anchor: Flat metal strap with notch to interlock with flange of metal stud and two holes for inserting vertical legs of wire tie specially formed to fit anchor section. Strap is made from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication; anchor wire tie is made from 3/16-inch (4.8-mm), hot-dip galvanized wire.
- d. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.
 - 1) Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, and slotted holes for inserting connector section.
 - 2) Connector Section: Rib-stiffened, sheet metal bent plate; sheet metal clip; or wire tie and rigid extruded vinyl clip designed to engage continuous wire. Size connector to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
 - 3) Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**.



- 4) Fabricate wire connector sections from 0.188-inch- (4.8-mm-) **-OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized, carbon **OR** stainless, **as directed**, steel wire.
 - e. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
 - f. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads.
- J. Miscellaneous Anchors
1. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
 2. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch (0.9-mm), galvanized steel sheet.
 3. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
 4. Postinstalled Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry 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 agency.
 - a. Corrosion Protection:
 - 1) Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
 - 2) Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
- K. Embedded Flashing Materials
1. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual OR Division 07 Section "Sheet Metal Flashing And Trim" as directed.
 - a. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.4 mm) thick.
 - b. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 10-oz./sq. ft. (3-kg/sq. m) weight or 0.0135 inch (0.34 mm) thick for fully concealed flashing; 16-oz./sq. ft. (5-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick elsewhere.
 - c. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.
 - d. Fabricate through-wall metal flashing embedded in masonry from stainless steel **OR** copper, **as directed**, with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond.
 - e. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
 - f. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
 - g. Metal Expansion-Joint Strips: Fabricate from stainless steel **OR** copper, **as directed**, to shapes indicated.
 2. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:



- a. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) **OR** 7-oz./sq. ft. (2-kg/sq. m), **as directed**, copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - b. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) **OR** 7-oz./sq. ft. (2-kg/sq. m), **as directed**, copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.
 - c. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
 - d. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy 0.025 inch (0.6 mm) thick, with a 0.015-inch- (0.4-mm-) thick coating of rubberized-asphalt adhesive.
 - e. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.
3. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.
 4. Solder and Sealants for Sheet Metal Flashings:
 - a. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - b. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 - c. Elastomeric Sealant: ASTM C 920, chemically curing urethane **OR** polysulfide silicone **as directed**, sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
 5. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer.
- L. Miscellaneous Masonry Accessories
1. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene, urethane or PVC.
 2. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall.
 3. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
 4. Weep/Vent Products: Use one of the following, unless otherwise indicated:
 - a. Wicking Material: Absorbent rope, made from cotton or UV-resistant synthetic fiber, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes. Use only for weeps.
 - b. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch (9-mm) OD by 4 inches (100 mm) long.
 - c. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.
 - d. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
 - e. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.
 - f. Aluminum Weep Hole/Vent: One-piece, L-shaped units made from sheet aluminum, designed to fit into a head joint and consisting of a vertical channel with louvers stamped in web and with a top flap to keep mortar out of the head joint; painted before installation to



- comply with Division 09 Section(s) "Exterior Painting" OR "Interior Painting", in color approved to match that of mortar.
- g. Vinyl Weep Hole/Vent: One-piece, offset, T-shaped units made from flexible, injection-molded PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color approved by Architect to match that of mortar.
5. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - a. Provide one of the following configurations:
 - 1) Strips, full-depth of cavity and 10 inches (250 mm) wide, with dovetail shaped notches 7 inches (175 mm) deep.
 - 2) Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
 - 3) Sheets or strips full depth of cavity and installed to full height of cavity.
 6. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
- M. Insulation
1. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
 2. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.
 3. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV **OR X, as directed**, closed-cell product extruded with an integral skin.
 4. Molded-Polystyrene Board Insulation: ASTM C 578, Type I.
 5. Polyisocyanurate Board Insulation: ASTM C 1289, Type I (aluminum-foil-faced), Class 2 (glass-fiber-reinforced).
 6. Adhesive: Type recommended by insulation board manufacturer for application indicated.
- N. Masonry Cleaners
1. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains from new masonry without damaging masonry. Use product approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
- O. Mortar And Grout Mixes
1. General: Do not use admixtures, unless otherwise indicated.
 - a. Do not use calcium chloride in mortar or grout.
 - b. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement and lime.
 - c. 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.
 2. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
 3. Mortar for Unit Masonry: Comply with ASTM C 270 **OR** BIA Technical Notes 8A **OR** IBC Standard, **as directed**, Proportion Specification.
 4. Mortar for Unit Masonry: Comply with ASTM C 270 **OR** BIA Technical Notes 8A **OR** IBC Standard, **as directed**, Property Specification.
 - a. For masonry below grade or in contact with earth, use Type M **OR** S, **as directed**.
 - b. For reinforced masonry, use Type S **OR** N, **as directed**.
 - c. For mortar parge coats, use Type S or N.



- d. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
- e. For interior non-load-bearing partitions, Type O may be used instead of Type N.
5. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - a. Pigments shall not exceed 10 percent of portland cement by weight.
 - b. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
6. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
7. Grout for Unit Masonry: Comply with ASTM C 476 **OR** IBC Standard, **as directed**.
 - a. 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 **OR** Table 21-C in the International Building Code, **as directed**, for dimensions of grout spaces and pour height.
 - b. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.
8. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

1.3 EXECUTION

A. Installation, General

1. Use full-size units without cutting if possible. If cutting is required, 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.
2. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
3. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
4. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
5. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
 - a. 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
 - b. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

B. Laying Masonry Walls

1. 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.
2. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
3. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
4. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
5. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

C. Mortar Bedding And Jointing



1. Lay hollow brick and concrete masonry units as follows:
 - a. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - b. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - c. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - d. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
 2. 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.
 3. Lay structural-clay tile as follows:
 - a. Lay vertical-cell units with full head joints, unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
 - b. Lay horizontal-cell units with full bed joints, unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position.
 - c. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- (6- to 10-mm-) thick joints.
 - d. Where epoxy-mortar pointed joints are indicated, rake out setting mortar to a uniform depth of 1/4 inch (6 mm) and point with epoxy mortar.
 4. Set firebox brick in full bed of refractory mortar with full head joints. Form joints by buttering both surfaces of adjoining brick and sliding it into place. Make joints just wide enough to accommodate variations in size of brick, approximately 1/8 inch (3 mm). Tool joints smooth on surfaces exposed to fire or smoke.
 5. Install clay flue liners to comply with ASTM C 1283. Install flue liners ahead of surrounding masonry. Set clay flue liners in full bed of refractory mortar 1/16 to 1/8 inch (1.6 to 3 mm) thick. Strike joints flush on inside of flue to provide smooth surface. Maintain expansion space between flue liner and surrounding masonry except where surrounding masonry is required to provide lateral support for flue liners.
 6. Set stone **OR** cast-stone, **as directed**, trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 7. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
 8. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.
- D. Composite Masonry
1. Bond wythes of composite masonry together using one of the following methods:
 - a. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. (0.42 sq. m) **OR** 2.67 sq. ft. (0.25 sq. m), **as directed**, of wall area spaced not to exceed 36 inches (914 mm) **OR** 24 inches (610 mm), **as directed**, o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 - 1) Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 - b. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - 1) Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes **OR** tab-type reinforcement, **as directed**.
 - 2) Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 2. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
 3. Collar Joints in Clay Tile Masonry: After each course is laid, fill the vertical, longitudinal joint between wythes solidly with mortar at exterior walls, except cavity walls, and interior walls and partitions.



4. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.
5. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
 - a. Provide individual metal ties not more than 8 inches (203 mm) **OR** 16 inches (406 mm), **as directed**, o.c.
 - b. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
 - c. Provide rigid metal anchors not more than 24 inches (610 mm) **OR** 48 inches (1220 mm), **as directed**, o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

E. Cavity Walls

1. Bond wythes of cavity walls together using one of the following methods:
 - a. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. (0.42 sq. m) **OR** 2.67 sq. ft. (0.25 sq. m), **as directed**, of wall area spaced not to exceed 36 inches (914 mm) **OR** 24 inches (610 mm), **as directed**, o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 - b. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - 1) Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes **OR** tab-type reinforcement, **as directed**.
 - 2) Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - 3) Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
 - c. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
2. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
3. Parge cavity face of backup wythe in a single coat approximately 3/8 inch (10 mm) thick. Trowel face of parge coat smooth.
OR
Coat cavity face of backup wythe to comply with Division 07 Section "Bituminous Dampproofing".

- #### F. Installing Cavity-Wall Insulation:
- Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit insulation between wall ties and other confining obstructions, with edges butted tightly. Press units firmly against inside wythe of masonry.

G. Masonry-Cell Insulation

1. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to 1 story in height, but not more than 20 feet (6 m).
2. Install molded-polystyrene insulation units into masonry unit cells before laying units.

H. Masonry Joint Reinforcement

1. General: Install in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
2. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
3. Provide continuity at wall intersections by using prefabricated T-shaped units.
4. Provide continuity at corners by using prefabricated L-shaped units.



- I. Anchoring Masonry To Structural Members
1. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - a. Provide an open space not less than 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**, in width between masonry and structural member, unless otherwise indicated.
 - b. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
 - c. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.
- J. Anchoring Masonry Veneers
1. Anchor masonry veneers to wall framing **OR** concrete and masonry backup, **as directed**, with seismic masonry-veneer anchors to comply with the following requirements:
 - a. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners.
 - b. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
 - c. Embed tie sections **OR** connector sections and continuous wire, **as directed**, in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
 - d. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - e. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 32 inches (813 mm) **OR** 24 inches (610 mm), **as directed**, o.c. horizontally with not less than 1 anchor for each 3.5 sq. ft. (0.33 sq. m) **OR** 2.67 sq. ft. (0.25 sq. m), **as directed**, of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.
- K. Control And Expansion Joints
1. 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.
 2. 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 (10 mm).
 - a. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.
- L. Lintels
1. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
 2. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.
- M. Flashing, Weep Holes, Cavity Drainage, And Vents
1. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
 2. Install flashing as follows, unless otherwise indicated:
 - a. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing as recommended by flashing manufacturer.
 - b. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.



- c. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
- d. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
3. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
4. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
5. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - a. Use specified weep/vent products or open head joints to form weep holes.
 - b. Space weep holes 24 inches (600 mm) o.c., unless otherwise indicated.
 - c. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
6. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
7. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products or open head joints to form vents.
 - a. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

N. Reinforced Unit Masonry Installation

1. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - a. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - b. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
2. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602 **OR** Section 2104.5 in the International Building Code, **as directed**.
 - a. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - b. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 **OR** Section 2104.6 in the International Building Code, **as directed**, for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - c. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

O. Field Quality Control

1. Inspectors: Engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
 - a. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
2. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
3. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.
4. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.



5. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.
 6. Mortar Test (Property Specification): For each mix provided, per ASTM C 780 **OR** IBC Standard, **as directed**. Test mortar for mortar air content and compressive strength.
 7. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019 **OR** IBC Standard, **as directed**.
- P. Parging
1. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm) with a steel-trowel finish. Form a wash at top of parging and a cove at bottom. Damp-cure parging for at least 24 hours and protect parging until cured.
- Q. Cleaning
1. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
 2. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - a. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 - b. Protect adjacent surfaces from contact with cleaner.
 - c. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - d. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - e. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - f. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
- R. Masonry Waste Disposal
1. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - a. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
 - b. Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off the Owner's property.

END OF SECTION 01 54 23 00a



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Task	Specification	Specification Description
01 54 23 00	01 22 16 00	No Specification Required
01 54 26 00	01 22 16 00	No Specification Required
01 54 29 00	01 22 16 00	No Specification Required
01 56 16 00	01 22 16 00	No Specification Required



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SECTION 01 56 26 00 - SEDIMENT REMOVAL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing of labor and equipment for sediment removal.

1.2 PRODUCTS - (Not Used)

1.3 EXECUTION

- A. The Contractor shall remove all material from areas as required to meet project requirements. Water and sediment removed from these areas shall be discharged to a sedimentation basin constructed and maintained by the Contractor. All work shall be in strict compliance with Pollution Control requirements and Dewatering requirements. All material removed shall be disposed of in an approved landfill in accordance with all State and Federal Regulations.

END OF SECTION 01 56 26 00



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SECTION 01 56 26 00a - EROSION CONTROL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of mesh or netting for erosion control. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS

A. Materials

1. Jute Mesh: Fed. Spec. CCC-C-467.
2. Plastic Mesh: Manufacturer's recommendation.
3. Plastic Netting: Manufacturer's recommendation.
4. Polypropylene Mesh: Manufacturer's recommendation.
5. Woven Fabric Fence: EPA specifications.
6. Hay-Bales: EPA specifications.

1.3 EXECUTION:

- A. Preparation: Grade, compact, fertilize, and seed the area to be protected.
- B. Installation: Apply blankets either horizontally or vertically to the slope. In ditches, apply blanket in direction of water flow. Lap and anchor blankets according to the manufacturer's instructions. Install woven fabric fence and hay bales adjacent to all excavated areas.

END OF SECTION 01 56 26 00a



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Task	Specification	Specification Description
01 56 26 00	01 22 16 00	No Specification Required
01 56 29 00	01 22 16 00	No Specification Required
01 56 33 00	01 22 16 00	No Specification Required
01 56 39 00	01 22 16 00	No Specification Required
01 57 13 00	01 56 26 00	Sediment Removal
01 58 13 00	01 22 16 00	No Specification Required
01 66 19 00	01 22 16 00	No Specification Required
01 71 13 00	01 22 16 00	No Specification Required



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SECTION 01 71 23 16 - CUTTING AND PATCHING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cutting and patching. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes procedural requirements for cutting and patching.

C. Definitions

1. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
2. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

D. Submittals

1. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - a. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - b. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - c. Products: List products to be used and firms or entities that will perform the Work.
 - d. Dates: Indicate when cutting and patching will be performed.
 - e. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
 - f. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 - g. the Owner's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

E. Quality Assurance

1. LEED Requirements for Building Reuse:
 - a. Credit MR 1.1 and 1.2, **as directed**: Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be removed; do not cut such existing construction beyond indicated limits.
 - b. Credit MR 1.3: Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be removed; do not cut such existing construction beyond indicated limits.
 - c. Credit MR 1.2 and 1.3, **as directed**: Maintain existing nonshell, nonstructural components (walls, flooring, and ceilings) not indicated to be removed; do not cut such existing construction beyond indicated limits.



2. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
 - a. **Refer to the Owner for list of elements that might otherwise be overlooked as structural elements and that require Architect's or Construction Manager's approval of a cutting and patching proposal.**
3. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
 - a. Primary operational systems and equipment.
 - b. Air or smoke barriers.
 - c. Fire-suppression systems.
 - d. Mechanical systems piping and ducts.
 - e. Control systems.
 - f. Communication systems.
 - g. Conveying systems.
 - h. Electrical wiring systems.
 - i. Operating systems of special construction in Division 13.
4. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise- and vibration-control elements and systems.
5. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
6. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

F. Warranty

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

1.2 PRODUCTS

A. Materials

1. General: Comply with requirements specified in other Sections.
2. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - a. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.



1.3 EXECUTION

A. Preparation

1. Temporary Support: Provide temporary support of Work to be cut.
2. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
3. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
4. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize **OR** prevent, **as directed**, interruption to occupied areas.

B. Performance

1. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - a. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
2. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - a. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - b. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - c. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - d. Excavating and Backfilling: Comply with requirements in applicable Division 31 where required by cutting and patching operations.
 - e. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - f. Proceed with patching after construction operations requiring cutting are complete.
3. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - a. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - b. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 1) Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - 2) Restore damaged pipe covering to its original condition.
 - c. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 1) Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.



-
- d. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - e. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
4. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 71 23 16



Task	Specification	Specification Description
01 74 16 00	01 22 16 00	No Specification Required



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**SECTION 01 74 19 00 - CONSTRUCTION WASTE MANAGEMENT**

1.1 GENERAL

A. Summary

1. This Section includes administrative and procedural requirements for the following:
 - a. Salvaging nonhazardous demolition and construction waste.
Note: All salvageable materials remain the property of the Owner and shall be turned over as directed when specified in the Job Order.
 - b. Recycling nonhazardous demolition and construction waste.
 - c. Disposing of nonhazardous demolition and construction waste.

B. Definitions

1. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
2. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
3. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
4. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
5. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
6. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

C. Performance Goals **OR** Requirements, **as directed**

1. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 50 **OR** 75, **as directed**, percent by weight of total waste generated by the Work.
2. Salvage/Recycle Goals **OR** Requirements, **as directed**: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:
OR
Salvage/Recycle Goals **OR** Requirements, **as directed**: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible. Owner has established minimum goals for the following materials:
 - a. Demolition Waste:
 - 1) Asphaltic concrete paving.
 - 2) Concrete.
 - 3) Concrete reinforcing steel.
 - 4) Brick.
 - 5) Concrete masonry units.
 - 6) Wood studs.
 - 7) Wood joists.
 - 8) Plywood and oriented strand board.
 - 9) Wood paneling.
 - 10) Wood trim.
 - 11) Structural and miscellaneous steel.
 - 12) Rough hardware.
 - 13) Roofing.
 - 14) Insulation.
 - 15) Doors and frames.



- 16) Door hardware.
- 17) Windows.
- 18) Glazing.
- 19) Metal studs.
- 20) Gypsum board.
- 21) Acoustical tile and panels.
- 22) Carpet.
- 23) Carpet pad.
- 24) Demountable partitions.
- 25) Equipment.
- 26) Cabinets.
- 27) Plumbing fixtures.
- 28) Piping.
- 29) Supports and hangers.
- 30) Valves.
- 31) Sprinklers.
- 32) Mechanical equipment.
- 33) Refrigerants.
- 34) Electrical conduit.
- 35) Copper wiring.
- 36) Lighting fixtures.
- 37) Lamps.
- 38) Ballasts.
- 39) Electrical devices.
- 40) Switchgear and panelboards.
- 41) Transformers.
- b. Construction Waste:
 - 1) Site-clearing waste.
 - 2) Masonry and CMU.
 - 3) Lumber.
 - 4) Wood sheet materials.
 - 5) Wood trim.
 - 6) Metals.
 - 7) Roofing.
 - 8) Insulation.
 - 9) Carpet and pad.
 - 10) Gypsum board.
 - 11) Piping.
 - 12) Electrical conduit.
 - 13) Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - a) Paper.
 - b) Cardboard.
 - c) Boxes.
 - d) Plastic sheet and film.
 - e) Polystyrene packaging.
 - f) Wood crates.
 - g) Plastic pails.

D. Submittals

1. Waste Management Plan: Submit 3 copies of plan within 7 **OR** 30, **as directed**, days of date established for commencement of the Work **OR** the Notice to Proceed **OR** the Notice of Award, **as directed**.



2. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include separate reports for demolition and construction waste, **as directed**. Include the following information:
 - a. Material category.
 - b. Generation point of waste.
 - c. Total quantity of waste in tons (tonnes).
 - d. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
 - e. Quantity of waste recycled, both estimated and actual in tons (tonnes).
 - f. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
 - g. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
 3. Waste Reduction Calculations: Before request for Final Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
 4. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
 5. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
 6. LEED Submittal: LEED letter template for Credit MR 2.1 and 2.2, **as directed**, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
 7. Qualification Data: For Waste Management Coordinator and refrigerant recovery technician.
 8. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- E. Quality Assurance
1. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council. Waste management coordinator may also serve as LEED coordinator.
 2. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
 3. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
 4. Waste Management Conference: Conduct conference at Project site. Review methods and procedures related to waste management including, but not limited to, the following:
 - a. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - b. Review requirements for documenting quantities of each type of waste and its disposition.
 - c. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - d. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - e. Review waste management requirements for each trade.
- F. Waste Management Plan
1. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste if Project requires selective demolition or building demolition. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
 2. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
 3. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.



- a. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - b. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - c. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - d. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
4. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
- a. Total quantity of waste.
 - b. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 - c. Total cost of disposal (with no waste management).
 - d. Revenue from salvaged materials.
 - e. Revenue from recycled materials.
 - f. Savings in hauling and tipping fees by donating materials.
 - g. Savings in hauling and tipping fees that are avoided.
 - h. Handling and transportation costs. Include cost of collection containers for each type of waste.
 - i. Net additional cost or net savings from waste management plan.

1.2 PRODUCTS (Not Used)

1.3 EXECUTION

A. Plan Implementation

1. General: Implement waste management plan as approved by the Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - a. Comply with Division 01 Section "Temporary Facilities And Controls" for operation, termination, and removal requirements.
2. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
3. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - a. Distribute waste management plan to everyone concerned within three days of submittal return.
 - b. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
4. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - a. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - b. Comply with Division 01 Section "Temporary Facilities And Controls" for controlling dust and dirt, environmental protection, and noise control.

B. Salvaging Demolition Waste



1. Salvaged Items for Reuse in the Work:
 - a. Clean salvaged items.
 - b. Pack or crate items after cleaning. Identify contents of containers.
 - c. Store items in a secure area until installation.
 - d. Protect items from damage during transport and storage.
 - e. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
 2. Salvaged Items for Sale and Donation: Not permitted.
 3. Salvaged Items for Owner's Use:
 - a. Clean salvaged items.
 - b. Pack or crate items after cleaning. Identify contents of containers.
 - c. Store items in a secure area until delivery to Owner.
 - d. Transport items to Owner's storage area on-site **OR** off-site **OR** designated by Owner, **as directed**.
 - e. Protect items from damage during transport and storage.
 4. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- C. Recycling Demolition And Construction Waste, General
1. General: Recycle paper and beverage containers used by on-site workers.
 2. Recycling Receivers and Processors: Refer to the Owner for available recycling receivers and processors.
 3. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner **OR** accrue to Contractor **OR** be shared equally by Owner and Contractor, **as directed**.
 4. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - a. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - 1) Inspect containers and bins for contamination and remove contaminated materials if found.
 - b. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - c. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - d. Store components off the ground and protect from the weather.
 - e. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.
- D. Recycling Demolition Waste
1. Asphaltic Concrete Paving: Grind asphalt to maximum 1-1/2-inch (38-mm) **OR** 4-inch (100-mm), **as directed**, size.
 - a. Crush asphaltic concrete paving and screen to comply with requirements in Division 31 Section "Earth Moving" for use as general fill.
 2. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
 3. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - a. Pulverize concrete to maximum 1-1/2-inch (38-mm) **OR** 4-inch (100-mm), **as directed**, size.
 - b. Crush concrete and screen to comply with requirements in Division 31 Section "Earth Moving" for use as satisfactory soil for fill or subbase.
 4. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - a. Pulverize masonry to maximum 3/4-inch (19-mm) **OR** 1-inch (25-mm) **OR** 1-1/2-inch (38-mm) **OR** 4-inch (100-mm), **as directed**, size.



- 1) Crush masonry and screen to comply with requirements in Division 31 Section "Earth Moving" for use as general fill **OR** satisfactory soil for fill or subbase, **as directed**.
 - 2) Crush masonry and screen to comply with requirements in Division 32 Section "Plants" for use as mineral mulch.
 - b. Clean and stack undamaged, whole masonry units on wood pallets.
 5. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
 6. Metals: Separate metals by type.
 - a. Structural Steel: Stack members according to size, type of member, and length.
 - b. Remove and dispose of bolts, nuts, washers, and other rough hardware.
 7. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
 8. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
 9. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
 - a. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.
 10. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - a. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
 11. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
 12. Plumbing Fixtures: Separate by type and size.
 13. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
 14. Lighting Fixtures: Separate lamps by type and protect from breakage.
 15. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
 16. Conduit: Reduce conduit to straight lengths and store by type and size.
- E. Recycling Construction Waste
1. Packaging:
 - a. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - b. Polystyrene Packaging: Separate and bag materials.
 - c. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - d. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
 2. Site-Clearing Wastes: Chip brush, branches, and trees on-site **OR** at landfill facility, **as directed**.
 - a. Comply with requirements in Division 32 Section "Plants" for use of chipped organic waste as organic mulch.
 3. Wood Materials:
 - a. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - b. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - 1) Comply with requirements in Division 32 Section "Plants" for use of clean sawdust as organic mulch.
 4. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
 - a. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - 1) Comply with requirements in Division 32 Section "Plants" for use of clean ground gypsum board as inorganic soil amendment.



F. Disposal Of Waste

1. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - a. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - b. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
2. Burning: Do not burn waste materials.
OR
Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
3. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner's property.
OR
Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01 74 19 00



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**SECTION 02 81 00 00 - EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for excavation and handling of contaminated material. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Separate cross-sections of each area before and after excavation and after backfilling.
2. Product Data: Work Plan within 30 calendar days after notice to proceed. No work at the site, with the exception of site inspections and surveys, shall be performed until the Work Plan is approved. The Contractor shall allow 30 calendar days in the schedule for the Owner's review. No adjustment for time or money will be made if resubmittals of the Work Plan are required due to deficiencies in the plan. At a minimum, the Work Plan shall include:
 - a. Schedule of activities.
 - b. Method of excavation and equipment to be used.
 - c. Shoring or side-wall slopes proposed.
 - d. Dewatering plan.
 - e. Storage methods and locations for liquid and solid contaminated material.
 - f. Borrow sources and haul routes.
 - g. Decontamination procedures.
 - h. Spill contingency plan.
3. Closure Report: Three (3) copies of the Closure Report within 14 calendar days of work completion at the site.
4. Test Reports
 - a. Backfill
 - b. Surveys
 - c. Confirmation Sampling and Analysis
 - d. Sampling of Stored Material
 - e. Sampling Liquid
 - f. Compaction
 - g. Test results.

C. Surveys

1. Surveys shall be performed immediately prior to and after excavation of contaminated material to determine the volume of contaminated material removed. Surveys shall also be performed immediately after backfill of each excavation. The Contractor shall provide cross-sections on 25 foot (7.6 meter) intervals and at break points for all excavated areas. Locations of confirmation samples shall also be surveyed and shown on the drawings.

D. Regulatory Requirements

1. Permits and Licenses: The Contractor shall obtain required federal, state, and local permits for excavation and storage of contaminated material. Permits shall be obtained at no additional cost the Owner.
2. Air Emissions: Air emissions shall be monitored and controlled in accordance with the Owner's Environmental Requirements.

E. Chemical Testing

1. Required sampling and chemical analysis shall be conducted in accordance with local requirements and the Owner's requirements.



F. Scheduling

1. The Contractor shall notify the Owner five (5) calendar days prior to the start of excavation of contaminated material. The Owner will **OR** The Contractor shall, **as directed**, be responsible for contacting regulatory agencies in accordance with the applicable reporting requirements.

1.2 PRODUCTS

A. Backfill

1. Backfill material shall be obtained from the location indicated on the drawings **OR** offsite sources approved by the Owner, **as directed**. Backfill shall be classified in accordance with ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, MH, CL, or CH and shall be free from roots and other organic matter, trash, debris, snow, ice or frozen materials. Backfill material shall be tested for the parameters listed below at a frequency of once per 3000 cubic yards (cubic meters). A minimum of one set of classification tests shall be performed per borrow source. One backfill sample per borrow source shall also be collected and tested for the chemical parameters listed below.

<u>Physical Parameter</u>	<u>Test Method</u>
Grain Size	ASTM D 422
Compaction	ASTM D 698

Backfill shall not be used until borrow source chemical and physical test results have been submitted and approved.

B. Spill Response Materials

1. The Contractor shall provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall be available at all times when contaminated materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.

1.3 EXECUTION

A. Existing Structures And Utilities

1. No excavation shall be performed until site utilities have been field located. The Contractor shall take the necessary precautions to ensure no damage occurs to existing structures and utilities. Damage to existing structures and utilities resulting from the Contractor's operations shall be repaired at no additional cost to the Owner. Utilities encountered that were not previously shown or otherwise located shall not be disturbed without approval from the Owner.

B. Clearing

1. Clearing shall be performed to the limits shown on the drawings in accordance with Division 2 Section "Site Clearing."

C. Contaminated Material Removal

1. Excavation: Areas of contamination shall be excavated to the depth and extent shown on the drawings and not more than 0.2 feet (60 mm) beyond the depth and extent shown on the drawings unless directed by the Owner. Excavation shall be performed in a manner that will limit spills and the potential for contaminated material to be mixed with uncontaminated material. An excavation log describing visible signs of contamination encountered shall be maintained for each area of excavation. Excavation logs shall be prepared in accordance with ASTM D 5434.
2. Shoring: If workers must enter the excavation, it shall be evaluated, shored, sloped or braced as required by U.S. Army Corps of Engineers (USACE) EM 385-1-1 and U.S. National Archives and Records Administration (NARA) 29 CFR 1926 section 650.



3. Dewatering: Surface water shall be diverted to prevent entry into the excavation. Dewatering shall be limited to that necessary to assure adequate access, a safe excavation, prevent the spread of contamination, and to ensure that compaction requirements can be met. No dewatering shall be performed without prior approval of the Owner.
- D. Confirmation Sampling And Analysis
1. the Owner shall be present to inspect the removal of contaminated material from each site. After all material suspected of being contaminated has been removed, the excavation shall be examined for evidence of contamination. If the excavation appears to be free of contamination, field analysis shall be used to determine the presence of contamination using a real time vapor monitoring instrument **OR** immunoassay field kits, **as directed**. Excavation of additional material shall be as directed by the Owner. After all suspected contaminated material is removed, confirmation samples shall be collected and analyzed.
 2. Samples shall be collected at a frequency as directed by the Owner. A minimum of one sample shall be collected from the bottom and each side wall of the excavation. Based on test results, the Contractor shall propose any additional excavation which may be required to remove material which is contaminated above action levels. Additional excavation shall be subject to approval by the Owner. Locations of samples shall be marked in the field and documented on the as-built drawings.
- E. Contaminated Material Storage
1. Material shall be placed in temporary storage immediately after excavation **OR** after treatment while awaiting test results, **as directed**. The following paragraphs describe acceptable methods of material storage. Storage units shall be in good condition and constructed of materials that are compatible with the material or liquid to be stored. If multiple storage units are required, each unit shall be clearly labeled with an identification number and a written log shall be kept to track the source of contaminated material in each temporary storage unit.
 2. Stockpiles
 - a. Stockpiles shall be constructed to isolate stored contaminated material from the environment. The maximum stockpile size shall be as directed by the Owner. Stockpiles shall be constructed to include:
 - 1) A chemically resistant geomembrane liner free of holes and other damage. Non-reinforced geomembrane liners shall have a minimum thickness of 20 mils (0.5 mm). Scrim reinforced geomembrane liners shall have a minimum weight of 40 lbs. per 1000 square feet (20 kg/100 square meters). The ground surface on which the geomembrane is to be placed shall be free of rocks greater than 0.5 inches (12 mm) in diameter and any other object which could damage the membrane.
 - 2) Geomembrane cover free of holes or other damage to prevent precipitation from entering the stockpile. Non-reinforced geomembrane covers shall have a minimum thickness of 10 mils (0.25 mm). Scrim reinforced geomembrane covers shall have a minimum weight of 26 lbs. per 1000 square feet (13 kg/100 square meters). The cover material shall be extended over the berms and anchored or ballasted to prevent it from being removed or damaged by wind.
 - 3) Berms surrounding the stockpile, a minimum of 12 inches (300 mm) in height. Vehicle access points shall also be bermed.
 - 4) The liner system shall be sloped to allow collection of leachate. Storage and removal of liquid which collects in the stockpile, in accordance with paragraph Liquid Storage.
 3. Roll-Off Units: Roll-off units used to temporarily store contaminated material shall be water tight. A cover shall be placed over the units to prevent precipitation from contacting the stored material. The units shall be located as shown on the drawings. Liquid which collects inside the units shall be removed and stored in accordance with paragraph Liquid Storage.
 4. Liquid Storage: Liquid collected from excavations and stockpiles shall be temporarily stored in 55 gallon barrels (220 L barrels) **OR** 500 gallon tanks (2000 L tanks), **as directed**. Liquid storage containers shall be water-tight and shall be located as shown on the drawings.



F. Sampling

1. Sampling of Stored Material

- a. Samples of stored material shall be collected at a frequency as directed by the Owner.
- b. Stored material with contaminant levels that exceed the action levels shall be treated offsite. Analyses for contaminated material to be taken to an offsite treatment facility shall conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Owner. Additional sampling and analyses to the extent required by the approved offsite treatment, storage or disposal (TSD) facility shall be the responsibility of the Contractor and shall be performed at no additional cost to the Owner **OR** subject to approval by the Owner, **as directed**.

OR

Stored material with contaminant levels that exceed the action levels shall be treated onsite.

2. Sampling Liquid

- a. Liquid collected from excavations **OR** storage areas **OR** decontamination facilities, **as directed**, shall be sampled at a frequency of once for every 500 gallons (2,000 L) of liquid collected.
- b. Liquid with contaminant levels that exceed action levels shall be treated offsite. Analyses for contaminated liquid to be taken to an offsite treatment facility shall conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Owner. Additional sampling and analysis to the extent required by the approved offsite treatment, storage or disposal (TSD) facility receiving the material shall be the responsibility of the Contractor and shall be performed at no additional cost to the Owner **OR** subject to approval by the Owner.

OR

Liquid with contaminant levels that exceed action levels shall be treated onsite.

3. Sampling Beneath Storage Units

- a. Samples from beneath each storage unit shall be collected prior to construction of and after removal of the storage unit. Samples shall be collected at a frequency as directed by the Owner from a depth interval of 0 to 0.5 feet (0 to 0.15 m).
- b. Based on test results, soil which has become contaminated above action levels shall be removed at no additional cost to the Owner. Contaminated material which is removed from beneath the storage unit shall be handled in accordance with paragraph Sampling of Stored Material. as directed by the Owner and at no additional cost to the Owner, additional sampling and testing shall be performed to verify areas of contamination found beneath stockpiles have been cleaned up to below action levels.

G. Spills

1. In the event of a spill or release of a hazardous substance (as designated in NARA 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act [OPA], 33 U.S.C. 2701 et seq.), the Contractor shall notify the Owner immediately. If the spill exceeds the reporting threshold, the Contractor shall follow the pre-established procedures as described in the Contingency Plan for immediate reporting and containment. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Cleanup shall be in accordance with applicable federal, state, and local regulations. as directed by the Owner, additional sampling and testing shall be performed to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the Owner.

H. Backfilling

1. Confirmation Test Results: Excavations shall be backfilled immediately after all contaminated materials have been removed and confirmation test results have been approved. Backfill shall be placed and compacted to the lines and grades shown on the drawings.



2. Compaction: Approved backfill shall be placed in lifts with a maximum loose thickness of 8 inches (200 mm). Soil shall be compacted to 90 percent of ASTM D 698 **OR** ASTM D 1557, **as directed**, maximum dry density. Density tests shall be performed at a frequency of once per 10,000 square feet (930 square meters) per lift. A minimum of one density test shall be performed on each lift of backfill placed. Field in-place dry density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. If ASTM D 2922 is used, a minimum of one in ten tests shall be checked using ASTM D 1556 or ASTM D 2167. Test results from ASTM D 1556 or ASTM D 2167 shall govern if there is a discrepancy with the ASTM D 2922 test results.
 - I. Disposal Requirements
 1. Offsite disposal of contaminated material shall be in accordance with Division 2 Section "Disposal of Hazardous Materials."
 - J. Closure Report
 1. Three copies of a Closure Report shall be prepared and submitted within 14 calendar days of completing work at the site. The report shall be labeled with the contract number, project name, location, date, and name of general contractor. The Closure Report shall include the following information as a minimum:
 - a. A cover letter signed by a responsible company official **OR** Professional Engineer registered in the state of the work who is a responsible company official, **as directed**, certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents and regulatory requirements.
 - b. A narrative report including, but not limited to, the following:
 - 1) site conditions, ground water elevation, and cleanup criteria;
 - 2) excavation logs;
 - 3) field screening readings;
 - 4) quantity of materials removed from each area of contamination;
 - 5) quantity of water/product removed during dewatering;
 - 6) sampling locations and sampling methods;
 - 7) sample collection data such as time of collection and method of preservation;
 - 8) sample chain-of-custody forms; and
 - 9) source of backfill.
 - c. Copies of all chemical and physical test results.
 - d. Copies of all manifests and land disposal restriction notifications.
 - e. Copies of all certifications of final disposal signed by the responsible disposal facility official.
 - f. Waste profile sheets.
 - g. Scale drawings showing limits of each excavation, limits of contamination, known underground utilities within 50 feet (15 m) of excavation, sample locations, and sample identification numbers. On-site stockpile, storage, treatment, loading, and disposal areas shall also be shown on the drawings.
 - h. Progress Photographs. Color photographs shall be used to document progress of the work. A minimum of four views of the site showing the location of the area of contamination, entrance/exit road, and any other notable site conditions shall be taken before work begins. After work has been started, activities at each work location shall be photographically recorded daily **OR** weekly, **as directed**. Photographs shall be a minimum of 3 x 5 inches (76.2 x 127.0 mm) and shall include:
 - 1) Soil removal and sampling.
 - 2) Dewatering operations.
 - 3) Unanticipated events such as spills and the discovery of additional contaminated material.
 - 4) Contaminated material/water storage, handling, treatment, and transport.
 - 5) Site or task-specific employee respiratory and personal protection.
 - 6) Fill placement and grading.



-
- 7) Post-construction photographs. After completion of work at each site, the Contractor shall take a minimum of four views of each excavation site. A digital version of all photos shown in the report shall be included with the Closure Report. Photographs shall be a minimum of 3 inches by 5 inches (76mm by 127 mm) and shall be mounted back-to-back in double face plastic sleeves punched to fit standard three ring binders. Each print shall have an information box attached. The box shall be typewritten and arranged as follows:
- Project Name: Direction of View:
 - Location: Date/Time:
 - Photograph No.: Description of View:

END OF SECTION 02 81 00 00



SECTION 02 81 00 00a - DISPOSAL OF HAZARDOUS MATERIALS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for disposal of hazardous materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Definition

1. Hazardous materials shall be defined as asbestos containing materials, lead-based paint, PCBs, bird waste, and other materials categorized as hazardous by the EPA.

C. Submittals

1. Before start of work: At the pre-construction meeting, the Contractor shall submit the following to the Owner's Representative for review. Do not start work until these submittal are returned with Owner's Representative stamp indicating that the submittal is returned for unrestricted use.
 - a. Copy of State or local license for hazardous waste hauler.
 - b. Certificate of at least one on-site supervisor which has satisfactorily completed the OSHA 40 hour Health and Safety course for handling hazardous materials.
 - c. Certificates of workers which have successfully completed the OSHA 40-Hour Health and Safety Course for Hazardous Materials.
 - d. List of the employees scheduled to perform this work.
 - e. Schedule of start and finish times and dates for this work.
 - f. Name and address of landfill where these waste materials are to be deposited. Include contact person and telephone number.
 - g. Material Safety Data Sheet (MSDS) for all materials to be removed.
 - h. If contractor introduces any chemical into the work environment, a MSDS for that chemical must be presented to the Owner's Representative prior to use.
 - i. Transporter must have notified the EPA and/or other appropriate local government agency in advance of its intentions to transport hazardous materials and, if applicable, receive an identification number.
 - j. Contingency Plan for handling emergencies with spills or leaks.
 - k. Certificates of workers which have successfully completed the OSHA 24-Hour Health and Safety Course for Hazardous Materials.

1.2 PRODUCTS**A. Materials**

1. Drums: Recovery or salvage drums acceptable for disposal of hazardous waste. Prior approval of drums is required. Drums or containers must meet the required OSHA, EPA (40 CFR Parts 264-264 and 300), and DOT Regulations (49 CFR Parts 171-178). Use of damaged containers shall not be allowed.
2. Labels: As required by the EPA and OSHA for handling, transportation, and disposal of hazardous waste.
3. Absorbent Material: Clay, soil or any commercially available absorbent used for the purpose of absorbing hazardous or potentially hazardous materials.

1.3 EXECUTION



-
- A. All waste shall be transported and disposed of in accordance with all federal, state and local guidelines and regulations. The contractor is to obtain all permits, licenses, etc., which are necessary for the transporting and disposal of hazardous waste.
 - B. Waste haulers shall maintain waste manifest and shipment record forms.

END OF SECTION 02 81 00 00a

**SECTION 02 82 16 00 - ENCAPSULATION (LOCK-DOWN) OF ASBESTOS-CONTAINING MATERIALS**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for encapsulation (lock-down) of asbestos-containing materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: Manufacturers technical information including label analysis and application instructions for each material proposed for use.
2. Installation Instructions: Manufacturer's installation instructions with specific project requirements noted.
3. Performance Warrantee: Manufacturers performance guarantee.
4. Material Safety Data Sheet: Material Safety Data Sheet in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for each surfactant and encapsulating material proposed for use on the work. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.

C. Delivery And Storage: Deliver materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

1. Name or title of material
2. Manufacturer's stock number and date of manufacture
3. Manufacturer's name
4. Thinning instructions
5. Application instructions
6. Deliver materials together with a copy of the OSHA Material Safety Data Sheet for the material.
- 7.

D. Job Conditions: Apply encapsulating materials only when environmental conditions in the work area are as required by the manufacturer's instructions.

E. Quality Assurance

1. Testing: Test material to be encapsulated using methods set forth in ASTM E1494 "Standard Practice for Encapsulants for Spray-or-Trowel-Applied Friable Asbestos-Containing Building Materials."

F. Warranty

1. Performance Warranty: Contractor shall submit written Performance Warranty, executed by the contractor, agreeing to repair/replace spray-on work which has cracked, fallen from substrate, or otherwise deteriorated to a condition where it would not perform effectively for its intended purposes due substantially to defective materials or workmanship and not due to abuse by occupants, improper maintenance, unforeseeable ambient exposures or other causes beyond anticipated conditions and contractors control. Warranty period shall be for at least one year after date of Final Completion.

1.2 PRODUCTS

A. Materials



1. Encapsulant system shall be an acrylic, elastomeric type, spray, brush or roller-applied, tinted penetrating or tinted bridging type, specifically designed for application to asbestos-containing material. System shall be equal to Global Encasement System as manufactured by GLOBAL Encasement Inc., 132-32nd Street, Union City, NJ 07087 U.S.A., Tel. (800) 266-3982/(201) 902-9770.
 - a. All encasement topcoat materials shall be warranted to be heavy-bodied, from the same manufacturer, and shall be long lasting, highly-pure (low VOC) materials that remain flexible, chalk resistant and resist cracking, peeling, algae and fungus that can cause future indoor air quality concerns.
 - b. To allow for building movement without cracking or disturbing fibrous materials, coating systems shall have passed testing to ASTM standards for adhesion, permeability, aged flexibility and with aged elasticity for the encasement system of over 250%.
 - c. Coatings shall be Class A Fire Rated, water-based, non-toxic, safe and easy to use, contain no hazardous ingredients by OSHA definition, comply with all known building codes and be non-flammable.
 - d. Coating materials shall have low VOC (Volatile Organic Compound) content.
 - e. Coating materials shall not release health threatening toxic smoke and fumes in a fire and shall comply with all known building codes.
 - f. Coating materials shall have passed the following testing standards:
 - 1) ASTM E 119 fire tests demonstrating that applying a multi-layer system over fireproofing does not adversely affect the fireproof rating of the fireproofing (3 hour test).
 - 2) UPITT Combustion Toxicity Test proving nothing toxic is released in a fire.
 - 3) ASTM E 84 and E162 fire tests for "Class A" - Surface Flammability and Burning Characteristics (Flame Spread = 0, Smoke Developed = 5).
 - 4) "Pull-off Adhesion" test per ASTM E736 equals or exceeds 9,950 lbs./sq. ft. (89.1 lbs./sq. in.).
 - 5) ASTM D 1653 and E96 "Water Vapor Permeability" (showing the rate that water vapor can pass through the system).
 - 6) Impact Resistance, "Tensile Strength" shall exceed 150 psi; "Elongation" shall exceed 250%.
 - 7) System shall be mildew resistant, impact resistant, scrub resistant, non-yellowing, non-chalking, highly blister resistant, rust resistant, highly chemical resistant and shall remain flexible after 1000 hour ASTM Accelerated Weather testing.
 - 8) Water-Based materials (low VOC) Volatile Organic Content of Primer-Sealer-Neutralizer = 0.1 g/L (0.001 lb./gal.) and Encasement Top Coat = 0.1 g/L (0.001 lb./gal.) as tested by EPA Method 24.
 - 9) Materials comply with applicable standards for installation on interior and/or exterior surfaces of a building.
 - 10) Encasement Systems shall provide additional water-proofing protection.
- B. Related Materials:
 1. Elastomeric architectural sealants, caulking compounds, primers, and similar materials shall be approved by the manufacturer of the encasement coatings. All materials used shall be applied in accordance with its manufacturer's recommendations.
- C. Applicable Standards
 1. Product shall be rated as acceptable for use intended when field tested in accordance with ASTM E 1494.

1.3 EXECUTION

A. General

Encapsulation (Lock-Down) Of Asbestos-Containing Materials

June 2018



1. Prior to applying any encapsulating material in Work Areas, Contractor shall obtain final visual inspection approval by the Project Administrator.
 2. Prior to applying any encapsulating material, Contractor shall ensure that application of the sealer will not cause the base material to fail and allow the sealed material to fall of its own weight or separate from the substrate. Should Contractor doubt the ability of the installation to support the sealant, request direction from the Owner's Representative before proceeding with the encapsulating work.
 3. Do Not Commence Application of encapsulating materials until all removal work within the work area has been completed.
- B. Worker Protection
1. Before beginning work with any material for which a Material Safety Data Sheet has been submitted provide workers with the required protective equipment. Require that appropriate protective equipment be used at all times.
- C. Application
1. Comply with all manufacturer's instructions for particular conditions of installation. Consult with manufacturer's technical representative for conditions not covered.
 2. Encapsulate all surfaces in full compliance with manufacturer's procedures.
 3. At completion of Encapsulation and before removal of Work Area enclosures and Pressure Differential System, decontaminate space in accordance with requirements of manufacturer's instructions.
 4. Remove all debris from the project site and restore area to proper conditions by cleaning all surfaces in accordance with manufacturer's written recommendations.
 5. At completion of work submit manufacturer's record of inspection of completed work and Manufacturers Performance Guarantee executed by both manufacturer and Contractor.

END OF SECTION 02 82 16 00



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SECTION 02 82 33 00 - REMOVAL OF FRIABLE ASBESTOS-CONTAINING MATERIALS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for removal of friable asbestos-containing materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Description

1. Furnish all labor, materials, facilities, equipment, services, employee training and testing, permits and agreements necessary to perform the work required for asbestos removal, encapsulation, repair, clean-up, decontamination, re-insulation and all other work in accordance with these specifications, in accordance with the latest regulations from the U.S. Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the recommendations of National Institute of Occupational Safety and Health (NIOSH), and any other applicable federal, state and local government regulations. Whenever there is a conflict or overlap of the above references, the most stringent provision is applicable.
2. The work specified herein shall be performed by competent persons trained, knowledgeable and qualified in the state-of-the-art techniques of asbestos abatement, handling and subsequent cleaning of contaminated areas.

C. Scope

1. The quantities of materials and limits of abatement work area(s) shall be verified by the asbestos contractor.

D. Asbestos Hazard

1. Asbestos-containing material when damaged or disturbed is subject to fiber releases. Wet methods are a primary means of controlling fiber release.
2. Strict compliance with each of the provisions outlined in these specifications for the encapsulation, repair and handling of asbestos-containing material is of great importance, because:
 - a. The inhalation of airborne asbestos fibers can cause a very serious and often fatal disease.
 - b. Workers may not be aware they are inhaling asbestos fibers.
 - c. Symptoms of the disease do not appear for many years.
 - d. Only the Contractor and its employees can prevent the inhalation of asbestos fibers, which can lead to the development of asbestos-related disease.
 - e. No insurance is available to provide for asbestos-related disease.

E. Other Hazardous Material

1. Contractor shall comply with OSHA 29 CFR 1926.62 - Lead in Construction when demolishing any equipment or architectural component identified as lead-containing or lead-based paint. The work of this project is considered a demolition activity.
2. the Owner anticipates that a substantial amount of the Project will involve lead paint.

F. Qualifications

1. the Owner and the Owner's Representative will verify and approve the experience of the Asbestos Abatement Contractor based upon submission at the time of bidding by Contractor evidence of the following:
 - a. Experience: Provide the names and locations of at least three asbestos abatement projects of comparable size and complexity comparable with this work. Provide the names and telephone numbers of contact person at previous projects. Provide the final air monitoring decontamination fiber levels achieved.



- b. Personnel: Provide the name(s) of "Competent Person" as defined by OSHA 29 CFR 1926.32(f) - Asbestos. Demonstrate the education and specialized training with successful completion of examination of an EPA approved course. Provide evidence of participation in five projects of complexity comparable with this project.
- c. Licensing and Certification: The Contractor must hold a current, valid asbestos license issued by the State in which the work is to be performed.

G. Notices And Record Keeping

1. Contractor shall maintain for at least 30 years, a record for each asbestos project in which the Contractor engages. Each record shall include the following information: name, address, and social security number of all personnel involved with the project, the name address and social security number of the OSHA "Competent Person" who will supervise the work, the amount of asbestos material that was removed, repaired, encapsulated or disturbed, the commencement and completion date of the work, copies of Hazardous Waste Manifest(s), personal air monitoring results and any other appropriate information.
2. The Contractor shall send written notification as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) to the Owner, at least 10 working days prior to beginning any work on asbestos-containing materials.
3. Include the following information:
 - a. Name and address of the Owner or operator.
 - b. Description of the facility being demolished or renovated, including the size, age, and prior use of the facility.
 - c. Estimate of the approximate amount of asbestos material present in the facility in terms of linear feet of pipe, and surface area on other facility components. For facilities in which the amount of asbestos materials is less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, explain techniques of estimation.
 - d. Location of the facility being demolished or renovated.
 - e. Scheduled starting and completion dates of demolition or renovation.
 - f. Nature of planned demolition or renovation and method(s) to be used.
 - g. 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).
 - h. Name and location of the waste disposal site where the asbestos waste material will be deposited.
4. Prior to commencement of work, the Contractor shall submit the following documents to the Owner's Representative. No work will be allowed to start until these documents have been approved:
 - a. The schedule of the work, including manpower, length and number of work shifts. Schedule shall be coordinated with the Owner's full occupancy of all areas of the building.
 - b. Satisfactory proof that written notification has been provided to the EPA regional office and the Owner.
 - c. Proof that all required permits, disposal site locations, and arrangements for transportation and disposal of asbestos-contaminated materials, supplies and the like have been obtained.
 - d. Complete a worker certificate indicating that all employees have had instruction and training on the hazards of asbestos exposure, the use and fitting of respirators, protective dress, wet and dry decontamination procedures, entry and exit from work areas, and all aspects of work procedures and protective measures.
 - e. Documentation indicating that all employees have received appropriate medical examinations and have successfully passed fit testing for the respirator to be worn. As a minimum, medical exams must be consistent with OSHA 29 CFR 1926.1101(K)(9)(viii)(G)-Asbestos Regulation.



- f. Samples of signs to be used in and around the work area to comply with OSHA 29 CFR 1926.1101(K)(9)(viii)(I)- Asbestos regulations and as required by federal, state and municipal regulations.
 - g. Material Safety Data Sheets (OSHA form 174 or equivalent) for all chemicals used during work performed under this section.
 - h. Encapsulation data and encapsulation procedures.
 - i. Design of pressure differential system including calculation used to arrive at the number of machines necessary to achieve one air change per every 10 minutes.
 - j. Location of personnel and material decontamination units for each work area.
5. Contractor shall provide written notification to the Owner's Representative of its intent to start work at least five days in advance. In no case will the Contractor start work until authorization to proceed is given.
 6. During the work, Contractor shall maintain a daily log which will be kept at the job site. Items to be included in the daily log shall include but are not limited to the following:
 - a. Meetings, purpose, attendees, discussions, items of resolution.
 - b. Visitations, authorized and unauthorized.
 - c. Sign-in sheets of all personnel entering and leaving the work area.
 - d. Special or unusual events (i.e., barrier breeching equipment failures).
 - e. Personal air monitoring results.
 - f. Two copies of the daily log are required for Project Closeout.
- H. Terminology (Definitions)
1. Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, enclosure or encapsulation.
 2. Air Lock - A system for permitting ingress or egress without permitting air movement between any two adjacent areas consisting of two curtained doorways. The air lock must be maintained in an uncontaminated condition at all times.
 3. Air Monitoring; - The process of measuring the asbestos fiber content of a specific volume of air in a stated period of time using methods approved or recommended by OSHA, EPA, NIOSH or other method approved by the Owner or the Owner's Representative.
 4. Amended water - Water to which a surfactant has been added.
 5. Asbestos - A generic name given to a number of naturally occurring hydrated mineral silicates that possess a unique crystalline structure, are incombustible in air, and are separable into fibers. Asbestos includes the asbestiform varieties of Chrysotile (serpentine), Crocidolite (Riebeckite), Amosite (Cummingtonite-Grunente), Anthophyllite, Actinolite, and Tremolite.
 6. Asbestos-containing material (ACM) - Any material that contains more than 1 percent asbestos by weight as determined by Polarized Light Microscopy (PLM).
 7. Authorized Visitor - the Owner or its designated representative, or a representative of any regulatory or other agency having jurisdiction over the project.
 8. Class I - Asbestos work means activities involving the removal of thermal systems insulation (TSI) and surfacing ACM and PACM.
 9. Class II - Asbestos work means activities involving the removal of ACM which is not TSI or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.
 10. Class III - Asbestos work means repair and maintenance operations where "ACM" including TSI and surfacing ACM and PACM is likely to be disturbed.
 11. Class IV - Asbestos work means maintenance and custodial activities during which employees contact but do not disturb ACM or PACM and activities to clean-up dust, waste and debris resulting from Class I, II and III activities.
 12. Critical Barrier - A unit of temporary construction which provides the only separation between an asbestos work area and an adjacent, potentially occupied, space. The critical barrier is composed of at least one intact sheet of polyethylene sheeting.
 13. Decontamination Enclosure System - A series of connected rooms with curtained doorways between any two adjacent rooms, for the decontamination of workers or of materials and equipment. A decontamination system contains at least two air locks.



14. Disposal - All procedures necessary to transport and deposit the asbestos-contaminated material stripped and removed from the building in a waste disposal site in compliance with applicable federal, state, and local regulations.
15. Disposal Site - A site approved by the EPA for the disposal of asbestos-containing wastes.
16. Encapsulant - A liquid which can be applied to asbestos-containing materials and which controls the possible release of fibers from the materials.
17. Encapsulation - The use of an agent to seal the surface (bridging encapsulant) or penetrate the bulk (penetrating encapsulant) of the asbestos-containing material.
18. HEPA -High Efficiency Particulate Air - A type of filter which is 99.97% efficient at filtering particles of 0.3 micrometers in diameter.
19. HEPA Vacuum Equipment - Vacuuming equipment equipped with a HEPA filter in the exhaust outlet, and so designed and maintained that 99.97% of all particles of 0.3 micrometer in diameter in the inlet air are collected and retained.
20. Negative Pressure Respirators - Respirators which function by the wearer breathing in air through a filter.
21. NIOSH - National Institute of Occupational Safety and Health.
22. the Owner's Representative - Authorized Consultants
23. Permissible Exposure Level (PEL) - A level of airborne fibers specified by OSHA as an occupational exposure standard for asbestos. It is 0.1 f/cc of air, eight-hour TWA, as measured by Phase Contrast Microscopy.
24. Repair - The restoration of damaged or deteriorated asbestos-containing material to intact condition.
25. Respirator Protection Program - A set of procedures and equipment required by OSHA if employees wear negative pressure respirators or if fiber levels are above the PEL.
26. Surfactant - Chemical wetting agent added to water to improve penetration, thus reducing the amount of water required for a given operation or area, and enhancing the effect of the water in reducing fiber release.
27. Thermal Systems Insulation - Material applied to pipes, fittings, boilers, breeching, tanks, ducts or other interior structural components to prevent heat loss or gain, or water condensation, or for other purposes.
28. Wet Cleaning - The process of eliminating asbestos contamination from building surfaces and objects by using cloths and mops or other cleaning tools that have been dampened with clean water and afterwards disposing of these cleaning tools as asbestos-contaminated waste.

I. Permits And Licenses:

1. The Contractor must 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.

J. Regulations

1. This section sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the specifications. This section also sets forth those 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.
2. 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.
3. 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. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable federal, state, and local regulations. The Contractor shall hold the Owner and the Owner's Representative harmless for failure to comply with any applicable work,



- hauling, disposal, safety, health or other regulation on the part of itself, its employees, or its Sub-Contractors.
4. Federal requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following regulations:
 - a. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA), including but not limited to:
 - 1) U.S. Department of Labor, OSHA, including, but not limited to:
 - a) Occupational Exposure to Asbestos, Tremolite, Anthophyllite and Actinolite; Final Rules
Title 29, Part 1910, Section 1001
Part 1926, Section 1101 of the Code of Federal Regulations
 - b) Respiratory Protection
Title 29, Part 1910, Section 134 of the Code of Federal Regulations
 - c) Construction Industry
Title 29, Part 1926.1011, of the Code of Federal Regulation
 - d) Access to Employee Exposure and Medical Records
Title 29, Part 1910, Section 2 of the Code of Federal Regulations
 - e) Hazard Communication
Title 29, Part 1910, Section 1200 of the Code of Federal Regulations
 - f) Specifications for Accident Prevention Signs and Tags
Title 29, Part 1910, Section 145 of the Code of Federal Regulations
 - 2) U.S. Environmental Protection Agency (EPA) including, but not limited to:
 - a) Asbestos Abatement Projects Rule
40 CFR Part 762
CPTS 62044, FRL 2843-9
Federal Register, Vol. 50 No. 134, July 12, 1985
P28530-28540
 - b) Regulation for Asbestos
Title 40, Part 61, Subpart A of the Code of Federal Regulations
 - c) National Emission Standard for Asbestos
Title 40, Part 61, Subpart M (Revised Subpart B) of the Code of Federal Regulations
 - 3) State requirements which govern asbestos abatement work and/or hauling and disposal of asbestos waste materials.
 - 4) Contractor shall abide by all local requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials including the following:
 - a) American National Standards Institute (ANSI)
1430 Broadway
New York, NY 10018
(212) 354-3300
 - b) Fundamentals Governing the Design and Operation of Local Exhaust Systems
Publication Z9.2-79
 - c) Practices for Respiratory Protection Publication Z288.2-80
 - d) American Society for Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA 19103
(215) 299-5400
 - e) Specification for Encapsulants for Friable Asbestos-Containing Building Materials
 - f) Safety and Health Requirements Relating to Occupational Exposure to Asbestos

K. the Owner's Representative

1. the Owner's Representative is authorized by the Owner to perform the following:
 - a. Have free access to all asbestos work areas.



- b. To assist in interpretation of procedures.
- c. To advise on all provisions of the contract documents pertaining to the control of asbestos.
- d. To stop work if, in the course of performing their monitoring duties, an instance of substantial nonconformance with the contract documents is observed.
- e. To stop work if a situation presenting a health hazard to workers or the Owner's employees or occupants of the building is observed.
- f. To act as the Owner's liaison in technical matters involving the asbestos-related work.
- g. To perform air sampling inside and outside the asbestos work area during the project. The Contractor shall cooperate fully with the Owner's Representative, its agents and employees, and ensure cooperation of its workers during collection of air samples and work area inspections.
- h. the Owner's Representative role in advising the Owner on environmental health matters does not relieve the Contractor's obligation to comply with all applicable health and safety regulations. Air monitoring results generated by the Owner's Representative shall not be used by the Contractor to represent compliance with regulatory agency requirements for monitoring of worker's exposure to airborne asbestos, nor shall any other activity on the part of the Owner's Representative represent the Contractor's compliance with applicable health and safety regulations.

L. Pre-Construction Conference

- 1. An initial progress meeting recognized as "Pre-Construction Conference" shall be held prior to start of any work. Contractor shall meet at project site, with General Superintendent, the Owner, the Owner's Representative, and other entities concerned with asbestos abatement work. Record discussions and agreements and furnish copy to each participant. Provide at least 72 hours advance notice to all participants prior to convening Pre-Construction Conference.
- 2. This is an organizational meeting, to review responsibilities and personnel assignments, to locate the containment and decontamination areas; and temporary facilities including power, light, water, etc.
- 3. Submit waivers on forms, and executed in a manner acceptable to the Owner. Administrative requirements that must proceed or coincide with Contractor's submittal for final payment shall consist of the following:
 - a. Completion of project closeout requirements.
 - b. Completion of items specified for completion beyond time of Final Completion (regardless of whether special payment application was previously made).
 - c. Assurance, satisfactory to the Owner, that unsettled claims will be settled and that work not actually completed and accepted will be completed without undue delay.
 - d. Transmittal of required project construction records to the Owner.
 - e. Landfill receipts for all asbestos-containing material.
 - f. Proof, satisfactory to the Owner, that taxes, fees and similar obligations of Contractor have been paid.
 - g. Removal of temporary facilities, services, surplus materials, rubbish and similar elements.
 - h. Consent of surety for final payment.

M. Project Closeout

- 1. Project closeout is the term used to describe certain collective project requirements that indicate completion of the work to be fulfilled near the end of the contract time. Also, in preparation for final acceptance of the work by the Owner, as well as, final payment to the Contractor and the normal termination of the Contract.
- 2. Include supporting documentation for completion as indicated in these contract documents.
- 3. Submit a statement on accounting of changes to the Contract Sum.
- 4. Advise the Owner of pending insurance change-over requirements.
- 5. Submit specific warranties, workmanship and maintenance bonds, maintenance agreements, final certifications and similar documents.



6. Obtain and submit releases enabling the Owner's full, unrestricted use of the work area and access to services and utilities. Where required, include occupancy permits, operating certificates and similar releases.
7. Results of the completed inspection will form the initial "punch-list" for final acceptance.
8. A complete record, certified by the testing laboratory, of all personal air monitoring results.
9. Complete the following cleaning operations as outlined in Paragraph "Decontamination Procedures" before requesting the Owner's Representative inspection for certification of Final Completion.
 - a. Remove exposed labels in finished spaces which are not required as permanent labels on materials supplied as part of the work, except for "Asbestos", "Asbestos Free", or Thermal Insulation Labels specified elsewhere.
 - b. Clean transparent materials, affected by the work including mirrors and window/door glass, to a polished condition, removing substances which are noticeably vision-obscuring materials. Replace broken glass and damaged transparent materials.
 - c. Clean exposed hard-surfaced finishes affected by the work, to a dirt-free condition, free of dust, stains, films and similar distracting substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.
 - d. Clean plumbing fixtures affected by the work to a sanitary condition, free of stains including those resulting from water exposure.
 - e. Replace all HVAC filters using materials supplied by the Owner or clean non-replaceable filters after minimum of two days of operation of HVAC equipment.
 - f. Clean light fixtures and lamps, which have been affected by the work so as to function with full efficiency. Replace lamps where inoperable.
 - g. Repair any damage to wall, ceiling and floor surfaces caused by installation and removal of the polyethylene sheeting.

N. Personnel Protection

1. Prior to commencement of work, the workers shall be instructed and be knowledgeable in the areas described in Paragraph "Submittals and Notices" having to do with employees.
2. Worker Protection - shall comply with 29 CFR 1910.134 (Respiratory Protection).
 - a. Because there is no known safe level of exposure to asbestos, it is prudent to reduce worker's exposures to as low a level as possible. Proper respiratory protection is critical in minimizing exposure.
 - b. Workers shall be provided, as a minimum, with personally issued and marked respirators equipped with high efficiency particulate filters approved by NIOSH to be worn in the designated work area and/or whenever a potential exposure to asbestos exists. Sufficient filters shall be provided for replacement as required by the workers or applicable regulations. Disposable respirators shall not be used.
 - c. No worker shall be exposed to levels greater than 0.01 f/cc as determined by the protection factor of the respirator worn and the work area fiber levels.
 - d. Whenever powered purifying respirator protection is used, a sufficient supply of replacement batteries and HEPA filter cartridges shall be provided to the workers.
 - e. Air monitoring required by OSHA is work of the Contractor and not covered in this specification. Contractor shall post, on a daily basis, results of the air monitoring results from the previous shift. A complete record, certified by the testing laboratory, of all personal air monitoring tests and results will be furnished to the Owner and the Owner's Representative prior to Contractor's Request for Final Payment.
 - f. During encapsulation operations or usage of other organic base aerosols (e.g., spray glue, expanding foam), workers shall be provided with combination cartridges consisting of organic vapor and HEPA sections.
 - g. Workers shall be provided with sufficient sets of protective full-body clothing to be worn in the designated work area and/or whenever potential exposure to asbestos exists. Such clothing shall include, but not be limited to, full-body coveralls, headgear and gloves. Workers shall assure that hoods covering their hair are worn in the designated work areas



at all times. Eye protection and hard hats shall be provided as required by applicable safety regulations. Eye protection shall be worn during encapsulation operations. Non-disposable type protective clothing and footwear shall be left in the work area until the end of the asbestos abatement work, at which time such items will be disposed of as asbestos waste.

- h. Non-skid footwear shall be provided to all abatement workers. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.
 - i. Protective clothing shall not be worn in lieu of street clothing outside the work area.
 - j. Visitor Clothing: The Contractor shall provide authorized visitors with suitable respirator, protective clothing, headgear, eye protection, and footwear as described herein, whenever they enter the work area.
3. Decontamination and Work Procedures: The decontamination and work procedures to be followed by workers shall be posted as described in these specifications.
 4. Worker and Authorized Visitor Protection Procedures:
 - a. Each worker and authorized visitor shall, upon entering the job site, remove street clothes in a designated clean change area and put on a respirator with new filters and clean protective clothing before entering the work area.
 - b. The Contractor's employees shall perform a positive/negative respirator fit test each time it enters the work area. If leakage occurs, the respirator must be re-adjusted or replaced.
 - c. Workers shall maintain their respirators in a safe operating condition. The condition of respirators shall be checked daily.
 - d. Workers and visitors shall complete the decontamination procedures as outlined in the specification upon exiting the work area.
 - e. Workers shall not eat, drink, smoke, or chew gum or tobacco in or near the asbestos work areas.
 - f. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbance of asbestos-containing or contaminated materials and until final cleanup is completed.

O. Air Monitoring

1. The airborne fiber counts outside the work area will be monitored to detect faults in the work area isolation such as contamination of the building outside of the work areas with airborne asbestos fibers, failure of filtration or rupture in the negative pressure system. 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. In the case of mini-enclosures the Owner's Representative will monitor air in a remote location of the residence to determine the baseline of asbestos.
2. The airborne fiber counts in the work area will be monitored. The purpose of this air monitoring will be to detect airborne fiber counts which may significantly challenge the ability of the work area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers. In the case of mini-enclosures the Owner's representative may monitor air outside of several enclosures if they are in close proximity.
3. Contractor shall maintain an average airborne count inside the work area of less than 0.5 f/cc. If the fiber counts rise above this figure for any sample taken, revise work procedures to lower fiber counts. If the TWA fiber count for any work shift or eight-hour period exceeds 0.5 f/cc, stop all work, leave pressure differential system in operation and notify the Owner's Representative. Do not recommence work until authorized in writing by the Owner's Representative.
4. If airborne fiber counts exceed 1.0 f/cc for any period of time cease all work until fiber counts fall below 0.5 f/cc and notify the Owner's Representative. Do not recommence work until authorized in writing by the Owner's Representative.
5. If any air sample taken outside of the work area exceeds the 0.01 f/cc of air, Contractor shall immediately and automatically stop all work. If this air sample was taken inside the building and outside of critical barriers around the work area, immediately erect new critical barriers to isolate the affected area from the balance of the building. Erect Critical Barriers at the next existing structural isolation of the involved space (e.g., wall, ceiling, and floor). Leave Critical Barriers in



- place until completion of work and insure that the operation of the negative pressure system in the work area results in a flow of air from the balance of the building into the affected area.
6. If the exit from the clean room of the personnel decontamination unit enters the affected area, establish a temporary decontamination facility consisting of a shower room and changing room. After cleaning and decontamination of the affected area remove the shower room and leave the changing room in place as an air lock.
 7. After certification of visual inspection in the work area, remove critical barriers separating the work area from the affected area. Final air samples will be taken within the entire area.
 8. 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 Phase Contrast Microscopy (PCM) NIOSH 7400 Method procedures. If work has stopped due to high airborne fiber counts, air samples will be secured in the same area by the Owner's Representative for analysis by electron microscopy. "Airborne fibers" counted in samples analyzed by Scanning or Transmission Electron Microscopy (TEM) shall be only asbestos fibers, but of any diameter and length. Subsequent to analysis by Electron Microscopy the number of airborne fibers shall be determined by multiplying the number of fibers, regardless of composition, counted by the PCM NIOSH 7400 Method procedure by a number equal to asbestos fibers counted divided by all fibers counted in the electron microscopy analysis.
 9. If 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 0.1 f/cc, or if any one sample exceeds 0.2 f/cc, then the cost of such analysis will be born by the Contractor, at no additional cost to the Owner.
 10. the Owner's Representative will secure at least the following air samples to establish a base line before start of work involving large enclosures:

Location Sampled	Number of Samples	Analysis Method	Detection Limit f/cc	Minimum Volume Liters	Rate LPM
Each Work Area	1	PCM	0.01	1,900	2-16
Outside Each Work Area	1-3	PCM	0.01	1,900	2-16

11. Base Line is an action level expressed in f/cc, which is ten percent greater than the largest of the following:
 - a. Average of the samples collected on cellulose ester filters outside each work area.
 - b. Average of the samples collected on cellulose ester filters outside the building.
 - c. 0.01 fibers per cubic centimeter.
12. Daily: From start of work of Paragraph "Temporary Enclosure" through the work of Paragraph "Project Decontamination," the Owner may be taking the following samples on a daily basis. The location of each air sample will be determined by the Owner's Representative.
 - a. Baseline
 - b. Work Area
13. For larger enclosures samples will be collected on 25 mm cassettes with the following filter media:

PCM: 0.8 micrometer mixed cellulose ester.

Location Sampled	Number of Samples	Analysis Method	Detection Limit f/cc	Minimum Volume Liters	Rate LPM
Each Work Area	2	PCM	0.01	1,900 as required by conditions	2-16
Outside Each Work Area Critical Barrier	1	PCM	0.01	1,900	2-16
Clean Room	1	PCM	0.01	1,900	2-16
Equip Decon	1	PCM	0.01	1,900	2-16



14. Additional samples may be taken at the Owner or the Owner's Representative discretion. If airborne fiber counts exceed allowed limits, additional samples will be taken as necessary to monitor fiber levels.
15. The services of a testing laboratory will be employed by the Owner to perform laboratory analysis of the air samples. Samples will be sent daily so that verbal reports on air samples can be obtained in a timely manner. A complete record, certified by the testing laboratory, of all air monitoring tests and results will be furnished to the Owner's Representative, the Owner and the Contractor.
16. Air samples may be analyzed on site by the Owner's Representative, if they are to be analyzed by the NIOSH 7400 Method.
17. Cellulose ester filters will be analyzed using the PCM NIOSH 7400 Method. Thus analysis will be carried out at a laboratory located off the job site.
18. At the completion of the work in occupied areas and prior to the dismantling of the isolation system, final air clearance will be conducted by the Owner's Representative.
19. Decontamination of the work area will be considered complete when all samples indicate fiber levels are less than 0.01 f/cc of air as analyzed by PCM NIOSH 7400 Method or an average of less than 70 structures per square millimeter of filter area as analyzed by TEM; Level II AHERA Method.
20. The Contractor may conduct its own air monitoring and laboratory testing. If it elects to do this the cost of such air monitoring and laboratory testing shall be included in the Contract Sum.

P. Equipment Removal Procedures

1. Clean all external surfaces of contaminated waste containers and equipment thoroughly by wet sponging or HEPA vacuuming before moving such items into the equipment decontamination enclosure system washroom for final cleaning and removal to uncontaminated areas. Ensure that personnel do not leave the work areas through the equipment decontamination enclosure system.

Q. Disposal Activities

1. It is the responsibility of the Contractor to comply with current federal, state and local regulations concerning the waste handling, transportation, and disposal of asbestos-containing material (ACM) and accompanying solvents or residues.
2. The Contractor will document actual disposal of the waste at the designated landfill by completing Disposal Certificate or submitting proof of landfill receipt.

1.2 PRODUCTS

A. Materials

1. All Contractor's equipment delivered to the site shall be free of asbestos contamination.
2. Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.
3. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Materials that become contaminated shall be disposed of in accordance with applicable regulations.
4. Polyethylene flame retardant sheet of 6-mil thickness shall be used unless otherwise specified. Polyethylene sheeting shall be sized to minimize the frequency of joints. Polyethylene sheeting must satisfy the National Fire Prevention Association Standard 701, "Small Scale Fire Test for Flame Resistant Textile and Film."
5. Adhesive tape shall be capable of sealing joints of adjacent sheets of polyethylene and for use in attachment of polyethylene sheet to finished or unfinished surfaces of similar materials and shall be capable of adhering under dry and wet conditions, including use of amended water. Contractor shall use adhesive tape compatible with finished surfaces.



6. Protective devices such as, but not limited to, disposable clothing, respirators, gloves, hard hats, etc. shall be used.
7. Wetting agent shall be a mixture of 50/50 polyoxyethylene ether and polyglycol ester or equivalent commercial product.
8. Encapsulant materials shall be the bridging and penetrating type and conform with the following characteristics:
 - a. Encapsulants shall not be solvent-based or utilize a hydrocarbon in the liquid in which the solid parts of the encapsulant are suspended.
 - b. Encapsulant shall not be flammable.
9. A non-hardening lagging sealer for enclosing and sealing raw exposed edges and surfaces of asbestos-containing materials.
10. Pre-mixed or job mixed insulating plaster manufactured for use on plumbing equipment shall be used when repairing damaged thermal insulation material.
11. Non-woven fibrous glass mat and open weave glass fiber mat cloth for repair of thermal systems insulation.
12. Fire retardant sealant shall prevent fire, smoke, water and toxic fumes from penetrating through sealants. Sealant shall have a flame spread, smoke and fuel contribution of zero, and shall be ASTM and Underwriter's Laboratory (UL) rated for three hours for standard method of fire test for fire stop systems.

B. Tools And Equipment

1. Provide suitable tools for repair and encapsulation of asbestos-containing materials and for removal of asbestos-containing materials that are beyond repair. Wire brushes shall not be used as a means of removing or cleaning asbestos-containing materials from surfaces, if they are used as the surface is being sprayed with water or amended water.
2. Provide sufficient number of HEPA-filtered vacuum cleaners equipped with pick-up adapters, steel floor wands, crevice tools, and carpet tools.
3. Airless sprayers capable of spraying amended water shall be provided in sufficient number to allow continuous uninterrupted work.
4. Asbestos filtration devices shall utilize high efficiency particulate air (HEPA) filtration systems.
5. Transportation equipment, as required, shall be suitable for loading, temporary storage, and unloading of contaminated waste without exposure to persons or property, and shall be quiet in motion if used within the building.

1.3 EXECUTION

A. Safety Procedures For Power And Lighting

1. The use of wet methods for removal, repair, encapsulation or cleaning procedures increases the potential for electrical shock when working around electrical panels, conduit, light fixtures, alarm systems, junction boxes, transformers, etc. In coordination with the Owner, de-energize as much electrical equipment as possible to prevent electrical shock to employees performing the work. The Contractor shall use the following precautions:
 - a. Use non-conductive tools and vacuum attachments.
 - b. Utilize "hot line" covers over energized cables and power lines when possible.
 - c. Ensure all electrical equipment in use is properly grounded before the job starts. Check outlets, wiring, extension cords and power pickups.
 - d. Avoid stringing wiring across floors. Elevate wiring if possible.
 - e. Ensure electrical outlets are tightly sealed and taped to avoid water spray.
 - f. Determine operating voltages of equipment and lines before working on or near energized parts.
 - g. Energized parts must be insulated or guarded from employee contact and other conductive objects. Extension cords must be three-wire type and connected to a Ground Fault Interrupter (GFI) circuit.
 - h. Lock or secure de-energized circuits at panel and post warning signs.



- i. Seal heating vents with two layers of polyethylene sheeting prior to the start of work. The Contractor shall repair any damage caused by Contractor's operations to duct work, grilles, dampers, louvers or HVAC equipment at the completion of the work at Contractor's expense. Coordinate all lock out and or de-energizing with the Owner.

B. Temporary Facilities

1. Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the work and operations of the building. Coordinate all installations and shut downs with building owner.
2. Relocate, modify and extend services and facilities as required during the course of work so as to accommodate the entire work of the project.
3. Provide new or used materials and equipment that are undamaged and in serviceable condition. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.
4. During the erection and/or moving of scaffolding, care must be exercised so that the polyethylene floor covering is not damaged.
5. Clean, as necessary, debris from non-slip surfaces.
6. At the completion of abatement work, clean all construction aids within the work area, wrap in one layer of 6-mil polyethylene sheet and seal before removal from the work area.
7. Temporary water service connections to the Owner's water system shall include back flow protection. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered.
8. Employ heavy-duty abrasion-resistant hoses with a pressure rating 50 percent greater than the maximum pressure of the water distribution system to provide water into each work area and to each Decontamination Unit. Provide fittings as required to allow for connection to existing wall hydrants or spouts, as well as temporary water heating equipment, branch piping, showers, shut-off nozzles and equipment.
9. Electrical Services shall comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electric service.
10. Provide a weatherproof, grounded temporary electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period. Install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in every area of work.
11. Provide receptacle outlets equipped with ground fault interrupters, reset button and pilot light, for plug-in connection of power tools and equipment.
12. Use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas of work. All cords shall be elevated off the floor inside the containment area.
13. Temporary wiring in the work area shall be type UL non-metallic sheathed cable located overhead and exposed for surveillance. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide liquid tight enclosures or boxes for wiring devices.
14. Provide Type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical or grease-oil-flammable liquid fires. In other locations provide type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.
15. Use of the Owner's existing toilet facilities, as indicated, will be permitted, so long as these facilities are properly cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore these facilities to the condition prevalent at the time of initial use. All provisions of these specifications regarding leaving the work area must be met.
16. When mini-enclosures area being used all of the requirements above will be enforced by the Owner's Representative. The construction and set-up of the mini-enclosures may be done by the Abatement Contractor.



C. Pressure Differential System

1. Before start of work Contractor shall submit design of pressure differential system to the Owner's Representative for review. Do not begin work until system has been approved by the Owner's Representative. Include in the submittal the following:
 - a. Number of pressure differential machines 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.
2. If the enclosure is not a mini-enclosure, the Contractor must supply the required number of asbestos air filtration units to the site in accordance with these specifications. Each unit shall include the following:
 - a. Cabinet constructed of steel or other durable materials able to withstand damage from rough handling and transportation. The width of the cabinet should be less than 30 inches to fit through standard-size doorways. 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. Unit shall be mounted on casters or wheels.
 - b. Rate capacity of fan according to useable air-moving capacity under actual operating conditions. Use centrifugal-type fan.
 - 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. Provide HEPA Units that are individually tested and certified on site by an independent testing agency to have an efficiency of not less than 99.97 percent when challenged with 0.3 m dioctylphthlaate (DOP) particles when tested in accordance with Military Standard Number 2182 and Army Instruction Manual 136-300-175A. Provide filters that bear a UL586 label to indicate ability to perform under specified conditions.
 - f. Pre-filters, which protect the final filter by removing the larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. The first-stage pre-filter shall be a low-efficiency type (e.g., for particles 10 microns and larger). The second-stage (or intermediate) filter shall have a medium efficiency (e.g., effective for particles down to 5 microns). Pre-filters and intermediate filters shall be installed either on or in the intake grid of the unit and held in place with special housings or clamps.
 - g. 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 useable 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. Provide units equipped with an elapsed time meter to show the total accumulated hours of operation.
 - h. 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. 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).
 - i. Electrical components shall be approved by the National Electrical Manufacturers Association (NEMA) and Underwriters' Laboratories (UL). Each unit shall be equipped with overload protection sized for the equipment. The motor, fan, fan housing, and cabinet shall be grounded.
 - j. If a mini-enclosure is used the air filtration unit may be a HEPA filtered vacuum with a flow rate of at least 100 cubic feet per minute (CFM).
3. Provide a fully operational pressure differential system within the work area maintaining continuously a pressure differential across work area enclosures of 0.02 inches of water for glove



- bag operations and mini-containments. Demonstrate to the Owner's Representative the pressure differential by use of pressure differential meter or a manometer, before disturbance of any asbestos-containing materials. In the case of a mini-enclosure visual evidence of pressure differential through the use of a smoke generation tube shall be sufficient as in paragraph C.13 of this section.
4. Continuously monitor and record the pressure differential between the work area and the building outside of the work area.
 5. Provide fully operational negative pressure systems supplying a minimum of one air change every ten minutes (six changes per hour), less in the instance of a mini-enclosure. Determine the volume in cubic feet of the work area by multiplying floor area by ceiling height. Determine total ventilation requirement in cubic feet per minute (cfm) for the work area by dividing this volume by the air change rate.
 6. Ventilation Required (CFM) = Volume of work area (cu. ft.)/10 min.
 7. Determine number of units needed to achieve ten-minute change rate by dividing the ventilation requirement (CFM) above capacity of exhaust unit(s) used. Capacity of a unit for purposes of this section is the capacity in cubic feet per minute with fully loaded filters (pressure differential which causes loaded filter warning light to come on) in the machines labeled operating characteristics.
 8. Add one additional unit as a backup in case of equipment failure or machine shutdown for filter changing.
 9. Locate exhaust unit(s) so that makeup air enters work area primarily through decontamination facilities and traverses work area as much as possible. This may be accomplished by positioning the unit(s) at a maximum distance from the worker access opening or other makeup air sources.
 10. Vent to outside of building, unless authorized in writing by the Owner's Representative.
 11. Each unit shall be serviced by a dedicated minimum 115v-20A circuit with overload device tied into an existing building electrical panel which has sufficient spare capacity to accommodate the load of all pressure differential units connected. Dedication of an existing circuit may be accomplished by shutting down existing loads on the circuit.
 12. Test pressure differential system before any asbestos-containing material is wetted or removed. After the work area has been prepared, the decontamination facility set up, and the exhaust unit(s) installed, start the unit(s) (one at a time). Demonstrate operation and testing of pressure differential system to the Owner's Representative.
 13. Demonstrate of operations of the pressure differential system to the Owner's Representative will include, but not be limited to, the following:
 - a. Plastic barriers and sheeting move lightly in toward work area.
 - b. Curtain of decontamination units move lightly in toward work area.
 - c. There is a noticeable movement of air through the decontamination unit. Use stroke tube to demonstrate air movement from clean room, and from equipment room to work area.
 - d. Use smoke tubes to demonstrate a positive motion of air across all area in which work is to be performed.
 - e. Use a differential pressure meter or manometer to demonstrate a pressure difference of at least 0.02 inches (as allowed) of water across every barrier separating the work area from the balance of the building or outside. This is not required in the case of a mini enclosure.
 14. Start exhaust units before beginning work (before any asbestos-containing material is disturbed). After abatement work has begun, run units continuously to maintain a constant negative pressure until decontamination of the work area is complete. Do not turn off units at the end of the work shift or when abatement operations temporarily stop.
 15. Do not shut down pressure differential system during encapsulating procedures, unless authorized by the Owner's Representative in writing. Start abatement work at a location farthest from the exhaust units and proceed toward them. 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.
 16. 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. The units may be required to run for a longer time after decontamination, if



dry or only partially wetted asbestos material was encountered during any abatement work. In the case of a mini-enclosure the vacuum may be removed and the entrance sealed following encapsulation until the clearance sample is collected.

- 17. Prior to final air test, remove pre-filter and wipe out inside lip of negative air machine.
- 18. When a final inspection and the results of final air tests indicate that the area has been decontaminated, exhaust units may be removed from the work area. 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.

D. Work Area Preparation

- 1. The work area is the location where asbestos-abatement work occurs. It is a variable of the extent of work of the contract. It may be a portion of a room, a single room, or a complex of rooms. 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.
- 2. Pre-clean fixed objects, walls and floor surfaces within the proposed work areas using HEPA filtered vacuum equipment and wet cleaning methods as appropriate.
- 3. Seal all openings, supply and exhaust vents, and convectors within ten feet of the work area with 6-mil polyethylene sheeting secured and completely sealed with plastic adhesion tape.
- 4. Contact fire control agencies to review procedures prior to start of work.
- 5. Provide 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, four- or six- mils thick, frosted or black.
- 6. Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene and supporting surface.
- 7. 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. Should the area beyond the work area(s) become contaminated with asbestos-containing dust or debris as a consequence of the work, clean those areas in accordance with the procedures indicated in Paragraph "Decontamination Procedures." All such required cleaning or decontamination shall be performed at no additional cost to the Owner.
- 8. Place all tools (i.e., scaffolding, staging) necessary for the work in the area to be isolated prior to erection of plastic sheeting temporary enclosure.
- 9. Disable ventilation systems or any other system bringing air into or out of the work area. Disable system by disconnecting wires, removing circuit breakers, by lockable switch or other positive means that will prevent accidental premature restarting of equipment.
- 10. Remove and dispose of all electrical and mechanical items, such as lighting fixtures, clocks, diffusers, registers, escutcheon plates, etc., which cover any part of the surface on which work is to be performed.
- 11. All general construction items such as cabinets, casework, doors and window trim, moldings, ceilings, trim, etc., which cover the surface of the work as required to prevent interference with the work. To be performed by the Owner: 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.
- 12. Permit Access to the work area only through the Decontamination Unit. All other means of access shall be closed off and sealed and warning signs displayed on the clean side of the sealed access.
- 13. Provide Warning Signs at each visual and physical barriers reading as follows in both English and Spanish:

<u>Legend</u>	<u>Notation</u>
KEEP OUT	3" Sans Serif Gothic or Block
BEYOND THIS POINT	1" Sans Serif Gothic or Block
ASBESTOS ABATEMENT WORK	1" Sans Serif Gothic or Block



IN PROGRESS
BREATHING ASBESTOS DUST MAY BE
HAZARDOUS TO YOUR HEALTH

1" Sans Serif Gothic or Block
14 Point Gothic

14. Alternate methods of containing the work area may be submitted to the Owner's Representative for approval. Do not proceed with any such method(s) without prior written approval of the Owner's Representative.
15. Individually seal all ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, convectors and speakers, and other openings into the work area with plastic adhesion tape alone or with polyethylene sheeting at least 4-mil in thickness, taped securely in place with plastic adhesion tape. Maintain seal until all work including Project Decontamination is completed. Take care in sealing off lighting fixtures to avoid melting or burning of sheeting.
16. Provide sheet plastic barriers at least 6-mil in thickness as required to completely seal openings from the work area into adjacent areas. Seal the perimeter of all sheet plastic barriers with plastic adhesion tape or spray cement.
17. Where applicable, construct framing of the containment out of fire treated wood or aluminum studs. Mini-enclosure frames may be constructed of Polyvinyl Chloride (PVC) tubing.
18. Cover all walls in work area extending to the underside of the ceiling grid system with one layer of polyethylene sheeting, at least 6-mil in thickness, mechanically supported and sealed with plastic adhesion tape or spray-glue in the same manner as "Critical Barrier" sheet plastic barriers. Tape all joints with plastic adhesion tape. Contractor shall be responsible for repair of damaged wall finishes.
19. Cover floor with two layers of 6-mil polyethylene sheeting (exclude for floor tile and adhesive).
20. Provide Pressure Differential System per Paragraph "Pressure Differential System."
21. If the enclosure barrier is breached in any manner that could allow the passage of asbestos debris or airborne fibers, then add the affected area to the work area, enclose it as required by this section of the specification and decontaminate it as described in Paragraph "Decontamination Procedures."
22. Establishing a Mini-Containment area:
 - a. Establish work area so that unauthorized entry is prevented; Construct a two-compartment fire treated wood frame around work area; install one layer 6-mil polyethylene sheeting to structural members and two layers 6 mil polyethylene sheeting to the floor. Exception: no floor required if mini-containment is being constructed to perform a floor tile activity. Seal all edges to wall, ceiling, and floor surfaces with duct tape. Install viewing inspection windows, where feasible.
 - b. Seal all penetrations with duct tape such as pipes, electrical conduit, or ducts contained within the mini-containment.
 - c. Install triple 6-mil polyethylene flaps at both doorways. Place portable sprayer with clean water, disposable towels, and pre-labeled disposal bag in air lock.
 - d. Install appropriate signs on outside of mini-containment area.
 - e. Install HEPA vacuum; extend hose into mini-containment area for general vacuuming, negative air, and cleaning of disposal suit.
 - f. Accumulate all loose materials for disposal. Place in approved container. Apply appropriate labels. Adequately wet clean all wall, floor, tool and equipment surfaces.
 - g. Abatement worker must wear two disposable suits. Remove outer suit in work area and place in a plastic bag. Enter air lock.
 - h. In air lock, wet wipe respirator and wash hands with clean water. Remove respirator and place in a clean plastic bag. Proceed to remote shower unit where inner suit may be removed.

E. Worker Protection

1. This section describes the equipment and procedures required for protecting workers against asbestos contamination and other work place hazards except for respiratory protection.
2. Respiratory Protection is specified in Paragraph "Respiratory Protection."



3. Train in accordance with EPA's Model Accreditation Plan, 40 CFR 763 - Asbestos, all workers in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. Include but do not limit the topics covered in the course to the following:
 - a. Methods of recognizing asbestos.
 - b. Health effects associated with asbestos.
 - c. Relationship between smoking and asbestos in producing lung cancer.
 - d. Nature of operations that could result in exposure to asbestos.
4. Importance of and instruction in the use of necessary protective controls, practices and procedures to minimize exposure including:

Engineering controls
Work practices
Respirators
Housekeeping procedures
Hygiene facilities
Protective clothing
Decontamination procedures
Emergency procedures
Waste disposal procedures
Appropriate work practices for the work
Requirements of medical surveillance program
Review of OSHA 29 CFR 1926.1101(k)(9)(viii)(G) - Asbestos
Pressure differential systems
Work practices including hands on or on job training
Personal decontamination procedures
Air monitoring, personal and area

5. 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. In the absence of specific airborne fiber data, provide medical examination for all workers who will enter the work area for any reason. Examination shall, at minimum, meet OSHA requirements as set forth in 29 CFR 1926.1101(k)(9)(viii)(G) - Asbestos. In addition, provide an evaluation of the individual's ability to work in environments capable of producing heat stress in the worker.
6. Before start of work Contractor shall submit the following to the Owner's Representative for review. Do not start work until receipt of the Owner's Representative.
 - a. An original signed copy of the Certificate of Worker's Acknowledgement found at the end of this specification, for each worker who is to be at the job site or enter the work area.
 - b. Courses outline or name of institution providing the worker training course.
 - c. 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.
7. Provide disposable full-body coveralls and disposable head covers, and require that they be worn by all workers in the work area. Provide a sufficient number for all required changes, for all workers in the work area.
8. Provide work boots with non-skid soles, and where required by OSHA, foot protectives, for all workers. Provide boots at no cost to workers. Paint uppers of all boots red with water proof enamel. Do not allow boots to be removed from the work area for any reason, after being contaminated with asbestos-containing material. Dispose of boots as asbestos contaminated waste at the end of the work.
9. Provide head protectives (hard hats) as required by OSHA for all workers, and provide four spares for use by the Owner's Representative, and the Owner. 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. Provide hard hats with plastic strap type suspension. Require hats



to remain in the work area throughout the work. Thoroughly clean, decontaminate and bag hats before removing them from work area at the end of the work.

10. Provide eye protectives (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury.
11. 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 gloves as asbestos contaminated waste at the end of the work.
12. Respirators, disposable coveralls, head covers, and footwear covers shall be provided by the contractor for the Owner, the Owner's Representative, and other authorized representatives who may inspect the job site.
13. Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the work. The following procedures are minimums to be adhered to regardless of fiber count in the work area.
14. Each time work 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. Proceed through shower room to equipment room and put on work boots.
15. In the event a mini-enclosure is used refer to Paragraph "Work Area Preparation" for personal decontamination procedures.

F. Respiratory Protection

1. Instruct and train each worker involved in asbestos abatement or maintenance and repair of friable asbestos-containing materials in proper respiratory use and require that each worker always wear a respirator, properly fitted on the face in the work area from the start of any operation which may cause airborne asbestos fibers until the work area is completely decontaminated. Use respiratory protection appropriate for the fiber level encountered in the work place or as required for other toxic or oxygen-deficient situations encountered.
2. Except to the extent that more stringent requirements are written directly into the Contract Documents, the following 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 were bound herewith. Where there is a conflict in requirements set forth in these regulations and standards meet the more stringent requirement.
 - a. 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.
 - b. ANSI - American National Standard Practices for Respiratory Protection. ANSI Z88.2-1980.
 - c. NIOSH - National Institute for Occupational Safety and Health.
 - d. MSHA - Mine Safety and Health Administration.

G. Type Of Respiratory Protection Required

1. Provide Respiratory Protection as indicated in paragraph below. Where paragraph below does not apply, determine the proper level of protection by dividing the expected or actual airborne fiber count in the work area by the "protection factors" given below. The level of respiratory protection which supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below 0.01 fibers/cubic centimeter is the minimum level of protection allowed.
2. Eight-hour Time Weighted Average (TWA) of asbestos fibers to which any worker may be exposed shall not exceed 0.1 fibers/cubic centimeter.
3. For purposes of this section fibers are defined as all fibers regardless of composition as counted in the OSHA Reference Method (ORM), NIOSH P&CAM 239 or 7400 procedure, or asbestos fibers of any size as counted using either a scanning or transmission electron microscope.
4. Require that respiratory protection be used at all times that there is any possibility of disturbance of asbestos-containing materials whether intentional or accidental.
5. Require that a respirator be worn by anyone in a work area at all times, regardless of activity, during a period that starts with any operation which could cause airborne fibers until the area has been cleared for re-occupancy.



H. Respiratory Protection Factor

<u>Respirator Type</u>	<u>Protection Factor</u>
Air purifying: Negative pressure respirator High efficiency filter Half facepiece	10
Air purifying: Negative pressure respirator High efficiency filter Full facepiece	50
Powered-air purifying (PAPR): Positive pressure respirator High efficiency filter Half or Full facepiece	100
Type C supplied air: Positive pressure respirator continuous-flow Half or full facepiece	100
Type C supplied air: Positive pressure respirator pressure demand Full facepiece	1000
Type C supplied air: Positive pressure respirator pressure demand Full facepiece Equipped with an auxiliary positive pressure Self-contained breathing apparatus (SCBA)	over 1000
Self-contained breathing apparatus (SCBA): Positive Pressure respirator Pressure demand Full facepiece	over 1000

I. Air Purifying Respirator

1. Provide half face or full face type respirators. Equip full-face respirators with a nose cup or other anti-fogging device as would be appropriate for use in air temperatures less than 32 degrees Fahrenheit.
2. Provide, at a minimum, 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). In addition, 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.
3. Supply with a sufficient quantity of respirator filters approved for asbestos, so that workers can change filters during the work day. Require that respirators be wet-rinsed, and filters discarded, each time a worker leaves the work area. Require that new filters be installed each time a worker re-enters the work area. Store respirators and filters at the job site in the changing room and protect totally from exposure to asbestos prior to their use. Do not use single use, disposable or quarterface respirators.



- J. Powered Air Purifying Respirator (PAPR)
1. Provide full-facepiece type respirators. Provide nose-cups for full-facepiece respirators. Provide, at a minimum, HEPA type cartridges approved by NIOSH/MSHA and certified for use in atmospheres containing asbestos dusts.
 2. Provide, at a minimum, one extra battery pack for each respirator so that one can be charging while one is in use.
 3. Provide non-cloth belts capable of being decontaminated in shower.
 4. Supply with 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. Require that regardless of flow, filter cartridges be replaced after 40 hours of use. Require that HEPA elements in filter cartridges be protected from wetting during showering. 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. Caution should be used to avoid shorting battery pack during washing.
- K. Required Respiratory Protection
1. Regardless of airborne fiber levels, require the following minimum level of respiratory protection:
 - a. Half-face air purifying respirators may be used during set-up of the containment and removal of the material so long as fiber counts inside the respirator do not exceed .01 f/cc fibers per cubic centimeter.
- L. Decontamination Units -Three-Stage
1. Provide a Personnel Decontamination Unit consisting of a serial arrangement of rooms or spaces, Changing Room, Shower Room, Equipment Room adjacent to each full containment area.
 2. Require all persons without exception to pass through this decontamination unit for entry into and exiting from the work area for any purpose. Do not remove equipment or materials through Personnel Decontamination Unit.
 3. Changing (Clean) Room:
 - a. Provide a room that is physically and visually separated from the rest of the building for the purpose of changing into protective clothing.
 - b. Locate so that access to work area from changing room is through shower room.
 - c. Separate changing room from the building by a double-sheeted polyethylene flapped doorway.
 - d. Provide sub-panel at changing room to accommodate all removal equipment. Power sub-panel 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.
 4. Shower Room:
 - a. Provide 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.
 - b. Construct room by providing a shower pan and two shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining wood floor in shower pan at elevation of top of pan.
 - c. Separate this room from rest of building, drying room and airlock with airtight walls fabricated of 6-mil polyethylene.
 - d. Provide splash proof entrances to Drying Room and Airlock.
 5. Equipment Room (contaminated area):
 - a. Require work equipment, footwear and additional contaminated work clothing to be left here. This is a change and transit area for workers. Separate this room from the work area by a 6-mil polyethylene flap doorway.
 - b. Separate this room from the rest of the building, the shower room and work area with air tight walls fabricated of 6-mil polyethylene.



- 6. Clean Room: Provide Clean Room to isolate the holding room from the building exterior.
- 7. Load-out Area:
 - a. The load-out area is the transfer area from the building to a truck or dumpster.
 - b. Wet wipe bags before they are passed through the equipment decon-chamber.
 - c. When cleaning is complete pass items into holding room. Close all doorways except the doorway between the holding room and the Clean Room.
 - d. Workers from the area outside the containment area enter holding area and remove decontaminated equipment and/or containers for disposal.
 - e. Require these workers to wear full protective clothing and appropriate respiratory protection.
 - f. At no time is a worker from an uncontaminated area to enter the enclosure when a removal worker is inside.
 - g. Post an approximately 20 inch x 14 inch manufactured caution sign at each entrance to the work area displaying the following legend with letter sizes and styles of a visibility required by OSHA 29 CFR 1926.1101(k)(9)(viii)(J) - Asbestos.

LEGEND
DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED
IN THIS AREA

- h. Provide spacing between respective lines at least equal to the height of the respective upper line.
- i. Additional Signage: Shall also be posted in accordance with OSHA 29 CFR 1926.1101(k)(9)(viii)(J) - Asbestos

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA

DANGER
ASBESTOS
CANCER AND LUNG HAZARD
KEEP OUT

- j. Post an approximately 10 inch by 14 inch manufactured sign at each entrance to each work area displaying the following legend with letter sizes and styles of a visibility at least equal to the following:

<u>LEGEND</u>	<u>NOTATION</u>
No Food, Beverages or Tobacco Permitted	3/4 inch Block
All Persons Shall Don Protective Clothing (Coverings) Before Entering the Work Area	3/4 inch Block
All Persons Shall Shower Immediately After Leaving Work Area and Before Entering the Changing Area	3/4 inch Block



M. Decontamination Procedures

1. Contractor shall require all workers and visitors to adhere to the following personal decontamination procedures whenever they leave the work area:
 - a. Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area.
 - b. When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the Equipment Room.
 - c. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:
 - 1) Thoroughly wet body including hair and face. If using a PAPR, hold blower unit above head to keep canisters dry.
 - 2) 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. Pay particular attention to seal between face and respirator and under straps.
 - 3) 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 breathe.
 - 4) Carefully wash face-piece of respirator inside and out.
 - d. 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.
 - 1) Shower completely with soap and water.
 - 2) Rinse thoroughly.
 - 3) Rinse shower room walls and floor prior to exit.
 - 4) Proceed from shower to changing room and change into street clothes or into new disposable work items.
 - e. Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area with a half or full face cartridge type respirator:
 - 1) When exiting area, remove disposable coveralls, disposable headcovers, and disposable footwear covers or boots in the equipment room.
 - 2) Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator and filters to avoid asbestos fibers while showering. The following procedure is required as a minimum:
 - 3) Thoroughly wet body from neck down.
 - 4) Wet hair as thoroughly as possible without wetting the respirator filter if using an air purifying type respirator.
 - 5) Take a deep breath, hold it and/or exhale slowly, complete wetting of hair, thoroughly wetting face, respirator and filter (air purifying respirator). While still holding breath, remove respirator and hold it away from face before starting to breath.
 - 6) Dispose of wet filters from air purifying respirator.
 - 7) Carefully wash facepiece of respirator inside and out.
 - 8) Shower completely with soap and water.
 - 9) Rinse thoroughly.
 - 10) Rinse shower room walls and floor prior to exit.
 - 11) Proceed from shower to changing room and change into street clothes or into new disposable work items.

N. Project Decontamination

1. If the asbestos abatement work is on damaged or friable materials, then the building space is deemed contaminated before start of the work and in need of decontamination. In this case, the



- procedure includes two cleanings of the primary barrier plastic prior to its removal and two cleanings of the room surfaces to remove any new or existing contamination.
2. 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, or which may previously have had elevated fiber levels due to friable materials in the space.
 3. Work of this section also includes the cleaning, decontamination, and removal of temporary facilities installed prior to abatement work and decontamination of all surfaces (ceiling, walls, floor) of the work area, and all furniture or equipment in the work area.
 4. First 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/or a HEPA filtered vacuum. (Note: A HEPA vacuum will fail if used with wet material). Do not perform dry dusting or dry sweeping. Use each surface of a cleaning cloth one time only and then dispose as contaminated waste. Continue this cleaning until there is no visible debris from removed materials on plastic sheeting or other surfaces. Upon authorization of the Owner's Representative proceed with encapsulation of substrate.
 - b. Perform encapsulation of substrate where required at this time. Maintain pressure differential system in operation during encapsulation work. Allow encapsulant to dry before proceeding with removal of Secondary layer of plastic.
 5. Second Cleaning
 - a. Upon authorization of the Owner's Representative, remove all Primary Barrier sheeting and Material Decontamination Unit, if there is one, leaving only the following:
 - 1) Critical Barrier which forms the sole barrier between the work area and other portions of the building or outside.
 - 2) Critical Barrier Sheeting over lighting fixtures and clocks, ventilation openings, doorways, convectors, speakers and other openings.
 - 3) Personnel Decontamination Unit.
 - 4) Pressure Differential System in continuous operation.
 - b. Remove all filters in Air Handling System(s) and dispose of as asbestos-containing waste.
 6. Final Cleaning: Carry out a final cleaning of all surfaces in the work in the same manner as the first cleaning immediately after removal of primary plastic. This cleaning is now being applied to existing room surfaces. Take care to avoid water marks or other damage to surfaces.
 7. Visual Inspection: Perform a complete visual inspection with the Owner's Representative 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. If any such debris, residue, dust or other matter is found repeat cleaning and continue decontamination procedure from that point. When the area is visually clean, complete the certification at the end of this section.
 8. Final Air Sampling
 - a. After the work area is found to be visually clean, air samples will be taken and analyzed in accordance with the procedures set forth in Paragraph "Powered Air Purifying Respirator (PAPR).
 - b. If Release Criteria are not met, repeat cleaning and continue decontamination procedure from that point.
 - c. If Release Criteria is met, remove the interior of the decontamination unit leaving in place only the Critical Barriers separating the work area from the rest of the building and the operating negative pressure system.
 - d. Any small quantities of residual material found upon removal of the plastic sheeting shall be removed with a HEPA filtered vacuum cleaner and local area protection. If significant quantities, as determined by the Owner's Representative, are found then the entire area affected shall be decontaminated as specified herein for the cleaning.

- O. Work Area Clearance
1. Air Monitoring



- a. Visual Inspection is required as a prerequisite of air testing.
 - b. To determine if the elevated airborne asbestos structure concentration 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.
2. Aggressive Sampling
- a. All air samples will be taken using aggressive sampling techniques as follows. (There are no standards available for flow rate of leaf blowers or large fans. However, this information is not critical to the success of the procedure).
 - b. Before sampling pumps are started, the exhaust from forced-air equipment (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 five minutes per 10,000 cubic feet of room volume.
 - c. Air samples will be collected in areas subject to normal air circulation away from room corners, obstructed locations, and sites near windows, doors or vents.
3. Schedule of Air Samples
- a. General: The number and volume of air samples taken and analytical methods used by the Owner's Representative will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical instruments used. In each homogeneous work area after completion of all cleaning work, samples will be taken and analyzed by either PCM or TEM analysis.
 - b. Transmission Electron Microscopy (TEM) Samples:
 - 1) In each homogeneous work area after completion of all cleaning work, samples will be taken and analyzed by either PCM or TEM analysis as follows:
 - 2) Samples will be collected on 25 mm cassettes with filter media: TEM - 0.45 micrometer mixed cellulose ester or 0.40 micrometer polycarbonate, with 5.0 micron mixed cellulose ester backing filter.

Location Sampled	Number of Samples	Detection Limit (f/cc)	Minimum Volume (Liters)	Rate LPM
Each Work Area	5	0.005	1,300	2-10

- 3) TEM Analysis will be performed using the analysis method set forth in the AHERA Regulation 40 CFR Part 763 Appendix A.
 - 4) Asbestos Structures referred to in this Section include asbestos fibers, bundles, clusters, or matrices, as defined by method of analysis.
 - 5) Decontamination of the work site is complete when all the sample results are below 0.01 fibers per cubic centimeters (f/cc) of air or 70 structures per square millimeter.
- c. Phase Contrast Microscopy (PCM) Samples:
- 1) In each homogeneous work area after completion of all cleaning work, samples may be taken and analyzed as follows:
 - 2) Samples will be analyzed by PCM for clearance in areas where ceiling tile and/or pipe insulation are removed
 - 3) Samples will be collected on 25 mm cassettes with filter media: PCM - 0.8 micrometer mixed cellulose ester.

Location Sampled	Number of Samples	Detection Limit (s/cc)	Minimum Volume (Liters)	Rate LPM
Each Work Area	1-5	0.01	2,400	2-10

- 4) PCM Analysis: Fibers on each filter will be measured using the NIOSH 7400 Method entitled "Fibers" published in the NIOSH Manual of Analytical Methods, 3rd Edition, Second Supplement, August 1987.



- 5) Fibers: Referred to in this section include fibers regardless of composition as counted by the phase contrast microscopy method used
 - 6) Decontamination of the work site is complete when all the sample results are below 0.01 fibers per cubic centimeters (f/cc) of air or 70 structures per square millimeter.
4. Failure of Clearance Sampling: Should results from analysis of final clearance air samples not meet the specified criteria, Contractor will be responsible for the payment of all costs, including Consultant's time for subsequent clearance air sampling. The costs associated with subsequent re-sampling for final clearance shall be deducted from the Contractor's final payment of the contract amount.

P. Removal Of Pipe Insulation

1. The work of this section applied to the removal of asbestos-containing Pipe Insulation.
 - a. Place one layer of 6-mil fire retardant polyethylene sheeting directly below the work. The sheet shall be of sufficient size to completely wrap the pipe once it has been removed.
 - b. Thoroughly wet the ends of the pipe with amended water and scrape off a minimum of 6 inches of asbestos wrap from both ends of the pipe. Immediately place the wetted material into pre-labeled asbestos disposal bag(s).
 - c. Detach the pipe at each scraped end and place the pipe onto one sheet of 6-mil fire retardant polyethylene sheeting. Wrap the pipe with the 6-mil fire retardant polyethylene sheeting. Contractor shall wrap the pipe with a second sheet of 6-mil, fire retardant polyethylene sheeting and label as asbestos-containing material. Dispose of the bag(s) and duct in accordance with the Paragraph "Handling and Disposal of Asbestos Contaminated Waste" of this specification.
 - d. Upon clearance from the Owner's Representative, Contractor shall remove the 6-trail, fire retardant polyethylene sheeting from the openings.

Q. Glove Bag Removal

1. The work of this section applies to full containment or glovebag removal.
2. Isolate the area in accordance with Paragraph "Temporary Facilities."
3. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area.
4. Set up pressure differential isolation and ventilation of the work area in accordance to Paragraph "Pressure Differential System."
 - a. Upon approval of the enclosure by the Owner's Representative, Contractor may proceed to remove the material using the following method.
 - b. Thoroughly wet to satisfaction of the Owner's Representative, asbestos-containing insulation to be removed prior to stripping and/or tooling to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet the substrate without causing excess dripping. Allow time for removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions. If insulation is covered with canvas, Contractor will wet the exterior covering and slice it with utility knife while saturating the material.
 - c. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels using commercially available "foggers."
 - d. Remove saturated asbestos-containing material in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. 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.
 - e. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing.
 - f. Contractor must always clean area of visible asbestos debris prior to end of shift.
5. These procedures shall be followed to remove pipe insulation elbows:
 - a. Install critical barriers to isolate the work site. Install 2 or 3 Stage Decontamination Units.



- b. HEPA vacuum the work site.
 - c. Provide negative air machine in addition to those required, 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 2-inch diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0" from any scraping or brushing activity.
 - d. Locate intake of duct so that airflow is horizontally and slightly downward into intake. Replace primary filter on negative air machine at an interval of no greater than 30 minutes. Allow no more than one scraping or brushing activity per negative air machine.
 - e. Check pipe where the work will be performed. Wrap damaged (broken lagging, hanging, etc.), pipe in 6 mil plastic and "candy-stripe" with duct tape. Place one layer of duct tape around undamaged pipe at each end where the glovebag will be attached.
 - f. Place necessary tools into pouch located inside glovebag. This will usually include: bone saw, utility knife, rags, scrub brush, wire cutters, tin snips and pre-wetted cloth.
 - g. Place one strip of plastic adhesion tape along the edge of the open top slit of glove bag for reinforcement.
 - h. Place the glove bag around section of pipe to be worked on and staple top together through reinforcing tape. Next, tape the ends of glovebag to pipe itself, where previously covered with plastic or tape.
 - i. Use smoke tube and aspirator bulb to test seal. Place tube into water sleeve (two-inch opening to glovebag) squeezing bulb and filling bag with visible smoke. Remove smoke tube and twist water sleeve closed. While holding the water sleeve tightly, gently squeeze glovebag and by using a flashlight, look for smoke leaking out, (especially at the top and ends of the glovebag). If leaks are found, tape closed using plastic adhesion tape and re-test.
 - j. Insert wand from garden sprayer through water sleeve. Plastic adhesion tape water sleeve tightly around the wand to prevent leakage.
 - k. One person places its hands into the long-sleeved gloves while the second person directs garden sprayer at the work.
 - l. Use bone saw, if required, to cut insulation at each end of the section to be removed. A bone saw is a serrated heavy gauge wire with ring-type handles at each end. Throughout this process, spray amended water or removal encapsulant on the cutting area to keep dust to a minimum.
 - m. Remove insulation using putty knives or other tools. Place pieces in bottom of bag without dropping.
 - n. Rinse all tools with water inside the bag and place back into pouch.
 - o. Using scrub brush, rags and water, scrub and wipe down the exposed pipe. (Inexpensive horse rub-down mittens work well for this).
 - p. Remove water wand from water sleeve and attach the small nozzle from HEPA-filtered vacuum. Turn on the vacuum only briefly to collapse the bag.
 - q. Remove the vacuum nozzle, twist water sleeve closed and seal with plastic adhesion tape.
- R. Handling And Disposal Of Asbestos-Containing Waste
1. All waste and asbestos contaminated waste shall be double bagged in pre-labeled 6-mil airtight puncture resistant bags. Labeling shall be in accordance with OSHA and EPA requirements.
 - a. Bags of asbestos-containing waste shall be sealed with tape in the work area. Asbestos waste shall not be allowed to dry out prior to sealing bags. While in the work area, bags shall be decontaminated of any bulk debris by wet wiping. Bags shall be pre-labeled in accordance with OSHA and EPA.
 - b. The Contractor shall ensure that the sealed bags are transported to the waste disposal site.
 2. The Contractor shall establish a manifest system to enable the Owner to report the quantity of asbestos waste being deposited at the landfill. Contractor shall report the quantity of waste in pounds or tons as appropriate. The Contractor must be able to demonstrate custody over all asbestos waste from the time it is removed from the work area until it is deposited at the land fill.



- a. Copies of the manifest and any receipts generated during the handling and disposal process shall be provided to the Owner's Representative and the Owner.
 - b. Final manifest and documents must be provided to the Owner's Representative and the Owner within two weeks of the removal of the asbestos materials from the site by the waste hauler.
- S. Encapsulation Of Asbestos-Containing Materials
1. General provisions of Contract, including General and Supplementary Conditions and Division 01, apply to work of this section.
 - a. The work includes the sealing of all piping or vessels from which asbestos-containing insulation has been removed with one coat of a lock down encapsulant.
 - b. Where repair work is being performed, the end will be sealed with a minimum of one coat of bridging encapsulant.
 2. Submittals
 - a. Product Data: Submit manufacturer's technical information including label analysis and application instructions for each material proposed for use.
 - b. Installation Instructions: Submit manufacturer's installation instructions with specific project requirements noted.
 - c. Performance Warrantee: Submit manufacturer's performance guarantee.
 - d. Certification: Submit written approval of entity installing the encapsulant from encapsulant manufacturer.
 - e. Material Safety Data Sheet: Submit the 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 on the work. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.
 3. Deliver materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
 - a. Name or title of material
 - b. Manufacturer's stock number and date of manufacture
 - c. Manufacturer's name
 - d. Thinning Instructions
 - e. Application Instructions
 4. Deliver materials together with a copy of the OSHA Material Safety Data Sheet for the material.
 5. Job Conditions
 - a. Apply encapsulating materials only when environmental conditions in the work area are as required by the manufacturer's instructions.
 6. Quality Assurance
 - a. Installation of Spray-on Encapsulation Materials: Install spray-on materials by a firm and personnel approved by the manufacturer of the primary materials.
 - b. Testing: Test material to be encapsulated using methods set forth in ASTM E1494 "Standard Practice for Encapsulants Spray-or-Trowel-Applied for Friable Asbestos-Containing Building Materials."
 - c. Performance Warranty: Submit written Performance Warranty, executed by the manufacturer and co-signed by the Contractor, agreeing to repair/replace spray-on work which has cracked, fallen from substrate, or otherwise deteriorated to a condition where it would not perform effectively for its intended purposes due substantially to defective materials or workmanship and not due to abuse by occupants, improper maintenance, non-foreseeable ambient exposures or other causes beyond anticipated conditions and manufacturer's/contractor's control.
 - d. Compatibility: Selection and use of encapsulant shall be compatible with replacement materials. Submit manufacturer's data indicating compatibility with replacement materials.
 7. Product Selection
 - a. Encapsulants: Provide penetrating or bridging type encapsulants specifically designed for application to asbestos-containing material.



- b. Standards: Product shall be rated as acceptable for use intended when field tested in accordance with ASTM E1494 "Standard Practice for Encapsulants Spray-or-Trowel-Applied for Friable Asbestos-Containing Building Materials."
 - c. Fire Safety: Use only materials that have a flame spread index of less than 25, when dry, when tested in accordance with ASTM E84.
8. Manufacturers
- a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to the following:
 - 1) Penetrating Encapsulants: As currently accepted by the EPA. Refer to most recent EPA approval list.
 - 2) Bridging Encapsulants: As currently accepted by the EPA. Refer to most recent EPA approval list.
9. General
- a. Prior to applying any encapsulating material, ensure that application of the sealer will not cause the base material to fail and allow the sealed material to fall of its own weight or separate from the substrate. Should Contractor doubt the ability of the installation to support the sealant, request direction from the Owner's Representative before proceeding with the encapsulating work.
 - b. Do Not Commence Application of encapsulating materials until all removal work within the work area has been completed.
10. Worker Protection
- a. Before beginning work with any material for which a Material Safety Data Sheet has been submitted, provide workers with the required protective equipment. Require that appropriate protective equipment be used at all times.
 - b. In addition to protective breathing equipment required by OSHA requirements or by this specification, use painting pre-filters on respirators to protect the dust filters when organic solvent based encapsulants are used.
11. Substrate
- a. Apply lock down encapsulant to all substrate after all asbestos-containing materials have been removed. Apply in strict accordance with the manufacturer's printed instructions for use of the encapsulation as an asbestos coating. Any deviations from such printed instructions shall be approved by the Owner's Representative in writing prior to commencing work.
 - b. Apply encapsulant with an airless spray gun with air pressure and nozzle orifice as recommended by the encapsulant manufacturer.
- T. Removal Of Floor Tile
- 1. This section applies to the removal of floor tile.
 - a. Prior to start of work, wet wipe all surfaces including floor tile to remove any visible dust.
 - b. Isolate the room by sealing hallway or doors and installing critical barriers on all ducting, windows and other penetrations of the room, in the specified area. Install a splash guard a minimum of 4 feet high on the walls of the room with one layer of 6-mil fire retardant poly.
 - c. Install a two-stage decontamination configuration contiguous (under certain conditions may be remote) with the work in accordance with Paragraph "Decontamination Units."
 - d. Using water or amended water in a Hudson-type sprayer or garden sprayer, lightly mist the area where the material is to be removed. This may take several passes with the hose of the sprayer. Allow time for the water to soak into the material.
 - e. Immediately place individual tiles in proper asbestos disposal bags. Vacuum collapse the bag, twist the neck of the bag, tape with duct tape, fold the twisted portion over onto itself and tape again. Wipe the outside of the bag with clean damp cloths and place the bag into a second prelabeled disposal bag. Tape shut the second bag.
- U. Removal Of Fireproofing



1. The work of this section applies to the removal of all asbestos containing fireproofing including all over-spray that may be located on concrete block, columns, metal deck, beams, fixtures conduit and ducting.
 - a. Isolate the floor per Paragraph "Temporary Enclosure."
 - b. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area.
 - c. Set up pressure differential isolation and ventilation of the work area in accordance to Paragraph "Temporary Pressure Differential and Air Circulation System."
 - d. Upon approval of the enclosure by the Owner's Representative, contractor may proceed to remove the material using the following method.
 - e. Pre-clean columns, beams, electrical, mechanical and plumbing systems in the work area using wet wipe and HEPA vacuuming methods. Mask off with flame retardant polyethylene sheeting to protect from contamination during bulk abatement.
 - f. Thoroughly wet to satisfaction of the Owner's Representative, asbestos-containing fireproofing to be removed prior to stripping and/or tooling to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet the substrate without causing excess dripping. Allow time for removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions.
 - g. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels using commercially available "foggers."
 - h. Remove saturated asbestos-containing material in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. 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.
 - i. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing.
 - j. Provide Pressure Differential Machine in addition to those required in Paragraph "Pressure Differential System," 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 brushing activity.
 - k. Locate intake of duct so that air flow is horizontally and slightly down-ward into intake. Replace primary filter on pressure differential machine at an interval of no greater that 30 minutes. Allow no more than one scraping or brushing activity per pressure differential machine.
- V. Removal Of Wall Plaster: HEPA vacuum work site.
 1. Place two layers of 6-mil flame retardant polyethylene sheeting on the floor adjacent to the wall to be demolished. Pull the wall down in manageable sections onto the polyethylene sheeting. Control dust and fiber release by misting the air and lightly wetting the material with amended water from a Hudson-type sprayer or garden sprayer as it is demolished.
 2. Wrap the first layer of polyethylene sheeting around the material and seal with duct tape. Wrap the second layer of polyethylene sheeting around the bundle and seal with duct tape.
 3. Label and dispose of the entire bundle.
 4. Provide Pressure Differential Machine in addition to those required in Paragraph "Pressure Differential System," 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-inch diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0" from any scraping or brushing activity.
 5. Locate intake of duct so that air flow is horizontally and slightly down-ward into intake. Replace primary filter on negative air machine at an interval of no greater that 30 minutes.

W. Clean-Up Of Asbestos-Containing Debris On Ceiling Tile Or Solid Ceiling



1. This section applies to the decontamination of the entire plaster ceiling, removal of existing fiberglass on duct work and removal of all batt insulation covering the existing plaster ceiling.
 - a. Isolate the floor per Paragraph "Temporary Facilities."
 - b. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area. General Contractor will give direction regarding exact location of decontamination unit(s).
 - c. Set up pressure differential isolation and ventilation of the work area in accordance to Paragraph "Temporary Pressure Differential and Air Circulation System."
 - d. Upon approval of the enclosure by the Owner's Representative, contractor may proceed to remove the material using the following method:
 2. These procedures shall be followed to for clean up of asbestos-containing debris on existing plaster ceiling:
 - a. This work will be performed prior to the removal of fireproofing. The isolation of the work area is considered essential to the pre-cleaning activities for the total area. Isolate the area in accordance with Paragraph "Temporary Facilities."
 - b. Remove asbestos-containing debris and fiberglass batt and duct insulation and decontaminate the area using the following procedures:
 - 1) Remove all small debris with the HEPA vacuum.
 - 2) Gently mist all fiberglass insulation, remove from ducts and ceiling and place into pre-labeled hazardous disposal bags and dispose of in accordance with Paragraph "Disposal of Asbestos Containing Waste Material."
 - 3) Exposure of ducting will expose all fireproofing overspray, this material may be removed during the removal of fireproofing from decks and beams.
 - 4) Pick up all large visible debris on the ceiling or any horizontal surfaces and place in the bottom of a 6-mil polyethylene disposal bag conforming to the requirements of Paragraph "Disposal of Asbestos-Containing Waste." Place pieces in the bag without dropping and avoiding unnecessary disturbance and release of material.
 - 5) HEPA vacuum the entire plaster ceiling surface.
 - c. Upon completion of the decontamination of the area request a visual inspection of the ceiling and other horizontal surfaces. This area will be considered a portion of work area for the duration of the work and will be included in the final encapsulation of the area.
- X. Removal Of Adhesive: This section applies to the removal of all asbestos-containing floor tile and adhesive, sheet vinyl flooring, vinyl floor tile, and baseboard adhesive, etc.
1. Ensure that workers are equipped with proper respiratory protection. In addition to the HEPA cartridges, respirators must also be equipped with organic solvent cartridges.
 2. Provide HEPA filtered fan units in the vicinity of the work. Arrange so that units exhaust outside the building. Replace primary filters on HEPA filtered fan units at an interval of no greater than 30 minutes.
 3. Apply adhesive removal solvent as recommended by manufacturer after removal of floor tile has been completed.
 4. Provide tile adhesive (mastic) remover that meets the following criteria:
 - a. Flash Point: 122E or greater.
 - b. Special Precautions: No heavy smoke generated if ignited.
 - c. Health Effects: Limited to mild skin rash or eye irritation.
 - d. Respiratory Protection: MSHA - NIOSH approved Organic vapor cartridges in conjunction with standard HEPA filters.
 - e. Petroleum Distillates: None.
 - f. Odor: Pine, Citrus or none.

Use of diesel fuel in the removal of tile and baseboard adhesive is strictly prohibited.

5. Remove adhesive in small sections from all areas. Do not allow material to dry out. As adhesive is removed, simultaneously pack rags contaminated with adhesive material into disposal bags. Twist



neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside of bag and move to material decontamination unit.

6. Upon completion of adhesive removal, thoroughly clean bare substrate of all solvent residue.
7. Place adhesive residue in proper asbestos disposal bags. Vacuum collapse the bag, twist the neck of the bag, tape with duct tape, fold the twisted portion over onto itself and tape again. Wipe the outside of the bag with clean damp cloths and place bag into second pre-labeled disposal bag. Tape shut the second bag.



CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT

PROJECT NAME: _____

PROJECT ADDRESS: _____

CONTRACTOR: _____

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 employers. 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
- Pressure differential systems
- Work practices including hands-on or on-the-job training
- Personal decontamination procedures
- Air monitoring, personal and area

MEDICAL EXAMINATION: I have had a medical examination within the last 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 _____ Witness _____

Printed Name _____ Social Security Number _____



CERTIFICATION OF VISUAL INSPECTION

AREA _____

In accordance with Paragraph "Project Decontamination" the Contractor hereby certifies that it has visually inspected the work area (all surfaces including pipes, beams, ledges, walls, ceiling and floor, Decontamination Unit, sheet plastic, etc.) and has found no dust, debris or residue.

By: _____

Signature _____ Date _____

Print Name _____

Print Title _____

OWNER'S REPRESENTATIVE CERTIFICATION

the Owner's Representative hereby certifies that it has accompanied the Contractor on its visual inspection and verifies that this inspection has been thorough and to the best of its knowledge and belief, the Contractor's certification above is a true and honest one.

Signature _____ Date _____

Print Name _____

Print Title _____



RESPIRATORY PROTECTION PROGRAM

Project Name _____

Location _____

Date _____

Based upon airborne asbestos-fiber counts encountered on previous projects of similar type working on materials similar to those found on the above referenced project. The following level of respiratory protection is proposed for the indicated operations to maintain an Airborne Fiber Count (as measured by the NIOSH 7400 Method) below the specified Permissible Exposure Limit (PEL) inside the respirator face piece.

Operation	Anticipated f/cc	Respiratory Protection	Protection Factor	f/cc in Mask
Installing sheet plastic				
Removing trim in contact with asbestos-containing material				
Removal of architectural finish or fireproofing				
Removal of pipe insulation				
Removal of fitting insulation				
Encapsulation of pipe and boiler insulation				
Gross debris removal				
Cleaning "primary" sheet plastic				
Cleaning "critical" barrier				
Removing Decontamination Unit				
Other				

The Contractor certifies that to the best of its knowledge and belief the above represent a true and accurate representation of Airborne Fiber Counts to be expected for the operations indicated, and are based upon airborne fiber data from past projects with similar materials and operations.

Contractor _____

Signature _____ Date _____

Print Name _____ Title _____

END OF SECTION 02 82 33 00



SECTION 02 82 33 00a - REMOVAL OF NONFRIABLE ASBESTOS-CONTAINING MATERIALS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for removal of nonfriable asbestos-containing materials. Products shall be as follows or as directed by the the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Definitions

1. ACM: Asbestos Containing material which is any material containing more than one percent asbestos.
2. Amended Water: Water containing a wetting agent or surfactant with a maximum surface tension of 2.9 Pa 29 dynes per centimeter when tested in accordance with ASTM D 1331.
3. Area Sampling: Sampling of asbestos fiber concentrations which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.
4. Asbestos: The term asbestos collectively refers to a naturally occurring mineral known by the following specific names: chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.
5. Asbestos control Area: That area where asbestos removal operations are performed. The area shall be isolated by physical boundaries to assist in the prevention of the uncontrolled access by non-qualified persons.
6. Asbestos Fibers: Those fibers having an aspect ratio of at least 3:1 and longer than-5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.
7. Asbestos Permissible Exposure Limit: 0.1 fibers per cubic centimeter of air as an e-hour time weighted average measured in the breathing zone as by defined 29 CFR 1926.1101 or other Federal legislation having legal jurisdiction for the protection of workers health.
8. Background: The ambient airborne asbestos concentration in an uncontaminated area as measured prior to any asbestos hazard abatement efforts. Background concentrations for contaminated areas are measured in similar but asbestos free locations.
9. Contractor: The Contractor is that individual, or entity under contract to the Owner to perform the herein listed work.
10. Contractor/Supervisor (Asbestos abatement): A person who has successfully completed training and is therefore accredited as a Contractor/Supervisor under a State Model Accreditation Plan or EPA Model Accreditation Plan as described in 40 CFR 763.
11. Critical Barrier: The layer of polyethylene sheeting that covers an opening or penetration in a room or area that is to become a negative pressure enclosure.
12. Encapsulation: The abatement of an asbestos hazard through the appropriate use of chemical encapsulants.
13. Encapsulants: Specific materials in various forms used to chemically or physically entrap asbestos fibers in various configurations to prevent these fibers from becoming airborne. There are four types of encapsulants as follows which must comply with performance requirements as specified herein.
 - a. Removal Encapsulant (can be used as a wetting agent)
 - b. Bridging Encapsulant (used to provide a tough, durable surface coating to asbestos containing material)
 - c. Penetrating Encapsulant (used to penetrate the asbestos containing material encapsulating all asbestos fibers and preventing fiber release due to routine mechanical damage)
 - d. Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed).
14. Friable Asbestos Material: Any material containing more than one percent asbestos that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.



15. Glovebag Technique: Those asbestos removal and control techniques put forth in 29 CFR 1926.1101.
16. HEPA Filter Equipment: High efficiency particulate air (HEPA) filtered vacuum and/or exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters shall retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.
17. the Owner: That qualified person employed directly by the Owner to monitor, sample, inspect the work, and advise the Owner.
18. Negative Pressure Enclosure (NPE): That engineering control technique described as a negative pressure enclosure in 29 CFR 1926.1101.
19. Non-friable Asbestos Material: Material that contains asbestos in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers during any appropriate use, handling, storage or transportation. It is understood that asbestos fibers may be released under other conditions such as demolition, renovation, removal, or mishap.
20. Personal Sampling: Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with 29 CFR 1926.1101.
21. Competent Person (CP): A person who has successfully completed training and is therefore accredited under a legitimate State Model Accreditation Plan or EPA Model Accreditation Plan as described in 40 CFR 763 as a Contractor/Supervisor and shall be appropriately licensed according to the Statutes of the State in which the work is to be performed.
22. TEM: Refers to Transmission Electron Microscopy.
23. Time Weighted Average (TWA): The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers.
24. Wetting Agent: A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied. An equivalent wetting agent must have a surface tension of at most 2.9 Pa 29 dynes per centimeter when tested in accordance with ASTM D 1331.

C. Requirements

1. Description of Work: The work covered by this section includes the handling and control of asbestos containing materials and describes some of the resultant procedures and equipment required to protect workers, the environment and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of any asbestos containing materials generated by the work. More specific operational procedures shall be outlined in the Asbestos Hazard Abatement Plan called for elsewhere in this specification. The asbestos work includes the use of non-friable removal technique(s) which is governed by 40 CFR 763 as indicated. Provide non-friable removal technique(s) as outlined in this specification for the locations indicated.
2. Medical Requirements: Provide medical requirements including but not limited to medical surveillance and medical record keeping as listed in 29 CFR 1926.1101.
 - a. Medical Examinations: Before exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1926.1101 or other pertinent State or local directives. This requirement must have been satisfied within the 12 months prior to the start of work on this contract. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. Specifically identify x-ray films of asbestos workers to the consulting radiologist and mark medical record jackets with the word "ASBESTOS."
 - b. Medical Records: Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of 30 years after termination of employment and make records of the required medical examinations and exposure data available for inspection and copying to: The Assistant Secretary of Labor for Occupational



- Safety and Health (OSHA), or authorized representatives of them, and an employee's physician upon the request of the employee or former employee.
- c. Medical Certification: Submit written certification for each worker and contractor/supervisor, signed by a licensed physician indicating that the worker and contractor/supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1926.1101 and 29 CFR 1910.134 as prescribed by law.
3. Training: Train all personnel involved in the asbestos control work in accordance with United States Environmental Protection Agency (USEPA) Asbestos Hazard Emergency Response Act (AHERA) training criteria or State training criteria whichever is more stringent. The Contractor shall document the training by providing a copy of a current training certification to the the Owner for each person assigned to work on this project. Furnish each employee with respirator training and fit testing documentation as required by 29 CFR 1910.134. Provide instruction on the engineering and other hazard control techniques and procedures to be used on this project.
 - a. Employee Training: Submit copies of training certificates for each employee indicating that the employee has received training at the appropriate level in accordance with 40 CFR 763.
 4. Permits, Licenses, and Notifications: Notify the local air pollution control district/agency and the the Owner in writing 10 working days prior to commencement of work in accordance with 40 CFR 61-SUBPART M or applicable state and local regulations. Obtain necessary permits or licenses in conjunction with asbestos removal, encapsulation, hauling, and disposal. Post the permit and/or license at the work site, visible from a non-controlled area. Notify the local fire department 3 days prior to removing fire-proofing material from the building including notice that the material contains asbestos.
 5. Environment, Safety and Health Compliance: Comply with the applicable requirements of the current issue of 29 CFR 1926.1101, 40 CFR 61-SUBPART A, and 40 CFR 61-SUBPART M or applicable State or local regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification, applicable regulations, or referenced documents vary, the most stringent requirement shall apply.
 - a. Site Inspection: While performing asbestos engineering control work, the Contractor shall be subject to on-site inspection by the Federal, State, or local regulatory agencies and the Contracting Officer or its designated representative. If the work is found to be in violation of Federal, State, or local regulations or this specification, the Contracting Officer or its representative will issue a stop work order to be in effect immediately and until the violation is resolved. All related costs including standby time required to resolve the. violation shall be at the Contractor's expense.
 6. Respiratory Protection Program: Establish and implement a respirator program as required by ANSI 288.2 and 29 CFR 1910.134. Submit a written program manual or operating procedure including methods of compliance with regulatory statutes.
 - a. Respirator Program Records: Submit records of the respirator program as required by ANSI 288.2 and 29 CFR 1910.134.
 7. Contractor/Supervisor (Asbestos Abatement): The Contractor shall be represented on-site by a trained contractor/Supervisor. This person shall be on-site at all times when asbestos work is in progress. The Qualified Person, as defined herein, can be the Contractor/Supervisor.
 8. Hazard Communication: Adhere to all parts of 29 CFR 1910.1200 and 29 CFR 1926.59. Provide the Contracting Officer with a copy of the Material Safety Data Sheets (MSDS) for all materials brought to the site. Review the Asbestos Survey Report(s) provided by the the Owner, if any.
 9. Asbestos Hazard Abatement Plan: Submit a detailed plan of the safety precautions such as lockout, tag-out, tryout, fall protection, and confined space entry procedures and equipment and work procedures to be used in the removal of materials containing asbestos. The plan shall be prepared by the Contractor (and reviewed and signed by an asbestos consultant (LAC) licensed according to the Statutes of the State in which the work is to be performed) for review and recommendation for approval by the the Owner. The plan shall be forwarded to the the Owner for final approval at least 10 days prior to beginning abatement activities. The plan shall include but not be limited to the detailed description of personal protective equipment and work practices to



be used including, but not limited to, respiratory protection, type of whole-body protection, the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage areas, change rooms, removal method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos encapsulant to be used, locations of local exhaust equipment, planned air sampling strategies, and a detailed description of the method to be employed in order to control environmental pollution. The plan shall also include both fire and medical emergency response plans. The Asbestos Hazard Abatement Plan must be approved in writing prior to starting any asbestos work.

10. Testing Laboratory: Submit the name, address, and telephone number of each testing laboratory selected for the sampling, analysis, and reporting of airborne concentrations of asbestos fibers along with evidence that each laboratory selected holds the appropriate State license and/or permits and certification that each laboratory is American Industrial Hygiene Association (AIHA) accredited and that persons counting the samples have been judged proficient by current inclusion on the AIHA Asbestos Analysis Registry (AAR) and successful participation of the laboratory in the Proficiency Analytical Testing (PAT) Program. Where analysis to determine asbestos content in bulk materials or transmission electron microscopy is required, submit evidence that the laboratory is accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis.
11. Landfill Approval: Submit written evidence that the landfill for disposal is approved for asbestos disposal by the USEPA and State and local regulatory agency(s).
12. Waste Shipment Records/Asbestos Waste Manifest: Submit waste shipment records and/or asbestos manifest records, prepared in accordance with applicable Federal, State, or local regulations, signed and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill, within 3 days after delivery.
13. Negative Exposure Assessment: Submit objective data demonstrating that the method(s) used for the specified non-friable ACM removal does not release airborne concentrations of asbestos fibers exceeding the TWA PEL or excursion limit. This data may be from previous work within the last 12 months or from initial exposure assessments on this project. Data from previous work must have been gathered by the firm employed on this contract, using workers trained to the same level, with the ACM and workplace conditions "closely resembling" the conditions for this contract.
14. Contractor Daily Reports: Prepare a written report for each day that asbestos work is being accomplished. The report should be submitted to the the Owner monthly. The report as a minimum shall include the following, where applicable:
 - a. Daily Visual Inspection Reports: Prepare a written report documenting compliance with the Asbestos Hazard Abatement Plan and Federal, State, or local regulations.
 - b. Air Sampling Reports: Complete fiber counting within 24 hours of the "time off" of the sample pump. Notify the the Owner immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Sampling results shall be submitted to the the Owner the day following receipt. The affected employees will be provided copies of the results where required by law within 3 working days. These results shall be signed by the air sampler and the testing laboratory employee that analyzed the sample.
 - c. Pressure Differential Recordings for Local Exhaust System-Not Used
 - d. Asbestos Disposal Quantity Report: The Contractor shall record and report daily the amount of asbestos containing material removed and the amount transported for disposal. Deliver the report for the previous day and cumulative totals with amounts of material removed reported in linear meters or square meters linear feet or square feet as described initially in this specification and the amounts of material transported for disposal reported in cubic meters yards.

D. Submittals

1. Submit the following in accordance with Section "Submittal Procedures."
 - a. Vacuums and tools



- b. Respirators
- c. Wetting Agent
- d. Material Safety Data Sheets (MSDS) for all materials proposed for transport to the project site
- e. Local exhaust system
- f. Pressure differential automatic recording instrument
- g. Daily Reports
- h. Asbestos hazard abatement plan
- i. Testing laboratory
- j. Training Certificates
- k. Landfill approval
- l. Employee training
- m. Medical certification requirements
- n. Waste shipment records/Asbestos waste manifest
- o. Respiratory Protection Program
- p. Negative Exposure Assessment
- q. Local Exhaust system
- r. Show compliance with ANSI Z9.2 by providing manufacturers' certifications.
- s. Permits, licenses, and Notifications
- t. Rental equipment
- u. Respirator program records
- v. Protective clothing decontamination quality control records
- w. Protective clothing decontamination facility notification.

E. Quality Assurance

1. Glovebags-Not Used
2. Rental Equipment: Provide a copy of the written notification to the rental company concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.
3. Protective Clothing Decontamination Quality Control Records: Provide all records that document quality control for the decontamination of reusable outer protective clothing.
4. Protective Clothing Decontamination Facility Notification: Submit written evidence that persons who decontaminate, store, or transport asbestos contaminated clothing used in the performance of this contract were duly notified in accordance with 29 CFR 1926.1101.

1.2 PRODUCTS

A. Encapsulants

1. See Division 21 Section "Facility Fire-suppression Water-service Piping".

1.3 EXECUTION

A. Equipment

1. Respirators: Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH). Provide personnel engaged in pre-cleaning, cleanup, handling, and removal of asbestos containing materials with the appropriate respiratory protection as specified in 29 CFR 1910.134.
2. Exterior Whole Body Protection
 - a. Outer Protective Clothing: Provide personnel exposed to asbestos with disposable "non-breathable," or reusable "non-breathable" whole body outer protective clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape. Reusable whole body



- outer protective clothing shall be either disposed of as asbestos contaminated waste upon exiting from the asbestos regulated work area or be properly decontaminated.
- b. Work Clothing-Not Used
 - c. Decontamination of Reusable Outer Protective Clothing: When reusable outer protective clothing is used, transport the double bagged clothing to a previously notified commercial/industrial decontamination facility for decontamination. Perform non-destructive testing to determine the effectiveness of asbestos decontamination. If representative sampling is used, ensure the statistical validity of the sampling results. If representative sampling is used, reject any entire batch in which any of the pieces exceed 40 fibers per square millimeter. Inspect reusable protective clothing prior to use to ensure that it will provide adequate protection and is not or is not about to become ripped, torn, deteriorated, or damaged, and that it is not visibly contaminated. Notify, in writing, all personnel involved in the decontamination of reusable outer protective clothing as indicated in 29 CFR 1926.1101.
 - d. Eye Protection: Provide goggles to personnel engaged in asbestos abatement operations when the use of a full face respirator is not required.
3. Warning Signs and Labels: Provide bilingual warning signs printed in English and Spanish at all approaches to asbestos control areas. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos.
- a. Warning Sign: Provide vertical format conforming to 29 CFR 1926.1101 minimum 20 by 14 inches (500 by 355 mm) displaying the following legend in the lower panel:

<u>Legend</u>	<u>Notation</u>
Danger	25 mm one inch Sans Serif Gothic or Block
Asbestos	25 mm one inch Sans Serif Gothic or Block
Cancer and Lung Disease Hazard	6 mm 1/4 inch Sans Serif Gothic or Block
Authorized Personnel only Respirators and Protective Clothing are Required in this Area	6 mm 1/4 inch Gothic 6 mm 1/4 inch Gothic

Spacing between lines shall be at least equal to the height of the upper of any two lines.

- b. Warning Labels: Provide labels conforming to 29 CFR 1926.1101 of sufficient size to be clearly legible, displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING ASBESTOS DUST MAY
CAUSE SERIOUS BODILY HARM

- 4. Vacuums and Tools: Vacuums shall be leak proof to the filter and equipped with HEPA filters. Filters on vacuums shall conform to ANSI Z9.2 and UL 586. Do not use power tools to remove asbestos containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation systems. Remove all residual asbestos from reusable tools prior to storage or reuse.

B. General



1. Pre-Asbestos Work Conference: The Contractor and the Contractor/Supervisor shall meet with the Contracting officer prior to beginning work, to discuss in detail the Asbestos Hazard Abatement Plan, including work procedures and safety precautions. Once approved by the Owners Engineer, the plan will be enforced as if a part of this specification. Any changes required in the specification as a result of the plan shall be identified specifically in the plan to allow for free discussion and approval by the Owners Engineer prior to starting work.
 2. Asbestos Control Area Requirements: The Contractor shall demarcate the asbestos control area(s) using physical barriers and signs to prevent access by unauthorized personnel. This area is defined by 29 CFR 1926.1101 as the regulated area.
 3. Work Procedure: Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61-SUBPART M, applicable State or local regulation, and as specified herein. Use wet removal procedures. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, drinking, chewing gum or tobacco, or applying cosmetics shall not be permitted in the asbestos control area(s). Personnel of other trades not engaged in the removal of asbestos containing material shall not be exposed at any time to airborne concentrations of asbestos. If an asbestos fiber release or spill, stop work immediately, correct the condition to the satisfaction of the Owners Engineer, including clean-up and clearance sampling, if appropriate, prior to resumption of work.
 4. Furnishings: Furniture will be removed from the area of work by the Owner before asbestos work begins.
 5. Pre-cleaning: Wet wipe and HEPA vacuum all surfaces potentially contaminated with asbestos prior to establishment of an enclosure.
- C. Removal Procedures: Wet asbestos containing material with a fine spray of amended water during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Remove material and immediately place in 0.15 mm 6 mil plastic disposal bags. Remove asbestos containing material in a gradual manner, with continuous application of the amended water in such a manner that no asbestos material is disturbed prior to being adequately wetted. Where unusual circumstances prohibit the use of 0.15 mm 6 mil plastic bags, submit an alternate proposal for containment of asbestos fibers to the Owner's Engineer for approval. Asbestos containing material shall be containerized while wet. At no time shall asbestos containing material be allowed to accumulate or become dry. Handle asbestos containing material as indicated in 40 CFR 61-SUBPART M, applicable State or local regulation, and 29 CFR 1926.1101.
1. Exposed Pipe Insulation Edges-Not Used
 2. Negative Pressure Enclosure: Block and seal openings in areas where the release of airborne asbestos fibers can be expected. Establish an asbestos negative pressure enclosure with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated asbestos work area.
 - a. Personnel/Equipment Decontamination Unit: Provide a temporary facility with a separate equipment/dirty change room and clean change room. Provide a shower that complies with 29 CFR 1926.51 in between the dirty room and clean room for personnel required to wear whole body protective clothing. Provide two separate lockers for each asbestos worker, one in each locker room. Keep street clothing and street shoes in the clean locker. HEPA vacuum and remove asbestos contaminated disposable protective clothing while still wearing respirators at the boundary of the asbestos work area and seal in impermeable bags or containers for disposal. Do not wear work clothing between home and work. All employees shall shower before changing into street clothes. Collect used shower water and filter with approved water filtration equipment to remove asbestos contamination. Dispose of filters and residue as asbestos waste. Discharge clean water to the sanitary system. Dispose of asbestos contaminated work clothing as asbestos contaminated waste or properly decontaminate as specified in the Asbestos Hazard Abatement Plan.
 - b. Waste Load-Out Unit: Provide a separate temporary area expressly for short-term storage of bagged asbestos containing material that is ready for disposal. The unit shall be the only port used to transfer waste to a truck, dumpster, or other approved on-site storage facility. It



shall not be used for personnel egress. A waste load-out unit shall be integral to each negative pressure enclosure.

3. Non-friable Removal Procedures:

- a. Under normal conditions EPA Category II, non-friable asbestos containing materials may not be considered hazardous; however, this material may release airborne asbestos fibers during demolition and removal; therefore it must be handled in a manner to prevent the release of asbestos fibers. At no time will this material be mechanically chipped, sawed, sanded, or ground.
- b. Prior to beginning removal, establish an Asbestos Control Area and install Critical Barriers as specified elsewhere in this section. Submit a Negative Exposure Assessment which is less than 12 months old to the the Owner for approval or conduct air sampling as specified elsewhere in this section to establish the exposure levels for the exact removal method being used. The Contractor will establish the correct level of Personal Protective Equipment required.
- c. Acceptable methods of removal include, but are not limited to, the use of dry ice, a heat gun or lamp, citrus-based solvents, and hand tools with amended water. Removal shall be accomplished to keep the ACM substantially intact. Breakage into small pieces is an unacceptable work practice. The method shall be detailed in the Asbestos Abatement Plan and shall not be changed during the removal without Contracting Officer approval.
- d. Upon completion of the removal and clean-up, but prior to removal of critical barriers, the Contractor Testing company shall conduct a visual inspection of all areas affected by the removal. Re-clean as required.

D. Field Quality Control Requirements

1. Visual Inspections: The the Owner will conduct periodic inspections of all areas where asbestos removal and activities are in progress to ensure compliance with the approved Asbestos Hazard Abatement Plan and Federal/State regulatory requirements. This inspection shall include confirmation of proper control/containment/enclosure, worker protection, housekeeping, exhaust equipment operation, decontamination procedures, proper wetting and disposal, and inspection of work progress and work practices. Each activity will be documented as acceptable or noted as unacceptable with justification for the non-compliance.
2. Air Sampling: Sampling of airborne concentrations of asbestos fibers shall be performed in accordance with 29 CFR 1926.1101 and as specified herein. Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis. Air Sampling may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those results obtained by the Contractor, the Government will determine which results predominate.
 - a. Sampling Prior to Asbestos Work (Not Used)
 - b. Sampling During Asbestos Work
 - 1) The Contractor's testing company shall perform area sampling as indicated in 29 CFR 1926.1101 and governing environmental regulations. Perform area sampling at least once every week close to the work inside the enclosure, outside the personnel/equipment decontamination unit entrance to the enclosure.
 - 2) If sampling outside the enclosure shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the fiber release, and notify the the Owner immediately. Determine by testing if adjacent areas are contaminated. If so the Contractor shall clean the contaminated areas, visually inspect, and sample the areas as specified herein.
 - 3) The Contractor shall conduct personal sampling of at least 25% of the workers engaged in asbestos handling (removal, disposal, transport and other associated work) throughout the duration of the project. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers at any time exceeds 0.1 fibers



per cubic centimeter, notify the PQP immediately, evaluate work practices, and take corrective action to reduce airborne asbestos fibers.

E. Clean-Up And Disposal

1. Housekeeping

- a. Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. **DO NOT BLOW DOWN THE SPACE WITH COMPRESSED AIR.** All asbestos waste shall be placed in an approved on-site storage facility or transported for disposal daily. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the PQP shall visually inspect the asbestos control area for cleanliness. After final clean-up and acceptable pre-clearance airborne concentrations are attained but before the local exhaust system is turned off and the negative pressure enclosure removed), remove all pre-filters on the building HVAC system and provide new pre-filters.
- b. Dispose of filters as asbestos contaminated materials. Reestablish HVAC, mechanical, and electrical systems in proper working order.

2. Title to Materials: All waste materials, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified in applicable Federal, State, and local regulations and herein.

3. Disposal of Asbestos

- a. Collect all removed asbestos containing material, contaminated materials, contaminated water, scrap, debris, bags, containers, expendable equipment, and asbestos contaminated clothing which may produce airborne asbestos fibers and place in sealed fiber-proof, waterproof, non-returnable containers (e.g. double plastic bags 0.15 mm 6 mils thick, cartons, drums or cans). Wastes within the containers must be adequately wet in accordance with 40 CFR 61-SUBPART M. Affix a warning and Department of Transportation (DOT) label to each container including the bags or use at least 0.15 mm 6 mils thick bags with the approved warnings and DOT labeling preprinted on the bag.
- b. Each container or bag shall clearly indicate that the waste generator is the Owner and the development at which the waste is generated, and the Job Order number of the project.
- c. Prevent contamination of the transport vehicle (especially if the transport vehicle is a rented truck likely to be used in the future for non-asbestos purposes). These precautions include lining the vehicle cargo area with plastic sheeting (similar to work area enclosure) and thorough cleaning of the cargo area after transport and unloading of asbestos debris is complete. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) or State-approved asbestos landfill off the Owner's property. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste-containing drums or skids will be coordinated with the the Owner. Procedure for hauling and disposal shall comply with 40 CFR 61-SUBPART M, State, regional, and local standards. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags shall remain in the drum and the entire contaminated drum shall be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums shall wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site.

END OF SECTION 02 82 33 00a



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Task	Specification	Specification Description
02 82 33 00	01 22 16 00	No Specification Required
02 82 33 00	02 81 00 00a	Disposal Of Hazardous Materials
02 82 33 00	02 82 16 00	Encapsulation (Lock-Down) Of Asbestos-Containing Materials



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**SECTION 02 83 19 13 - REMOVAL AND DISPOSAL OF LEAD-CONTAINING PAINT**

1.1 GENERAL

A. Description Of Work

1. This specification covers the removal and disposal of lead-based or lead-containing paint. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Definitions

1. Action Level: Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8 hour period in an occupational/industrial environment.
2. Area Sampling: Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel.
3. Competent Person (CP): As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations. An industrial hygienist or safety professional certified for comprehensive practice by the American Board of Industrial Hygiene or by the Board of Certified Safety Professionals is the best choice.
4. Contaminated Room: Room for removal of contaminated personal protective equipment (PPE).
5. Decontamination Shower Facility: That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.
6. Eight-Hour Time Weighted Average (TWA): Airborne concentration of lead to which an employee is exposed, averaged over an 8 hour workday as indicated in 29 CFR 1926.62.
7. High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron or larger size particles.
8. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps.
9. Lead-Based Paint (LBP): Paint or other surface coating that contains lead in excess of 1.0 milligrams per centimeter squared or 0.5 percent by weight.
10. Lead-Based Paint Hazard (LBP Hazard): Any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, lead-based paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects.
11. Lead-Containing Paint (LCP): Lead-based paint or other similar surface coating containing lead or lead compound in excess of 0.06 percent by weight of the total nonvolatile content of the paint.
12. Lead Control Area: An enclosed area or structure, constructed as a temporary containment equipped with HEPA filtered local exhaust, which prevents the spread of lead dust, paint chips, or debris existing as a condition of lead-based paint removal operations. The lead control area is also isolated by physical boundaries to prevent unauthorized entry of personnel.
13. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter of air as an 8 hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than eight hours in a work day, the PEL shall be determined by the following formula:
$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs. worked per day.}$$
14. Personal Sampling: Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8 hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employees' work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches (150 to 225 mm) and centered at the nose or mouth of an employee.



15. Physical Boundary: Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean the same as "outside lead control area but inside boundary."

C. Submittals: Submit the following:

1. Product Data:
 - a. Vacuum filters
 - b. Respirators
2. Test Reports
 - a. Sampling results
 - b. Assessment data report
3. Certificates
 - a. Qualifications of CP
 - b. Testing laboratory</SUB> qualifications
 - c. Third party consultant qualifications
 - d. Lead-Based Paint/Lead-Containing Paint Removal Plan including CP approval (signature, date, and certification number)
 - e. Rental equipment notification
 - f. Respiratory protection program
 - g. Hazard communication program
 - h. EPA approved hazardous waste treatment or disposal facility for lead disposal
 - i. Hazardous waste management plan
 - j. Vacuum filters
4. Manufacturer's Instructions
 - a. Chemicals and equipment
 - b. Materials
 - c. Material safety data sheets for all chemicals
5. Closeout Submittals
 - a. Completed and signed hazardous waste manifest from treatment or disposal facility
 - b. Certification of medical examinations
 - c. Employee training certification

D. Qualifications Of CP

1. Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph entitled "Competent Person (CP) Responsibilities." Provide previous experience of the CP. Submit proper documentation that the CP is trained and licensed and certified in accordance with Federal, State, and local laws.

E. Third Party Consultant Qualifications

1. Submit the name, address, and telephone number of the third party consultant selected to perform the wipe sampling for determining concentrations of lead in dust or soil sampling. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State (or local) certification and accreditation program.

F. Testing Laboratory

1. Submit the name, address, and telephone number of the testing laboratory selected to perform the air and wipe and soil sampling, testing, and reporting of airborne concentrations of lead. Use a laboratory accredited under the EPA National Lead Laboratory Accreditation Program (NLLAP) by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis.

G. Lead-Based Paint/Lead-Containing Paint Removal Plan (LBP/LCPRP)



1. Submit a detailed job-specific plan of the work procedures to be used in the removal of LBP/LCP. The plan shall include a sketch showing the location, size, and details of lead control areas, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include in the plan, eating, drinking, smoking and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and paint debris disposal plan, air sampling plan, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air and baseline lead dust/soil concentrations are not reached or exceeded outside of the lead control area. Include site preparation and cleanup procedures. Include occupational and environmental sampling, training and strategy, sampling methodology, frequency, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan.
- H. Occupational And Environmental Sampling Results
1. Submit occupational and environmental sampling results to the the Owner within three working days of collection, signed by the testing laboratory responsible official, the employee that performed the sampling, and the CP.
 - a. The sampling results shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures in accordance with 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead.
 - b. Submit worker exposure data conducted during the task based trigger operations of 29 CFR 1926.62.
 - c. The initial monitoring shall determine the requirements for further monitoring and the need to fully implement the control and protective requirements including the compliance program (LBP/LCP) in accordance with 29 CFR 1926.62.
- I. Occupational And Environmental Assessment Data Report:
1. Some LBP/LCP removal work may not require full implementation of the requirements of 29 CFR 1926.62. Based on the experience of the Contractor and/or the use of a specific process or method for performing the work, the Contractor may be able to provide historic data (previous 12 months) to demonstrate that airborne exposures are controlled below the action level. Such methods or controls shall be fully presented in the LBP/LCPRP. To reduce the full implementation of 29 CFR 1926.62, the Contractor shall provide documentation in an Assessment Data Report.
 2. Submit occupational and environmental assessment report to the the Owner prior to start of work, signed by the testing laboratory responsible official, and the CP.
 - a. Submit a report that supports the determination regarding the reduction of the need to fully implement the requirements of 29 CFR 1926.62 and supporting the LBP/LCP. The exposure assessment shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures in accordance with 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.
 - b. Submit worker exposure data conducted during the task based trigger operations of 29 CFR 1926.62 with a complete process description in supporting a negative assessment.
 - c. The initial assessment shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the compliance program (LBP/LCPRP) in accordance with 29 CFR 1926.62.
- J. Quality Assurance
1. Medical Examinations: Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62, and 29 CFR 1926.103.



- a. Medical Records: Maintain complete and accurate medical records of employees for a period of at least 30 years or for the duration of employment plus 30 years, whichever is longer.
- b. Medical Surveillance: Provide medical surveillance to all personnel exposed to lead as indicated in 29 CFR 1926.62.
2. Competent Person (CP) Responsibilities
 - a. Certify training as meeting all federal, State, and local requirements.
 - b. Review and approve lead-based paint/lead-containing paint removal plan for conformance to the applicable referenced standards.
 - c. Continuously inspect lead-based paint removal work for conformance with the approved plan.
 - d. Perform air and wipe sampling.
 - e. Ensure work is performed in strict accordance with specifications at all times.
 - f. Control work to prevent hazardous exposure to human beings and to the environment at all times.
 - g. Certify the conditions of the work as called for elsewhere in this specification.
3. Training: Train each employee performing paint removal, disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State and local regulations.
 - a. Training Certification: Submit a certificate for each employee, signed and dated by the approved training source, stating that the employee has received the required lead training.
4. Respiratory Protection Program
 - a. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.
 - b. Establish and implement a respiratory protection program as required by ANSI Z88.2, 29 CFR 1926.103, 29 CFR 1926.62, and 29 CFR 1926.55.
5. Hazard Communication Program: Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.
6. Hazardous Waste Management: The Hazardous Waste Management Plan shall comply with applicable requirements of federal, State, and local hazardous waste regulations and address:
 - a. Identification and classification of hazardous wastes associated with the work.
 - b. Estimated quantities of wastes to be generated and disposed of.
 - c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of EPA, or State and local hazardous waste permit applications or permits or manifests, as required, and EPA Identification numbers.
 - d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
 - e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
 - f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.
 - g. Work plan and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily.
 - h. Unit cost for hazardous waste disposal according to this plan.
7. Environmental, Safety and Health Compliance: In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of Federal, State, and local authorities regarding removing, handling, storing, transporting, and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the the Owner for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply.



8. Pre-Construction Conference: Along with the CP, meet with the the Owner to discuss in detail the hazardous waste management plan and the lead-based paint/lead-containing paint removal plan, including work procedures and precautions for the removal plan.

K. Equipment

1. Respirators: Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust. Respirators shall comply with the requirements of 29 CFR 1926.62.
2. Special Protective Clothing: Furnish personnel who will be exposed to lead-contaminated dust with proper disposable uncontaminated, reusable protective whole body clothing, head covering, gloves, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.
3. Rental Equipment Notification: If rental equipment is to be used during lead-based paint handling and disposal, notify the rental agency in writing concerning the intended use of the equipment. Furnish a copy of the written notification to the the Owner.
4. Vacuum Filters: UL 586 labeled HEPA filters.
5. Equipment for Owner's Personnel: Furnish the the Owner with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the paint removal work within the lead controlled area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, and hand protection. PPE shall remain the property of the Contractor. Respiratory protection for the the Owner will be provided by the Owner.

L. Removal

1. Title to Materials: Materials resulting from demolition work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of in accordance with Division 02 Section(s) "Selective Structure Demolition" OR "Structure Demolition", except as specified herein.

1.2 PRODUCT

A. Chemicals

1. Submit applicable Material Safety Data Sheets for all chemicals used in paint removal work. Use the least toxic product approved by the the Owner.

B. Materials

1. The soluble metal content and the total metal content shall not exceed values which would cause a material to be classified as a hazardous waste.

1.3 EXECUTION

A. Protection

1. Notification: Notify the the Owner 20 days prior to the start of any paint removal work.
2. Lead Control Area Requirements
 - a. If LBP will be removed by means which will not likely create airborne, lead-containing dust (such as careful wet scraping or chemical stripping), establish a lead control area by situating critical barriers and physical boundaries around the area or structure where LBP/LCP removal operations will be performed.
 - b. If removal practice will create airborne, lead-containing dust (such as sanding, abrasive blasting, thermal cutting, demolition, or needle gun use), utilize full containment procedures - Contain removal operations by the use of critical barriers and HEPA filtered exhaust **OR** a negative pressure enclosure system with decontamination facilities and with HEPA filtered exhaust if required by the CP, **as directed**. For containment areas larger than 1,000 square feet (100 square meters) install a minimum of two 18 inch (450 mm) square viewing



- ports. Locate ports to provide a view of the required work from the exterior of the enclosed contaminated area. Glaze ports with laminated safety glass.
3. Protection of Existing Work to Remain: Perform paint removal work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better.
 4. Boundary Requirements: Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.
 - a. Physical Boundary: Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.
 - b. Warning Signs: Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.
 5. Furnishings:
 - a. The Owner will remove furniture and equipment from the building before lead-based paint removal work begins.
OR
 Furniture and equipment will remain in the building. Protect and cover furnishings or remove furnishings from the work area and store in a location approved by the the Owner.
OR
 Existing furniture and equipment is lead contaminated, decontaminate, dispose of as lead contaminated waste.
 6. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6 mil (0.15 mm) plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area. Provide temporary HVAC system for areas in which HVAC has been shut down outside the lead control area.
 7. Decontamination Shower Facility: Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.
 8. Eye Wash Station: Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.
 9. Mechanical Ventilation System
 - a. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.62.
 - b. To the extent feasible, use fixed local exhaust ventilation connected to HEPA filters or other collection systems, approved by the CP. Local exhaust ventilation systems shall be designed, constructed, installed, and maintained in accordance with ANSI Z9.2.
 - c. Vent local exhaust outside the building only and away from building ventilation intakes.
 - d. Use locally exhausted, power actuated, paint removal tools.
 10. Personnel Protection: Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.
- B. Work Procedures: Perform removal of lead-based paint in accordance with approved lead-based paint/lead-containing paint removal plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when lead-based paint is removed in accordance with 29 CFR 1926.62, except as specified herein. Dispose of removed paint chips and associated waste in compliance with Environmental Protection Agency (EPA), federal, State, and local requirements.
1. Personnel Exiting Procedures: Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:



- a. Vacuum themselves off.
 - b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
 - c. Shower **OR** Wash hands and face at the site, **as directed**, don appropriate disposable or uncontaminated reusable clothing; move to an appropriate facility; shower.
 - d. Change to clean clothes prior to leaving the physical boundary designated around the lead control area.
2. Air and Wipe Sampling
- a. Air sample for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling shall be directed or performed by the CP.
 - 1) The CP shall be on the job site directing the air and non-clearance wipe sampling and inspecting the lead-based paint removal work to ensure that the requirements of the contract have been satisfied during the entire lead-based paint removal operation.
 - 2) Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least 25 percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
 - 3) Submit results of air samples, signed by the CP, within 72 hours after the air samples are taken. Notify the the Owner immediately of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area.
 - 4) For high profile, sensitive work such as present in family housing, child care facilities, administrative buildings, kitchens, barracks, etc., surface dust sampling to determine clearance (i.e., that the work has not contaminated surfaces within and adjacent to the control area) should be performed by a third party to reduce a conflict of interest. Samples must be conducted by an individual not paid or employed or otherwise compensated by the LBP/LCP removal Contractor. State or local regulations may require third party testing if the LBP/LCP removal operation is considered a lead hazard reduction activity.
 - 5) Before any work begins, collect and analyze baseline or soil wipe samples in accordance with methods defined in federal, State, and local standards inside and outside of the physical boundary to assess the degree of dust contamination in the facility prior to lead-based paint removal.
 - b. Air Sampling During Paint Removal Work: Conduct area air sampling daily, on each shift in which lead-based paint removal operations are performed, in areas immediately adjacent to the lead control area. Sufficient area monitoring shall be conducted to ensure unprotected personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the condition(s) causing the increased levels. Notify the the Owner immediately. Determine if condition(s) require any further change in work methods. Removal work shall resume only after approval is given by the CP and the the Owner. For outdoor operations, at least one sample on each shift shall be taken on the downwind side of the lead control area.
3. Lead-Based Paint Removal
- a. Manual or power sanding of interior and exterior surfaces is not permitted. Provide methodology for removing LBP in work plan. Remove paint within the areas designated on the drawings in order to completely expose the substrate. Take whatever precautions necessary to minimize damage to the underlying substrate.
 - b. Avoid flash rusting or deterioration of the substrate. Provide surface preparations for painting in accord with Division 07.
 - c. Provide methodology for removing LBP/LCP removal processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other lead-contaminated debris/waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this LBP/LCP removal process in the LBP/LCPRP.



- d. Indoor Lead Paint Removal: Perform manual **OR** mechanical **OR** thermal **OR** chemical, **as directed**, paint removal in lead control areas using enclosures, barriers, or containments and powered locally exhausted paint removal tools. Collect residue and/or debris for disposal in accordance with federal, State, and local requirements.
 - e. Outdoor Lead Paint Removal: Perform outdoor removal as indicated in federal, State, and local regulations and in the LBP/CPRP. The worksite preparation (barriers or containments) shall be job dependent and presented in the LBP/LCPRP.
 - f. Sampling After Paint Removal: After the visual inspection, conduct soil sampling if bare soil is present during external removal operations and collect air samples inside and outside the lead control area to determine the airborne levels of lead inside and outside the work area. Collect wipe samples according to the HUD protocol contained in HUD Guidelines to determine the lead content of settled dust and dirt in micrograms per square foot (square meter) of surface area and parts per million (ppm) or micrograms per gram ($\mu\text{g/g}$) for soil.
4. Cleanup and Disposal
- a. Cleanup: Maintain surfaces of the lead control area free of accumulations of paint chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the paint removal operation has been completed, clean the area of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the CP. Reclean areas showing dust or residual paint chips or debris. After visible dust, chips and debris is removed, wet wipe and HEPA vacuum all surfaces in the work area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before restarting work.
 - b. Clearance Certification
 - 1) The CP shall certify in writing that the final air samples collected inside and outside the lead control area are less than 30 micrograms per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62 and 40 CFR 745; and that there were no visible accumulations of material and dust containing lead left in the work site. Do not remove the lead control area or roped off boundary and warning signs prior to the the Owner's acknowledgement of receipt of the CP certification.
 - 2) A third party consultant shall certify surface wipe sample results collected inside and outside the work area are less than 100 micrograms per square foot (0.1 square meter) on uncarpeted floors, less than 500 micrograms per square foot (0.1 square meter) on interior window sills and less than 800 micrograms per square foot (0.1 square meter) on window troughs **OR** not significantly greater than the initial surface loading determined prior to work, **as directed**.
 - 3) For exterior paint removal work, soil samples taken at the exterior of the work site shall be used to determine if soil lead levels had increased at a statistically significant level (significant at the 95 percent confidence limit) from the soil lead levels prior to the work. If soil lead levels do show a statistically significant increase above any applicable Federal or State standard for lead in soil, the soil shall be remediated back to the pre-work level.
 - c. Testing of Lead-Based Paint Residue and Used Abrasive: Test paint residue and used abrasive in accordance with 40 CFR 261 for hazardous waste.
 - d. Disposal
 - 1) Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing which may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261. Dispose of lead-contaminated waste material at an EPA or State approved hazardous waste treatment, storage, or disposal facility off Owner's property.



- 2) Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon (208 liter) drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. The the Owner or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
- 3) Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
- 4) All material, whether hazardous or non-hazardous shall be disposed in accordance with laws and provisions and Federal, State, or local regulations. Ensure waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.
5. Disposal Documentation: Submit written evidence that the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA and State or local regulatory agencies. Submit one copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262.
6. Payment for Hazardous Waste: Payment for disposal of hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials delivered is returned and a copy is furnished to the Owner.

END OF SECTION 02 83 19 13



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**SECTION 02 83 19 13a - LEAD PAINT RELATED ABATEMENT PROCEDURES**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for lead paint related abatement procedures. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. General Provisions

1. The site of this work will be occupied while work is being done. Perform the abatement work with the least inconvenience to the residents.
2. Take all necessary precautions to protect the property of the the Owner and its residents. Damaged property shall be repaired and restored to its original condition. If the damage is beyond repair, the Contractor shall replace it with new materials to match existing, at the Contractor's expense.
3. Hazardous waste generated during the abatement process (including lead-base paint) when carted away from the developments shall not be transferred from one vehicle to another except at a licensed transfer station.
4. Develop a work plan to be performed as requested by the the Owner. The detailed plan shall include sequencing of abatement work in a manner that will be least disruptive to the normal use of the non-work areas in the building. The plan should also include emergency procedures in case of fire.
5. The Contractor shall include all supplementary miscellaneous items not specified but implied or required in order to complete the work.
6. Workmanship required in the execution of the work herein specified shall be of good quality and subject to the approval of the the Owner.
7. Make in a timely fashion all applicable and necessary notifications to relevant Federal, State and Local authorities. The Contractor shall indemnify the the Owner and the the Owner's representative from, and pay all claims resulting from failure to adhere to these provisions.
8. the Owner may retain an independent Monitoring Contractor to monitor the abatement contract and conduct all wipe sampling and clearance tests.
9. Contractor performing lead-based paint abatement or renovation activities involving lead-based paint shall be a Certified Lead Abatement Contractor and shall ensure that supervisors and workers are trained and certified by U.S. EPA approved state program or equivalent, to perform lead paint removal operations.
10. Establish and implement a Chemical Hazard Communication Program as required by OSHA regulations 29 CFR 1926.59.
11. Provide workers with a comprehensive medical examination as required by OSHA regulations 29 CFR 1926.62 before exposure to lead contaminated dust. The medical examination shall be conducted to approve use of appropriate respirators and shall include biological monitoring. NIOSH/MSHA approved respirators shall be utilized.
12. For employees required to wear a negative pressure respirators: conduct a respirator fit test at the time of initial fitting and at least once every six (6) months thereafter as required by OSHA regulations 29 CFR 1926.62.
13. Determine if any worker will be exposed to lead at or above the action level in accordance with OSHA regulation 29 CFR 1926.62 and 29 CFR 1910.1025. Conduct an exposure assessment to identify the level of exposure a worker would be subjected to without respiratory protection. Assess the exposure level by obtaining personal monitoring samples representative of a full shift of at least an 8-hour TWA.
14. Furnish appropriate respirators approved by NIOSH/MSHA for use in atmospheres containing lead aerosols. Instruct workers in all aspects of respiratory protection. Maintain an adequate supply of HEPA filter elements and spare parts on site for all types of respirators in use.



15. For manual demolition, scraping, sanding, use of heat gun or power tool paint removal with HEPA collection systems, workers shall minimally use the half-mask negative pressure respirator with high efficiency filters (for airborne concentrations not in excess of 500 $\mu\text{g}/\text{m}^3$).
16. Ensure that work area preparation, work practices, and clean-up procedures comply with these specifications and applicable Federal, State and Local regulations.
17. Notify all applicable agencies five days prior to the date the abatement will begin and provide evidence of notifications to the the Owner at the pre-start meeting.

C. Submissions

1. Within ten (10) consecutive calendar days calculated from the date of the the Owner's Job Order, the Contractor shall tender all required submissions. Six (6) sets of each submission are required. Where physical samples are required two (2) physical samples shall be submitted for each item. In general, items shall include but not be restricted to the following:
 - a. Paint remover - corner cutter/Vac-Pac System by Pentek Inc; Decontamination Products Division 1026 Fourth Avenue, Corapolis, PA. 15108. Telephone No. (412) 262-0725 or approved equal.
 - b. Description of removal method to be used on each substrate condition including manufacturer's operating instructions and recommendation for equipment usage.
 - c. Copies of current training certificates of Staff to be assigned to the contract.
 - d. List of three previous lead abatement jobs performed successfully by Contractor and name, address, and telephone number of contact person for verification.
2. In the event that all or any portion of the submitted material is rejected by the the Owner, the Contractor shall tender new submissions. All submissions returned for corrections shall be resubmitted with the required corrections within ten(10) consecutive calendar days calculated from the date of rejection, until final submissions are obtained that require no further correction. In no event shall the Contractor be permitted to tender submissions hereunder beyond twenty (20) days from the the Owner's Job Order, unless duly extended in writing by the the Owner.
3. No work shall begin, nor shall the materials be ordered or delivered to the site until final approval of all submissions.

D. Applicable Regulations

1. 24 CFR Part 35
2. HUD "Guidelines For the Evaluation and Control of Lead-Based Paint Hazards in Housing"
3. Abatement work shall also be in accordance with applicable regulations of the Environmental Protection Agency (EPA), Occupational Safety & Health Agency (OSHA) and any State or Local LBP standards. Where there is a conflict between Federal, State or Local regulations, the more stringent requirement shall prevail.
4. OSHA Standards
 - a. 29 CFR 1926.20 General safety and health provisions;
 - b. 29 CFR 1926.21 Safety training and education;
 - c. 29 CFR 1925.25 Housekeeping;
 - d. 29 CFR 1926-28 Personal protective equipment;
 - e. 29 CFR 1926.51(f) Washing facilities;
 - f. 29 CFR 1926.55 Gases, vapors, fumes, dusts, and mists;
 - g. 29 CFR 1926.57 Ventilation
 - h. 29 CFR 1926.59 Hazardous Communication Standards;
 - i. 29 CFR 1926.103 Respiratory protection, and
 - j. 29 CFR 1926.62 Lead in Construction
5. The Contractor must comply with all applicable requirements of the Resource Conservation & Recovery Act (RCRA) of 1976 as amended in 1980 and 1984 by the Hazardous & Solid Waste Amendments (HSWA).
6. These Specifications refer to many requirements found in the preceding references but in no way is it intended to cite or reiterate all provisions therein or elsewhere. It is the Contractor's responsibility to obtain a copy, and know, understand and abide by all such regulations, guidelines and common practices.



1.2 PRODUCTS – (not used)

1.3 EXECUTION

A. Abatement

1. Have risk assessment or paint inspection performed by certified risk assessor or a certified inspector technician who is independent of the abatement contractor.
2. Develop a site specific lead hazard control plan, reviewed and signed by an asbestos consultant (LAC) who is licensed in the State in which the work is to be performed, and submit for review and approval to the the Owner.
3. Obtain any necessary building or waste permits, notify local authorities as required by applicable codes and laws.
4. Select specific building component replacement items, enclosure materials, paint removal equipment and/or chemicals, tools, and cleaning supplies. Consider waste management and historical preservation implications of selected treatment.
5. Develop project specific specifications.
6. Schedule other work so that leaded surfaces are not inadvertently disturbed and unprotected workers are not place at risk. Include time for clearance examinations and laboratory dust sample analysis in the scheduling process.
7. Select a certified abatement subcontractor.
8. Conduct a pre-construction conference to ensure that the subcontractor fully understands the work involved.
9. Notify residents of the dwelling and adjacent dwellings of the work and date it will begin. Coordinate this with the the Owner.
10. Correct any existing conditions that could impede the abatement work (i.e. trash removal, structural deficiencies).
11. Post warning signs and restrict entry to work area to authorized personnel. Implement worksite preparation procedures.
 - a. Place proper warning signs required by OSHA regulations at all entrances to the work area. Signage shall be minimum of 12" x 20" and shall state the following:

**WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING**

12. Coordinate test, pilot or sample portion approach to the project with the Owner.
13. Shut-down forced air heating, ventilation and air conditioning systems and cover all vents, diffusers, windows etc., with a single layer six-mil polyethylene sheet secured with duct tape. Exceptions shall be for minor disturbances of area less than 2 square feet and where if vents, diffusers, and windows are more than 5 feet away from surface being disturbed, they need not be covered.
14. Collect preabatement soil samples, which may not have to be analyzed until post abatement soil samples have been collected, analyzed, and compared to clearance standards. If postabatement soil levels are below applicable limits, the preabatement samples need not be analyzed.
15. Cover entrances to the work area with a single layer of 6 mil polyethylene sheets taped to the top and weighted at bottom.
16. Rig a containment non-flammable polyethylene sheet underneath the work area. This containment method should catch all stripped paint for proper disposal.
17. Execute abatement work.
18. Avoid spreading dust and debris outside the work area.
19. Store all waste in a secure area and make sure it is properly labeled with an accumulation start date.
20. Conduct daily and final cleanup.
21. Execute waste disposal procedures.



22. Maintain appropriate records.

B. Paint Removal

1. Do not use the following prohibited paint removal methods:
 - a. Dry scraping or sanding (except for limited areas)
 - b. Use of heat gun over 1,100°F
 - c. Open flame burning or torching
 - d. Machine sanding or grinding without HEPA vacuum exhaust tool
 - e. Abrasive blasting or sandblasting without HEPA vacuum exhaust tool
 - f. Uncontained hydro blasting or high-pressure wash
 - g. Use of chemical strippers containing Methylene chloride.
2. Select the appropriate worksite preparation level.
3. For heat gun work, provide fire extinguishers in the work area and ensure that adequate electrical power is available. Use for limited areas only. Train workers to avoid gouging or abrading the substrate.
4. For mechanical removal methods, use tools equipped with HEPA exhaust capability. Be sure workers keep the shroud against the surface being treated. Vacuum blasting and needle guns should not be used on wood, plaster, drywall, or other soft substrates. Observe all manufacturers directions for the amount of vacuum airflow required.
5. For wet scraping, use a spray bottle or wet sponge attached to the scraper to keep the surface wet while scraping. Apply enough water to moisten the surface completely, but not so much that large amounts of water run onto the ground or floor. Do not moisten areas near electrical circuits.
6. For chemical paint removers, determine if the building component can be removed and stripped offsite. Offsite stripping is generally preferred to onsite paint removal. Observe all manufacturers' directions for use of paint removers.
7. For offsite stripping, determine how to remove the component. Score the edges with a knife or razor blade to minimize the damage to adjacent surfaces. Punch or tag the building component, if similar building components are also being stripped offsite (i.e. doors). This will ensure that the individual component is reinstalled in the same location. Inform the offsite paint remover that the lead-based paint component is present for shipping. Wrap the component in plastic and send to the offsite stripping location. Clean all surfaces before reinstallation and remove any lead residue by HEPA vacuuming all surfaces, cleaning with other lead-specific cleaners, or phosphate detergents, and HEPA vacuuming again.
8. For onsite paint removal, first test the product on a small area to determine its effectiveness. Chemical paint removers may not be effective or desirable on exterior, deteriorated wood surfaces, aluminum, and glass. Provide neoprene, nitrile, rubber, or polyvinyl chloride (PVC) gloves (or other type of glove recommended by the manufacture); face shields; respirators with combination filter cartridges for lead dust and organic vapors(if appropriate); and chemically resistant clothing. Be sure to select the right type of organic vapor filter cartridge, gloves, and clothing for the specific chemical being used. Portable eyewash stations capable of providing a 15-minute flow must be on-site. Apply the chemical and wait the required period of time. Securely store chemical s overnight. For caustic chemical paint removers, neutralize the surface before repainting using glacial acetic acid (not vinegar). Repaint.
9. Make sure all debris is caught in the containment sheet for proper disposal.
10. Mark and legally dispose of waste in accordance with all applicable Federal, State and Local regulations. Most wastes from paint removal projects, such as paint chips and paint remover sludge, will need to be managed as hazardous waste.
11. Conduct clean-up
12. Have a certified risk assessor or inspector technician conduct a clearance examination and provide documentation and a Statement of Lead-Based Paint Compliance.

C. Building Component Replacement

1. Prepare work area by selecting proper worksite preparation level.
2. Prepare the hazardous material building component for removal. Turn off and disconnect any electrical circuits inside or near the building component to be removed.



3. Lightly mist the component to be removed (unless electrical circuits are located nearby).
4. Score all painted seams with a sharp knife.
5. Remove any screw, nails, or other fasteners.
6. Use flat pry instrument and hammer to pry component from the substrate.
7. Remove or bend back all nails.
8. Wrap and seal all bulk components in plastic and take them to a covered truck or secured waste storage area along a pathway covered in plastic. Shovel any debris. Dispose of properly.
9. HEPA vacuum any dust or chips in the area where the component was located.
10. Conduct cleaning and clearance activities.

D. Soil and Exterior Dust Abatement

1. Determine if soil lead hazard exists. For hazard to exist, a total of at least 9 square feet of soil in a single yard or area must be bare and soil concentrations must exceed 2,000µg/gram lead for the yard or building perimeter or 400µg/gram of lead for small, high-contact play areas (pending the development of an EPA soil standard). Bare soil above these levels shall be treated by either interim controls or abatement. Soil abatement is most appropriate when levels of lead are extraordinarily high (greater than 5,000µg/gram lead) and when use patterns indicate contact frequency and exposure will be high.
2. Collect Preabatement soil samples to determine baseline levels. These samples need not be analyzed if post abatement samples are below applicable clearance levels.
3. Determine the method of soil abatement (soil removal and replacement, soil cleaning, or paving). Soil cultivation (rototilling or turning over the soil) is not permitted.
4. If paving, use a high quality concrete or asphalt. Observe normal precautions associate with traffic load weight and thermal expansion and contraction. Obtain necessary permits. Keep soil cultivation to a minimum.
5. If removing and replacing soil.
 - a. Determine if waste soil will be placed in an offsite burial pit. Prepare vehicle operation and soil movement plan. Test new replacement soil (should not contain more than 200 µg/gram lead).
 - b. Contact local utilities to determine location of underground utilities including water, gas, cable TV, electric, telephone, and sewer. Mark all locations to be avoided
 - c. Remove fencing, if necessary to allow equipment access and define set limits with temporary fencing, signs, or yellow caution tape.
 - d. Tie and protect existing trees, shrubs, and bushes.
 - e. Have enough tools to avoid handling clean soil with contaminated tools.
 - f. Remove soil.
 - g. Clean all walkways, driveways, and street areas near abatement area.
 - h. Replace soil at proper grade to allow drainage. Replacement soil should be at least 2 inches above existing grade to allow for settling.
 - i. Install new soil covering (grass or sod) and maintain it through the growing season.
 - j. Determine if soil waste is hazardous and manage it accordingly
 - k. Conduct clean-up and clearance.
 - l. Provide walk-off doormats.
 - m. Maintain proper documentation.

E. Encapsulation

1. Determine if the applicable regulations also encapsulates to be used. Do not encapsulate the following surfaces:
 - a. Friction surfaces, such as window jambs and door jambs.
 - b. Surfaces that fail patch tests.
 - c. Surfaces with substrates or existing coatings that have a high level of deterioration.
 - d. Surfaces in which there is a known incompatibility between two existing paint layers.
 - e. Surfaces that cannot support the additional weight stress of encapsulation due to existing paint thickness.
 - f. Metal surfaces that are prone to rust or corrosion.
2. Conduct field tests of surfaces to be encapsulated for paint film integrity.



3. Consider special use and environmental requirements (i.e. abrasion resistance and ability to span base substrate cracks).
4. Provide to the the Owner encapsulant test data provided by the manufacturer.
5. Conduct at least one test patch on each type of building component where the encapsulant will be used. Report the results to the the Owner.
6. For both nonreinforced and reinforced coatings, use a 6" x 6" test patch area. Prepare the surface in the manner selected to complete the job. Prepared surfaces for patch testing should be at least 2" larger in each direction than the patch area.
7. For fiber-reinforced wall coverings, use 3" x 3" patch. For rigid coatings that cannot be cut with a knife, use soundness test. For all encapsulants, carry out the appropriate adhesion tests.
8. For liquid coating encapsulants, allow coating to cure, then visually examine it for wrinkling, blistering, cracking, bubbling, or other chemical reaction with the underlying paint.
9. Record results of all patch tests and provide to the the Owner.
10. Implement proper work site preparation level.
11. Repair all building components and substrates as needed (i.e. caulk cracks and repair sources of water leaks).
12. Prepare surfaces. Remove all dirt, grease, chalking paint, mildew and other surface contaminants, remnants of cleaning solutions, and loose paint. All surfaces should be deglossed, as needed.
13. Ventilate the contaminated area whenever solvents or chemicals are used.
14. During encapsulant application or installation, monitor temperature and humidity. For liquid coatings monitor coating thickness to ensure that the encapsulant manufacturer's installation/application specifications are followed.
15. Conduct clean up and clearance.
16. Provide the the Owner information on how to care for the encapsulation system properly.
17. Maintain records on the exact detailed locations of encapsulant applications, patch test specifications and results, product name, subcontractor, date of application, a copy of the product label and material Data Safety sheet (MSDS) for the product and provide to the the Owner.

F. Enclosure

1. Stamp, label or stencil all lead-based painted surfaces that will be enclosed with a warning approximately every 2 feet both horizontally and vertically on all components. The Warning shall read "**Danger Lead-Based Paint**". Deteriorated paint should not be removed from the surface to be enclosed.
2. Select the proper worksite preparation level.
3. Attach a durable drawing to the utility room closet showing where lead-based paint has been enclosed in the dwelling.
4. An independent inspector or technician or risk assessor should evaluate the integrity of the enclosure.
5. Repair any unsound substrates and structural members that will support the enclosure, if necessary.
6. Utilize appropriate enclosure material (drywall or fiberboard, wood paneling, laminated products, ridged tile and brick veneers, vinyl, aluminum m, or plywood).
7. Install extension rings for all electrical switches and outlets that will penetrate the enclosure.
8. If enclosing floors, remove all dirt with a HEPA vacuum to avoid small lumps in the new flooring.
9. Seal and back-caulk all seams and joints. Back-caulk means applying caulk to the underside of the enclosure.
10. When installing enclosure directly to painted surfaces, use adhesive and then anchor with mechanical fasteners (screws or nails).
11. Conduct clean up and clearance activities.
12. Maintain proper records and submit a Statement of Lead-Based Paint Compliance.

G. Final Cleaning Procedures

1. Use the following step-by-step procedures



- a. Assign responsibilities to specific workers for cleaning and for maintaining the cleaning equipment.
 - b. Have sufficient cleaning equipment and supplies before beginning work.
 - c. If contamination is extensive, conduct precleaning of the dwelling unit.
 - d. Conduct ongoing cleaning during the job, including regular removal of large and small debris and dust. Decontamination of all tools, equipment and worker protection gear is required before it leaves contaminated areas. Electrical equipment should be wiped and high-efficiency particulate air (HEPA) vacuumed, not wetted down, to minimize electrocution hazards.
 - e. Schedule sufficient time (usually 30 minutes to an hour) for complete daily cleaning, starting at the same time near the end of every workday after lead hazard control activity has stopped.
 - f. For final cleaning, wait at least 1 hour after active lead hazard control activity has ceased to let dust particles settle.
 - g. Use a vacuum cleaner equipped with a HEPA exhaust filter. HEPA vacuum all surfaces in the room (ceilings, walls, trim, and floors). Start with the ceiling and work down, moving toward the entry door. Completely clean each room before moving on.
 - h. Wash all surfaces with lead-specific detergent, high-phosphate detergent, or other suitable cleaning agent to dislodge any ground-in contamination, then rinse. Change the cleaning solution after every room is cleaned.
 - i. Repeat step g above. To meet clearance standards consistently, a HEPA vacuum, wet wash, and HEPA vacuum cycle is recommended. For interim control projects involving dust removal only, the final HEPA vacuuming step is usually not needed. Other cleaning methods are acceptable, as long as clearance criteria are met and workers are not over exposed.
 - j. After final cleaning perform visual examination to ensure that all surfaces requiring lead hazard control have been addressed and all visible dust and debris have been removed. Record findings and correct any incomplete work.
 - k. If other construction work will disturb the lead-based paint surfaces, it should be completed at this point. If those surfaces are disturbed, repeat the final cleaning step after construction work has been completed.
 - l. Paint and otherwise seal treated surfaces and interior floors.
 - m. Conduct clearance examination.
 - n. If clearance is not achieved, repeat final cleaning.
 - o. Continue clearance testing and repeated cleanings until dwelling unit achieves compliance with all clearance standards. The cost of repeated cleaning, after failure to achieve clearance is to be borne by the contractor.
 - p. Do not allow residents to enter work area until final cleaning is completed and clearance is established.
 - q. Cleaning equipment list is as follows:
 - 1) HEPA Vacuums
 - 2) Detergent
 - 3) Waterproof gloves
 - 4) Rags
 - 5) Sponges
 - 6) Mops
 - 7) Buckets
 - 8) HEPA vacuum attachments (crevice tools, beater bar for cleaning rugs)
 - 9) 6-mil plastic bags
 - 10) Debris containers
 - 11) Waste water containers
 - 12) Shovels
 - 13) Rakes
 - 14) Water-misting sprayers
 - 15) 6-mil polyethylene sheeting (or equivalent)
2. Order of execution for final cleaning steps should be as follows:



- a. As the first stage in final cleaning, floor plastic shall be misted and swept.
- b. Upper level plastic, such as on cabinets and counters should be removed first, after it has been misted and cleaned. All plastic should be carefully folded from the corners/ends to the middle to trap any remaining dust. Next remove both layers of plastic from the floor.
- c. Plastic sheets used to isolate contaminated rooms from noncontaminated rooms should remain in place until after cleaning and removal of other plastic sheeting, these sheets may then be misted, cleaned and removed last.
- d. Removed plastic should be placed into double 4-mil or single 6-mil plastic bags, or plastic bags with equivalent (or better) performance characteristics, which are sealed and removed from the premises. As with daily cleanings, this plastic removal process usually requires workers to use protective clothing and respirators.
- e. After plastic has been removed from the contaminated area, the entire area should be cleaned using the HEPA/wet wash/HEPA cycle.

H. Waste Testing And Disposal

1. General: All materials, whether hazardous or non-hazardous shall be properly disposed of. the Owner may hire an independent Monitoring Consultant to perform TCLP test to determine which of the wastes are hazardous. Contractor shall cooperate in this test. If less than 100kg (200 lbs) or 1/2 of a 55 gallon drum of hazardous waste per month will be generated, it is considered "conditionally exempt" abatement waste, and may be managed as solid non-hazardous waste. The RCRA hazardous waste manifest is not required when shipping this waste to an offsite disposal facility.
2. Separate Abatement Waste into The Following Four Categories:
 - a. Category I. Low lead waste (typically non-hazardous) e.g. Filtered personal and commercial wash water.
 - b. Category II. Architectural components - (painted finish carpentry items) e.g. Doors, windows, window trim and sills, baseboards, railings, moldings. (May do a TCLP to determine if they are hazardous).
 - c. Category III. Concentrated lead waste e.g. sludge from stripping, lead-base paint chip and dust, HEPA vacuum debris and filter, unfiltered wash waste, any waste included in EPA's list of hazardous waste.
 - d. Category IV. Material that cannot be determined to be either hazardous or non-hazardous must be tested by TCLP.

If the hazardous waste generated is greater than 100kg per month, dispose according to the referenced guidelines and RCRA hazardous waste management requirements including those listed below.

3. Disposal Requirements: Contact the regional EPA, state, local and all other pertinent authorities to determine lead-based paint debris disposal requirements. Comply with requirements of the Resource Conservation and Recovery Act (RCRA) and with applicable federal, state, county, or local waste requirements.
4. EPA ID Numbers: Obtain a Generator RCRA Hazardous Material ID number and coordinate this action through the State and secure any additional number as required.
5. Storage Requirements: Keep all hazardous items in a secure area or lockable container that is inaccessible to all persons other than the Contractor's personnel. Label all hazardous waste "Hazardous Waste" with the date that the Contractor began to collect the waste in that container. Keep hazardous and non-hazardous waste in separate containers. Until TCLP testing is completed, considered all items hazardous and store in a secured area or lockable container.
6. Waste Transportation: Transport hazardous waste using a RCRA/DOT/EPA certified Hazardous Waste Transporter. Submit names and qualifications of certified transporter/hauler for the Owner approval. The Contractor shall be responsible for all actions of the waste hauler as pertaining to waste removal and disposal under these procedures and all EPA, DOT and other applicable regulations.
7. Disposal Facility: Supply documents that detail the site(s) to be used for ultimate disposal. Submit documents from these sites proving that they are licensed/permitted to accept such waste and shall accept the waste proposed by the Contractor for treatment or ultimate disposal.



8. Waste Containers: Comply with EPA and DOT regulations for waste containers. Contact the state and local authorities to determine their criteria for containers. In the case of any conflict in regulations, the more stringent shall apply.
 9. Emergencies: Contact local fire, police, hospitals or local emergency response teams and inform them of the type of hazardous waste activity and ask for assistance in the event of any accident. Additionally, the container shall provide the following:
 - a. Keep and properly maintain a suitable fire extinguisher(s) on site.
 - b. Have a immediate means of communication with the regulatory agency in the event of an emergency.
 - c. Keep a list of phone numbers of regulatory agencies on site.
 - d. Appoint an emergency coordinator and ensure the coordinator is on site to supervise emergency procedures to be carried out in the event of an emergency.
 - e. Keep and maintain a "right to know" manual that is in an easily accessible location and in an area that is known to all employees.
 10. Transporting Waste: Provide certifications that the transporter is registered with the U.S. Department of Transportation is required by 49 CFR Part 107(a) transport hazardous waste.
 - a. Provide certifications that each vehicle dedicated to haul hazardous waste has been assigned a "U.S. DOT Hazardous Material Registration Number" as required by 49 CFR Part 107.
 - b. Be responsible for all other applicable permits pertaining to hauling, transport, reduction, and disposal of hazardous waste as they may apply to this project.
 - c. Vehicle: Ensure that all non-hazardous waste is transported in covered vehicles to a landfill, or lined landfill, if required.
 - d. Container Handling: Carefully place the containers into the truck or dumpster used for disposal. At no time shall debris or containers be thrown or dropped.
 - e. Liquid Wastes: Contain and properly dispose of all liquid wastes, including lead-contaminated wash water.
 - f. Containers: HEPA vacuum the exterior of all waste containers prior to removing the waste containers from the work area. Wet wipe the containers to ensure that there is no residual contamination. Then move containers out of the work area into the designated storage area.
- I. Clearance
1. Clearance on all abatement projects must be done by an independent certified risk assessor or inspector technician. Follow all jurisdictional law with regard to licensure requirements for personnel conducting clearance activities.
 2. Clearance step-by-step procedures are as follows:
 - a. Finish the lead hazard control clean-up effort. Seal floors before clearance (if necessary).
 - b. Wait 1 hour to allow any airborne dust to settle. Do not enter work area during that hour.
 - c. Conduct visual examination
 - 1) Determine if all required work has been completed and all lead-based paint hazards have been controlled.
 - 2) Determine if there is visible settled dust, paint chips, or debris in the interior or around the exterior.
 - d. Complete the Visual Clearance Form required by the the Owner; if all work is not completed inform the the Owner and order completion of the work and repeat cleanup, if necessary.
 - e. Conduct clearance dust sampling of the floors, interior window sills, and window troughs using approved protocol.
 - f. Conduct soil sampling if bare soil is present that was not sampled previously, or if exterior paint work was completed as part of the lead hazard control effort. Whenever exterior work has been don, it may be necessary to take samples from the soil that is not bare to determine if contamination has occurred. If results are above 1,000 µg/g (or 400 µg/g in high contact play area), compare the results to baseline soil sampling results to determine what additional measures are needed.
 - g. Complete the Dust and Soil Sampling Clearance Form required by the the Owner.



- h. Submit samples to a U.S. Environmental Protection Agency (EPA) recognized laboratory participating in the National Lead Laboratory Accreditation program (NLLAP) for analysis.
- i. Interpret results by comparing them to Interim Clearance Standards as listed below:
 - 1) Floors 400 µg/ft²
 - 2) Window sills 250 µg/ft²
 - 3) Window Troughs 800 µg/ft²
 - 4) Soils (Play area with children under 6 years of age) 400 µg/gram
- j. If clearance is achieved go to step N.
- k. Order repeated cleanings or soil treatments if results are above applicable standards. Clean all surfaces the sample represents.
- l. Continue sampling and repeated cleanings until the dwelling achieves compliance with all applicable clearance standards.
- m. Complete any related construction work that does not disturb a surface with lead-based paint (all work that does disturb painted surfaces or that could generate lead dust should be completed as part of the lead hazard control effort).
- n. Issue any necessary statements of lead-based paint compliance or releases and maintain appropriate records.

J. Labels

- 1. Use the following labels on drums used for disposal.

HAZARDOUS WASTE	
FEDERAL LAW PROHIBITS IMPROPER DISPOSAL.	
IF FOUND, CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY.	
GENERATOR INFORMATION:	
NAME _____	
ADDRESS _____ PHONE _____	
CITY _____ STATE _____ ZIP _____	
EPA- / MANIFEST ID NO. / DOCUMENT NO. _____ / _____	
ACCUMULATION START DATE _____ EPA WASTE NO. _____	
[HAZARDOUS WASTE, SOLID, N.O.S.]	
[_____]	
NA3077	
<small>D.O.T. PROPER SHIPPING NAME AND UN OR NA NO. WITH PREFIX</small>	
HANDLE WITH CARE!	
<small>STYLE HMM12</small>	



WORKPLACE ACCUMULATION CONTAINER		
Proper D.O.T. Shipping Name: _____	HAZARDOUS WASTE	Workplace Accumulation Start Date: <input type="text"/>
UN or NA# _____		
Generator Information:	FEDERAL LAW PROHIBITS IMPROPER DISPOSAL. IF FOUND, CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY. HANDLE WITH CARE!	Waste Accumulation Area: <input type="text"/>
Name: _____		
Facility: _____		
Address: _____		
Phone: _____		
City: _____		
State: _____ Zip: _____		
EPA / Manifest ID No. / Document No. _____		
State Manifest Document No. _____		
EPA Waste No. _____		
		MANEJESE CON CUIDADO CONTIENE DESPERDICIOS TOXICOS



K. Disposal of lead-based paint waste.

1. Follow the RCRA and HUD recommended practices as defined in the table below:

Waste Management Practices	Category I: Low Lead Waste	Category II: Architectural Components	Category III: Concentrated Lead Waste	Category IV: Other waste
RCRA Requirements	Manage as nonhazardous Waste	Depending upon knowledge or TCLP testing results, manage as solid hazardous or nonhazardous waste	If more than 100 kg/ month, manage as hazardous waste. If less than 100 kg/month manage as solid waste.	Use TCP to determine if waste is hazardous.
HUD Recommended Practices	Applicable	Applicable, if knowledge or TCLP testing indicates that it is nonhazardous.	Applicable if less than 100 kg/month otherwise subject to full RCRA regulations	Only applicable if TCLP testing shows waste is nonhazardous
Wrapped in plastic; seal all seams with tape (if acceptable to the disposal facility).	X	X	X	X
Stored in designated, secure area.	X	X	X	X
Covered During Transport	X	X	X	X
Prohibit cutting/breaking outside work area.	X	X	X	X
Cover ground with 6-mil plastic if handling outside.	X	X	X	X
Prohibit disposal in solid waste incinerators and reuse recycling for mulch	X	X	X	X
Recommended disposal in State licensed/permitted	X	X	If appropriate.	X



solid waste landfill.				
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L. Safety Requirements

1. To protect the health and safety of all persons involved, it is of the utmost importance that deleading is safely and correctly done in a timely manner. The following specific safety requirements are the responsibility of the Deleading Contractor.

K. General Safety:

1. General
 - a. NO ONE is to be allowed in the work area without an approved respirator except for methods that have been documented not requiring a respirator.
 - b. Each work area must be sealed from the remainder of the dwelling by taping plastic sheets (6 mil thick). Work areas must remain sealed off until both work and clean-up are completed.
 - c. Cover all floors, carpets, furniture and appliances with 6 mil plastic within the work area. Use automotive masking tape (2 inches wide) to seal all edges and seams.
 - d. Make certain all electrical connections are properly grounded.
 - e. At least three days prior to the start of any deleading work, post appropriate warning signs at all entrances and exits of work areas and leave in place until all clearance testing indicates that these areas are safe for re-occupancy. The signs must include the following phrase: "CAUTION LEAD HAZARD-KEEP OUT". Post bilingual signs when necessary.
2. Worker Safety: The Deleading Contractor shall take the following minimum precautions to protect the health of all individuals involved in the deleading process.
 - a. Pre-Abatement Medical Exam: Each employee shall undergo a medical examination to determine both respiratory fitness capability and also pre-existing/current blood lead level. Said results shall be provided to the employee and also to the Owner within 3 days of receipt of same, and in all cases, prior to employee's commencement to active abatement. Records of same are required to be kept by the Contractor for 40 years.
 - b. Medical Surveillance is the monitoring of worker blood levels. It is required that the Contractor have blood level monitoring of all active abatement and clean-up workmen and on-site supervisors performed and said results provided to the Owner.
 - 1) Before assignment to active abatement activity for each worker.
 - 2) 30 days after active abatement has begun.
 - 3) At least every two months during the first six months and every six months throughout the deleading job.
 - 4) At least every two months for each employee whose blood lead analysis indicated a blood lead level at or above 25 micrograms per deciliter. (20 micrograms per deciliter for women of child bearing age).
 - 5) At termination of employment.
 - 6) Contractor shall reassign any employee whose blood lead has reached 25 µg/dl (20 µg/dl for women of child bearing age) to a job function deemed safe from lead exposure. Said employee shall remain away from active abatement until such time as 2 consecutive months' blood tests indicate µg/dl below 20 µg/dl.
 - c. Respiratory Protection Programs must be established by the Contractor in accordance with OSHA regulations and qualitative respirator fit testing must be conducted daily by the on-site supervisor. Medical examinations must be performed by a physician prior to fit testing and at anytime when a worker demonstrates any difficulty breathing during the use of or the fit testing of respirators. The following are minimal acceptable respiratory protection program requirements as set up and administered by the Contractor:
 - 1) Written standard operating procedures which oversees the selection and use of respirators.
 - 2) Selection of respirators on the basis of hazards to which the worker is exposed.
 - 3) Worker training on the limitations and use of respirators (includes fit testing).
 - 4) Individual workers assigned respirators for their exclusive use only.



- 5) Daily cleaning and disinfecting of respirators.
- 6) Proper storage of all respirators.
- 7) Proper inspection of all respirators for wear and tear.
- 8) Continual surveillance of work area conditions and level of worker exposure or stress.
- 9) Use of approved respirators only, modified as needed by the weekly exposure monitoring results.
- 10) Supply weekly report covering items 1-9 to the Owner or its Lead Consultant.
- d. Exposure Monitoring is the measured concentration of lead in the workers breathing zones. The Contractor shall perform personnel monitoring during active abatement using the NIOSH 7072 method and shall be responsible for:
 - 1) Monitoring the level of worker protection needed during the abatement process;
 - 2) Evaluating, modifying and improving any engineering and work practice control(s) as needed;
 - 3) Evaluating each employee's personal quality of work and any need for additional worker training or safety instruction;
 - 4) Providing the Owner results of all personnel monitoring tests within 10 days of testing; and
 - 5) Providing half-face APR respirators with HEPA filters unless said monitoring test results dictate differently. OSHA guidelines shall be used to determine respirator PEL protection factors.
- e. Protective Clothing Equipment must be provided to all workers to help assure that lead dust is contained to the work areas. The following must be supplied/enforced by the Deleading Contractor:
 - 1) Full body protective clothing and shoe covers of appropriate sizes on a daily basis or as needed.
 - 2) Clean changing areas separated from the dirty/contaminated clothes storage area.
 - 3) Water and wash facilities for washing of hands and face and shower facilities if deemed necessary by the Owner's Lead Advisor.
 - 4) Instructing worker on proper maintenance of clothing and equipment.
 - 5) Proper disposal of disposable clothing and proper permanent work clothes.
 - 6) Enforcing the removal of protective clothing at the end of each work day and before eating, drinking and smoking.
 - 7) Enforcement of the removal of protective shoe covers before leaving work area.
3. Contractor/Worker Daily Safe-Work Procedures
 - a. Daily Start-Up:
 - 1) Workers to put on protective gear prior to entering work areas.
 - 2) All garment seams to be sealed with duct tape.
 - 3) All non-working garments must be stored in designated changing area.
 - 4) Respirators, as required, must be properly fitted before entering work area. Perform qualitative fit test.
 - b. Temporary depart:
 - 1) All protective clothing to be HEPA vacuumed while still being worn.
 - 2) All shoe covers to be removed and left in the work area (immediate departure upon removing).
 - 3) Remove all protective gear in designated "contaminated" changing area before eating, drinking, and smoking or before leaving work site.
 - 4) Wash hands and face.
 - 5) Clean respirators.
 - c. Daily Shut-Down:
 - 1) Dispose of protective clothing with abatement waste by sealing in a 6 mil poly bag.
 - 2) Laundered clothes must be placed in closed container.
 - 3) Wash hands and face.
 - 4) Shower if facilities allow and circumstances dictate.
 - 5) Clean all protective gear (respirators included).



4. Tenant's Safety: Temporary relocation of the tenants is necessary if the lead paint surface is broken. Temporary relocation of the tenants and their belongings is the responsibility of the Owner. However, the Contractor has the joint responsibility to administer and enforce the following safety practices on behalf of the occupants:
 - a. Adults
 - 1) NO OCCUPANT is allowed to enter the work area during paint removal and initial clean-up. A three day clean-up and settlement period may be imposed depending upon the abatement procedures used, at the discretion of the Owner or their Lead Consultant.
 - 2) the Owner shall notify all occupants in writing when they are allowed to return to their post-abated residence. Contractor shall abide by these notices.
 - 3) Every resident who has received prior notice of abatement is responsible for placing all personal items (clothing, dishes, linens, etc.) in closed, easy to handle containers; and move such items to the center of each room as requested.
 - 4) As long as visible dust remains, occupants may not occupy dwelling, and all surfaces within the dwelling must be re-washed with trisodium phosphate and HEPA vacuumed by deleading contractor.
 - 5) Persons reoccupying dwellings following abatement are required to report any visible dust or debris to the Owner immediately for additional Contractor clean-up.
 - b. Pregnant Women and Children
 - 1) Absolutely no pregnant women nor children under the age of twelve years of age may be allowed in the building while any part of the abatement process is going on.

END OF SECTION 02 83 19 13a



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SECTION 02 83 19 13b - XRF TESTING FOR LEAD-BASED PAINT**1.1 DESCRIPTION OF WORK**

- A. This specification covers the furnishing and installation of materials for XRF testing for lead-based paint. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 SUMMARY

- A. The Contractor shall perform work in accordance with the latest HUD Guidelines, in accordance with all applicable regulations of the Environmental Protection Agency (EPA), Occupational Safety & Health Agency (OSHA) and any applicable State or Local standards that may be more stringent than the Federal Standards except, as such guidelines are modified by the Owner in writing in this contract or any contract pursuant to this contract.
- B. Workmanship required in the execution of the work herein specified shall be of good quality and subject to the approval of the the Owner.

1.3 SUBMITTALS

- A. Notification Before Start of Work
 1. The Contractor shall send notices to the Project Superintendent, Residents, and the Department of Planning and Development 48 hours before the scheduled start of work. The Contractor shall make three (3) attempts to gain entry to each apartment, with proper 48 hour notification to the resident each time.
 2. The Contractor shall begin work no later than 48 hours after receiving a work proceed order.
- B. Copies of the submissions listed below must be tendered with the bid:
 1. Ability to perform XRF testing and paint chip sampling by submitting evidence of the successful completion of lead inspector training by all staff to be assigned to the job including inspector technicians. Training must be provided through a State approved EPA-Model program. All staff assigned to the Contract must also demonstrate training in the use of the XRF testing machines to be dedicated to this contract. The serial number of such XRF machine shall be provided to the Owner.
 - a. Contractor or Subcontractor performing the work must have at least 3 years of satisfactory experience (documented) in performing XRF testing for a City, State or Federal Agency.
 2. Laboratory certification by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.
 3. If a subcontractor will be used for any of the laboratory work of this contract, evidence of certification stated above must also be provided for the subcontractor.

C. XRF Testing Report Format



- a. All XRF report must be made after a formal submittal and approval by the Owner.
- b. A faxed summary report must be provided to the the Owner within 48 hours after completion of testing for a work Authorization. For XRF testing requiring confirmation by laboratory analysis of paint chip samples, the faxed summary report must be provided within 48 hours after the the Owner gives approval for testing of the collected paint chip samples.
- c. A detailed report must be provided to the the Owner within 5 business days after completion of the testing.

1.4 QUALITY ASSURANCE

- A. The work shall consist of furnishing all labor, material, insurance and all other incidental items required to do the following:
 1. XRF Testing
 - a. Random or comprehensive testing of various components in single family housing units, multi-family housing units, common areas and exterior sites, using any of the approved X-ray Fluorescence ("XRF") machines, to determine if the lead-based paint concentration is within permissible limits.
Note: Testing may be for entire apartments or selected rooms or components within the apartment.
 - b. The permissible limit shall be defined as a final reading showing a lead concentration of less than 1.0 mg/cm².
 - c. Refer to the Manufacturer's manual, as well as the "XRF Performance Characteristic Sheet" when determining calibration check tolerance, and other instrument specific information. Use the adjusted "XRF Performance Characteristic Sheets" in this contract when determining the inconclusive range.
 - d. In addition to the manufacturer's recommended warm up and quality control procedures, a set of three nominal XRF calibration check readings must be taken before the inspection begins and after the inspection has been completed in a particular unit, or every 4 hours, whichever occurs first. All reference material values and calibration check readings must be included in the report provided to the Owner.
 - e. Do not use the XRF to test highly curved or ornate surfaces, or surfaces inaccessible to the XRF, due to poor reliability of results. For such surfaces, laboratory analysis of paint chips must be done.
 - f. Only one XRF reading is required per testing combination. A unique testing combination is characterized by the room equivalent, the component, the substrate and the visible color of the paint. However, testing combinations with different colors on the same component and substrate may be combined into a single component type.
 - g. All inconclusive results must be treated according to the inspection rules using multi-family inspection or single family inspection rules as appropriate.
 - h. XRF field data sheets shall be filled out as they appear on completed Form 7.1 ("Single-Family Housing LBP Testing Data Sheet") and 7.5 ("Multifamily Housing LBP Testing Data Sheet") in HUD Guidelines.
 - i. Room equivalents or sections thereof that are not accessible for testing (i.e. locked bedrooms) shall be noted in the final report to the Owner.
 2. Laboratory testing of paint chips.
 - a. Collection of paint chips from various painted components for laboratory analysis due to XRF substrate corrected inconclusive and/or positive readings as directed by the the Owner.



- b. Laboratory preparation and testing by Flame Atomic Absorption Spectrometry (FAAS) or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) to determine if the lead paint concentration is within permissible limits.
 - c. The permissible limit shall be defined as a lead concentration less than 0.5% by weight.
 - d. Collect paint chips in accordance with ASTM ES28-94.
 - e. Prepare paint chips in the laboratory for testing in accordance with ASTM ES37-94.
 - f. Repair and repaint areas from which paint chips have been collected, to match adjacent areas, unless notified by the the Owner in writing to utilize a temporary covering for the tested surfaces. The Contractor shall provide water based latex paint for this purpose. Colors shall be limited to white and off-white; and other colors if provided by the tenant.
 - g. Only one paint chip is required per testing combination. A unique testing combination is characterized by the room equivalent, the component, the substrate, and the visible color of the paint. However, testing combinations with different colors on the same component and substrate may be combined into a single component type.
 - h. Field data sheets and signed chain of custodies must be attached to the final report to the Owner.
- B. Occupied Residences
1. Some of the work of this contract will be in occupied apartments. The Contractor shall perform all of the work of this contract with the least inconvenience to the tenants.
 2. The Contractor shall take all necessary precautions to protect the property of the the Owner, its residents and the public. The contractor must repair any damaged property, whether of the the Owner, its residents, or the public, and restore such property to its original condition. If the damage is beyond repair, the Contractor shall replace it with new, that in the judgement of the the Owner, match the existing materials and are of equal quality and workmanship. All such repairs shall be at the Contractor's expense.
- C. Applicable Regulations
1. ASTM Standards
 - a. ASTM E 1583 on evaluating laboratories used to determine lead levels;
 - b. ASTM E 1605 on terminology;
 - c. ASTM E 1613 on determining lead by atomic emission or atomic absorption spectroscopy;
 - d. ASTM E 1645 on laboratory preparation of paint-chip samples;
 - e. ASTM E 1775 on-site extraction and field portable stripping voltammetry analysis for lead;
 - f. ASTM PS 53 on identifying and managing lead in facilities;
 - g. ASTM PS 87 on ultrasonic extraction for later analysis for lead;
 - h. ASTM PS 88 on determining lead by portable electro analysis
 2. OSHA Standards (without limitation), include:
 - a. 29 CFR 1926.20 - General safety and health provisions;
 - b. 29 CFR 1926.21 - Safety training and education;
 - c. 29 CFR 1925.25 - Housekeeping;
 - d. 29 CFR 1926.28 - Personal protective equipment;
 - e. 29 CFR 1926.51(f) - Washing facilities;
 - f. 29 CFR 1926.55 - Gases, vapors, fumes, dusts, and mists;
 - g. 29 CFR 1926.57 - Ventilations;
 - h. 29 CFR 1926.59 - Hazardous Communication Standards;
 - i. 29 CFR 1926.10 - Respiratory protection; and
 - j. 29 CFR 1926.62 - Lead in Construction
 3. The Contractor must comply with all applicable requirements of the Resource Conservation & Recovery Act (RCRA) of 1976 as amended in 1980 and 1984 by the Hazardous & Solid Waste Amendments (HSWA).



4. The Contractor must follow the XRF Performance Characteristic Sheet (PCS) for all inspection activities. XRF PCSs are available from the National Lead Information Center Clearinghouse or through the HUD website at <http://www.hud.gov/offices/lead/lbp/hudguidelines/allpcs.pdf>.

1.5 PRODUCTS

- A. XRF Instruments and Testing Protocols
 1. The Contractor shall use XRF instruments that are approved by the Owner.
 2. XRFs must be used in accordance with the manufacturer's instructions and the XRF Performance Characteristic Sheet. If discrepancies exist between the XRF Performance Characteristic Sheet, the HUD Guidelines and the manufacturer's instructions, the most stringent guidelines should be followed.

1.6 EXECUTION

- A. Inspection and Testing
 1. **Single Family Testing Rules**
 - a. If the housing development has less
 - 1) than 10 units built between 1960-1970 or
 - 2) 20 units built before 1960 or
 - 3) the random testing rules in a multi-family development are not being used then single family testing rules must be followed.
 - b. List all testing combinations (see HUD Guidelines Table for an example) in all interior rooms, on all exterior building surfaces, and on surfaces in other exterior areas, such as fences, playground equipment, and garages. The "SingleFamily Housing LBP Testing Data Sheet" (see HUD Guidelines) or a comparable data collection instrument may be used for this purpose.
 - 1) Test all room equivalents inside and outside the dwelling unit. The final report must include a final determination of the presence or absence of lead-based paint on each testing combination in each room equivalent.
 - 2) Inspect each testing combination in each room equivalent, unless similar building component types with identical substrates (such as windows) are all found to contain lead-based paint in the first five interior room equivalents. In that case, testing of that component type in the remaining room equivalents may be discontinued, if and only if the Owner agrees beforehand to such a discontinuation. The inspector should then conclude that similar building component types in the rest of the dwelling unit also contain lead-based paint.
 - 3) Painted furniture that is physically attached to the unit (for example, a desk or dresser that is built-in) should be included in the inspection as a testing combination.
 - 4) Results of an inspection may be summarized by classifying component types across room equivalents if patterns or trends are supported by the data.
 - 5) All substrates across all room equivalents should be grouped into one of the six substrate categories (brick, concrete, drywall, metal, plaster, or wood).
 - c. Number and Location of XRF Readings
 - 1) XRF testing is required for at least one location per layers of paint should be included and the XRF probe testing combination, except for interior and exterior faceplate should be able to lie flat against the surface walls, where four readings should be taken, one on of the test location each wall.
 - 2) For interior and exterior walls: take at least four readings (one of ea. wall). If there are more than four walls test the four largest walls, calculate the average of the



- readings, round the result to same number of decimal places as the XRF instrument displays, and classify the remaining walls with the same painting history as the tested walls, based on this rounded average. When the remaining walls in a room equivalent clearly do not have the same painting history as that of the tested walls, test and classify the remaining walls individually.
- 3) Select areas of paint which are most likely to have old paint or coatings, where areas of paint appear thickest. Avoid testing where paint has worn away, chipped; or over pipes, electrical surfaces, nails, and any other possible interferences.
 - 4) A numbering system, floor plan, sketch or other system may be used to document which testing combinations were tested and sufficiently detailed enough for another individual to find them.
 - a) Side identification Identify perimeter wall sides with letters A, B, C, and D (or numbers or Roman numerals). Side A for single-family housing is the street side for the address. Side A in multi-family housing is the apartment entry door side. Side B, C, and D are identified clockwise from Side A as one faces the dwelling; thus Wall B is to the left, Wall C is across from Side A, and Side D is to the right of Side A. Each room equivalent's side identification follows the scheme for the whole housing unit. Because a room can have two or more entries, sides should not be allocated based on the entry point. For example, giving a closet a side allocation based on how the room is entered would make it difficult for another person to make an easy identification, especially if the room had two closets and two entryways.
 - b) Room Equivalent Identification Room equivalents should be identified by both a number and a use pattern (for example, Room 5-Kitchen). Room 1 can always be the first room, at the A-D junction at the entryway, or it can be the exterior. Rooms are consecutively numbered clockwise. If multiple closets exist, they are given the side allocation: for example, Room 3, Side C Closet. The exterior is always assigned a separate room equivalent identifier.
 - c) Sides in a Room Sides in an interior room equivalent follow the overall housing unit side allocation. Therefore, when standing in any four-sided room facing Side C, the room's Side A will always be to the rear, Side B will be to the left, and Side D will be to the right.
 - d) Building Component Identification Individual building components are first identified by their room number and side allocation (for example, the radiator in Room 1, Side B is easily identified). If multiple similar component types are in a room (for example, three windows), they are differentiated from each other by side allocation. If multiple components are on the same wall side, they are differentiated by being numbered left to right when facing the components. For example, three windows on Wall D are identified as windows D1, D2, and D3, left to right. If window D3 has the only old original sash, it is considered a separate testing combination from the other two windows. Codes or abbreviations for building components and/or locations may be used in order to shorten the time needed for data entry. If codes or abbreviations are used, the inspection records and the inspection report must include a table showing their meaning.
 - d. XRF Instrument Reading Time
 - 1) The recommended time to open an XRF instrument's shutter to obtain a single XRF result for a testing location depends on the specific XRF instrument model and the mode in which the instrument is operating. Follow manufacturer's instructions per HUD Guidelines.
 - e. XRF Calibration Check Readings
 - 1) Follow manufacturer's instructions per HUD Guidelines.

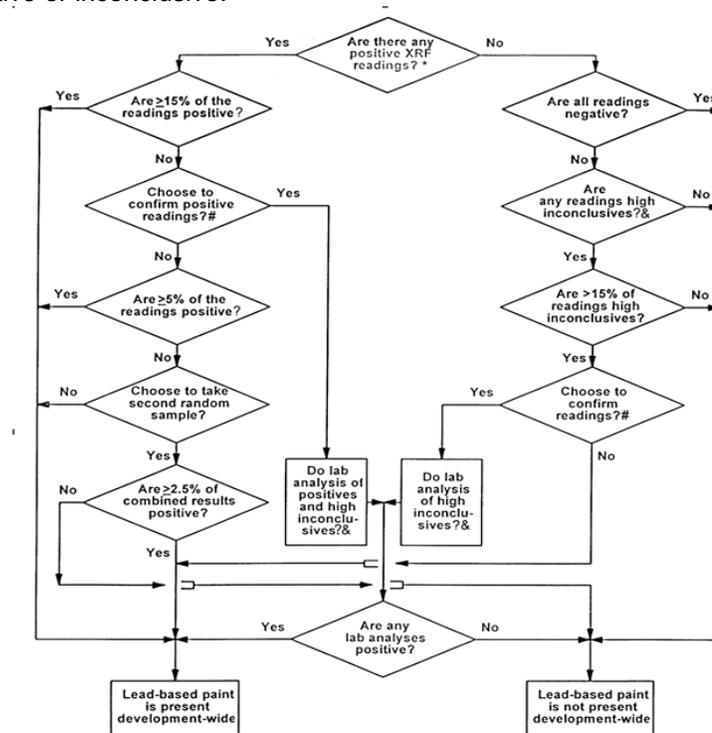


f. Substrate Correction

- 1) The XRF measurements, corrected for substrate contribution, if required by the Performance Characteristic Sheet ("PCS") for the particular type of instrument being used, should be sorted by the inspector by component type into the following categories:
 - a) Positive- A positive XRF reading in accordance with the XRF's Performance Characteristic Sheet.
 - b) Negative- A negative XRF reading in accordance with the XRF's Performance Characteristic Sheet.
 - c) High Inconclusive- An inconclusive XRF reading equal to or greater than the midpoint of the XRF's inconclusive range, in accordance with the XRF's Performance Characteristic Sheet.



- g. The following Decision analyses will be used to determine which components are positive, negative or inconclusive:



* "Positive," "negative," and "inconclusive" XRF readings are determined in accordance with the XRF instrument's Performance Characteristics Sheet as described in the HUD Guidelines for the Evaluation and Control of Lead Hazards in Housing, chapter 7.
 & A high inconclusive reading is an XRF reading at or above the midpoint of the inconclusive range. For example, if the inconclusive range is 0.41 to 1.39, its midpoint (average) is 0.90; a reading in the range from 0.90 to 1.39 would be a high inconclusive reading.
 # Any paint or coating may be assumed to be lead-based paint, even without XRF or laboratory analysis. Similarly, any XRF reading may be confirmed by laboratory analysis.

- 1)
- 2) All inconclusive results must be confirmed with laboratory analysis, or as an alternative must be classified as positive. the Owner may also wish to confirm positive XRF results with laboratory analysis. Therefore the Contractor must make a field determination of which XRF readings falls in the inconclusive or positive ranges and take paint chip samples during the XRF testing for possible laboratory analysis. If the majority of XRF readings are positive in the first few units, the inspector must consult with the Owner on whether to continue taking paint chip samples. Only the Owner may determine whether to submit collected paint chip samples for laboratory analysis or to classify the element as positive.

2. Multi-family Housing Testing Rules (Random Sampling)

- a. In order to use the Multi-family housing testing rules, there must multi-family housing is defined as any group of more than four units that are similar in construction from unit to unit
- b. Determine the number of randomly selected units to be tested in accordance with Table 7.3, below. Chapter 7 of the HUD Guidelines also describes how to select the units randomly. If a unit or units which were selected as part of the original random sample cannot be entered for a particular reason, a replacement unit(s) must be randomly selected in accordance with the HUD Guidelines.



Table 7.3 Number of Units to be Tested in Multi-family Building or Developments*

Number of Similar Units, Similar Common Areas, or Similar Exterior Sites	Pre-1960 or Unknown-Age Building or Development: Number of Units to Test *	1960-1977 Building or Development: Number of Units to Test *
1-10	All	All
11-13	All	10
14	All	11
15	All	12
16-17	All	13
18	All	14
19	All	15
20	All	16
21-26	20	16
27	21	17
28	22	18
29	23	18
30	23	19
31	24	19
32	25	19
33-34	26	19
35	27	19
36	28	19
37	29	19
38-39	30	20
40-48	31	21
49-50	31	22
51	32	22
52-53	33	22
54	34	22
55-56	35	22
57-58	36	22
59	37	23
60-69	38	23
70-73	38	24
74-75	39	24
76-77	40	24



Number of Similar Units, Similar Common Areas, or Similar Exterior Sites	Pre-1960 or Unknown-Age Building or Development: Number of Units to Test *	1960-1977 Building or Development: Number of Units to Test *
78-79	41	24
80-88	42	24
89-95	42	25
96-97	43	25
98-99	44	25
100-109	45	25
110-117	45	26
118-119	46	26
120-138	47	26
139-157	48	26
158-159	49	26
160-177	49	27
178-197	50	27
198-218	51	27
219-258	52	27
259-279	53	27
280-299	53	28
300-379	54	28
380-499	55	28
500-776	56	28
777-939	57	28
940-1004	57	29
1005-1022	58	29
1023-1032	59	29
1033-1039	59	30
1500	87	44
2000	116	58
2500	145	73
3000	174	87
3500	203	102
4000	232	116

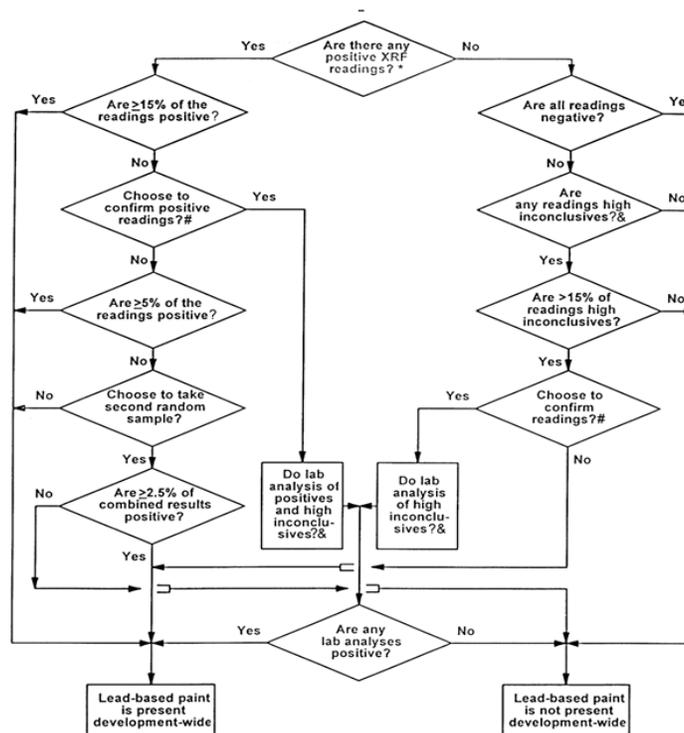
* For brevity, "Number of Units" and "Number of Units to Test" are used, but the number to test is the same for similar units, similar common areas, and similar exterior sites.



- c. An assessment on each tested component must note four attributes, also called a testing combination.
 - 1) The room equivalent (where the testing took place i.e. bedroom, bathroom, etc.)
 - 2) The component type (door, wall #1 - upper left, etc.)
 - 3) The substrate (brick, wood, concrete, drywall, plaster or metal).
 - 4) The color of the paint.
- d. These attributes must be included as part of the report.
- e. For each testing combination, the condition of the painted surfaces should be noted as either intact, fair or poor.
- f. One reading with the X-ray fluorescence (XRF) instrument on each testing combination is all that is required.
- g. At least 40 components of a given type must be tested to obtain the desired level of confidence in the results throughout the multi-family development. If less than 40 components of a given type exist in the buildings to be tested i.e. they are unique components, then the measurement should be taken using single family testing rules (described below). If less than 40 components of a given type exist in the units to be tested, additional components of this type can be identified in other units in the complex and tested to bring the total up to 40 so that multi-family testing rules can be used. The decision of which option the Contractor should use will be made by the the Owner.
- h. To increase the number of tested components of a given type, testing combinations with different colors on the same component and substrate may be combined into a single component type. For example, if "wood doors" is the component type, all wood doors tested for lead-based paint could belong to the same component type, regardless of color.
- i. A component type may be differentiated by color as long as there are 40 tested and there is a good reason for differentiation.
- j. The XRF measurements, corrected for substrate contribution, if required by the Performance Characteristic Sheet ("PCS") for the particular type of instrument being used, should be sorted by the inspector by component type into the following categories:
 - 1) Positive- A positive XRF reading in accordance with the XRF's Performance Characteristic Sheet.
 - 2) Negative- A negative XRF reading in accordance with the XRF's Performance Characteristic Sheet.
 - 3) High Inconclusive- An inconclusive XRF reading equal to or greater than the midpoint of the XRF's inconclusive range, in accordance with the XRF's Performance Characteristic Sheet.



- k. The following Decision analyses will be used to determine which components are positive, negative or inconclusive:



* "Positive," "negative," and "inconclusive" XRF readings are determined in accordance with the XRF instrument's Performance Characteristics Sheet as described in the HUD Guidelines for the Evaluation and Control of Lead Hazards in Housing, chapter 7.
& A high inconclusive reading is an XRF reading at or above the midpoint of the inconclusive range. For example, if the inconclusive range is 0.41 to 1.39, its midpoint (average) is 0.90; a reading in the range from 0.90 to 1.39 would be a high inconclusive reading.
Any paint or coating may be assumed to be lead-based paint, even without XRF or laboratory analysis. Similarly, any XRF reading may be confirmed by laboratory analysis.

- l. If there are readings on a component type(s) equal to or greater than 1.0 mg/cm² and paint chip samples are submitted to the laboratory, there are two possible results:
- 1) If all lab samples on a component type are below 0.5% lead by weight, the component type can be classified as negative throughout the development.
 - 2) If one or more lab results are positive, (equal to or greater than 0.5% lead by weight for a component) the the Owner will take one of three options:
 - a) Treat the component type as positive throughout the development, or
 - b) Test the component type throughout the development, or
 - c) If 5% or less of the component type are positive, take a second random sample, just testing that component type.
 - 3) If option 2)c) above is selected by the Owner and the combined results of the first and second random sample are less than 2½% positive, the following additional options are available depending on the results.
 - a) If no positives are found in the second sample, no further testing is necessary. Those positives in the first random sample will be monitored/abated (not by this Agreement), but the rest of the component type can be classified as negative.



- b) If positives are found on a component type in the second sample, the the Owner has the option to classify the component type as positive throughout the development or comprehensively test it.
 - c) If the combined results of the two random samples are equal to or greater than 2½%, the the Owner also has the option to comprehensively test the remaining components of that type or classify them as positive.
 - m. **Paint Chip Sample Size:** The Paint chip samples should be taken from a 4 square inch (25 square centimeter) area that is representative of the paint on the testing combination, as close as possible to any XRF reading locations and, if possible, unobtrusive. This area may be a 2" x 2" (5 x 5 centimeters) square, or a 1" x 4" (2.5 x 10 centimeters) rectangle, or have any other dimensions that equal at least 4 square inches (25 square centimeters). Regardless of shape, the dimensions of the surface area must be accurately measured (to the nearest millimeter or 1/16th of an inch) so that the laboratory results can be reported in mg/cm². Results should be reported as percent by weight if the surface area cannot be measured accurately or if all paint within the sampled area cannot be removed. In these cases, lead should be reported in ppm or percent weight, not in mg/cm². Smaller surface area can be used if acceptable to the laboratory. (See ASTM E 1729). In all cases those who take the samples should consult with the NLAAP recognized laboratory selected regarding the requirements for the submission samples for lead-based paint analysis.
 - n. If the the Owner decides to test in search of these hard-to-find components coated with lead based paint, the inspector must use the single family testing rules described in the previous section.
- 3. Common Areas and Exterior Sites Testing Rules**
- a. Similar common areas and similar exterior sites must always be tested, but in some cases they can be sampled in much the same way that dwelling units are. Common areas and building exteriors typically have a similar painting history from one building to the next. In multifamily housing, each common area (such as building lobby, laundry room, or hallway) can be treated as a dwelling unit. If there are multiple similar common areas, they may be grouped for sampling purposes I exactly the same way as regular dwelling units. However, dwelling units, common areas and exterior sites cannot be all mixed together in a single group. All testing combinations within each common area or building exteriors selected for testing must be inspected. This includes playground equipment, benches and miscellaneous testing combinations located throughout the development. The specific common areas and building exteriors to test should be randomly selected, in much the same way as specific units are selected using random numbers. The number of common areas to be tested should be taken from table 7.3 (HUD Guidelines). In this instance, common areas and building exteriors can be treated in the same way as housing units (although they are not to be confused with true housing units).
- 4. Unit and Common Area Drawings**
- a. Mark-ups of as built drawings depicting room equivalents that are tested must be provided as part of the report.
 - b. The Contractor should test in a clockwise path starting from the door through the space and room equivalents so that the approximate location of each component tested can be easily established by referencing the room equivalent and sides.
 - c. Each space must have a reference point (side A, B, C, D or wall 1, 2, 3 or 4). The wall with the door should always be referenced as wall 1 or side A. If there is more than one door, wall 1 or side A should be used to refer to the wall with the door through which the room is first entered when moving in a clockwise fashion through the unit.

B. Evaluation of the Inspection by the the Owner



1. The Contractor will be required to carry out retesting at no additional cost to the the Owner, after completion of the Inspection at each the Owner's development as described in the HUD Guidelines, for single family housing, multi-family housing and common areas. The the Owner shall randomly select the testing combinations to be retested and the Contractor shall perform the retesting using the same XRF instrument(s) which was/were used to take the original readings. An the Owner's inspector shall be present to observe all retesting. The retesting shall be limited to ten (10) testing combinations, and if necessary to repeat the retest, the testing combinations randomly selected for repeating the retest shall also be limited to ten.
 2. If the retest tolerance limit computed from the information provided in the "XRF Performance Characteristics Sheet" (see HUD Guidelines) is exceeded, the retest will be repeated as described in the HUD Guidelines for single family, multi-family housing and common areas. If the retest tolerance limit is exceeded again, the the Owner may require the Contractor to retest the entire development at no additional cost to the the Owner, or the the Owner may withhold all payments and terminate its agreement with the Contractor.
- C. Option to do Laboratory Testing only
1. The the Owner may, for a specific testing assignment, request in writing that the Contractor, when utilizing the multi-family housing testing rules for random sampling, or the single family housing testing rules, do all testing through laboratory analysis of paint chips rather than through XRF Spectrum Analyzer testing with laboratory confirmation as needed. Please note that under the single family housing testing rules, only one paint chip must be taken and analyzed for each component type.
- D. Waste Disposal
1. All waste generated must be legally disposed in accordance with Federal, State and Local regulations.

END OF SECTION 02 83 19 13b



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SECTION 02 83 19 13c - LEAD DUST WIPE, AIR AND TCLP SAMPLING AND ANALYSIS**1.1 DESCRIPTION OF WORK**

- A. This specification covers the furnishing and installation of materials for lead dust wipe, air and TCLP sampling and analysis. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 GENERAL

- A. Definitions: Unless otherwise specified the following definitions shall apply:
1. **"Approved"**: shall mean approved by all public agencies having jurisdiction, and the Owner.
 2. **"The Owner"**: shall mean the Owner and its designated authorized representatives.
 3. **"Contractor"**: shall mean the firm that is awarded this contract and is responsible to ensure compliance with Federal, State and City regulations as well as these Contract documents.
 4. **"Development or Project"**: a group of buildings in one or more designated geographical locations, owned or operated by the Owner and referred to by a common name by the Owner.
 5. **"Dust Cleaning Firm"**: shall mean the contractor under a separate contract or the Owner responsible for cleaning of lead dust, as directed by the Owner, until the clearance levels are achieved, as defined in the "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, June 1995" or latest edition published by the United States Department of Housing and Urban Development (HUD).
 6. **"Equal or Approved Equal"**: shall mean equal in the opinion of the Owner.
 7. **"HUD"**: the United States Department of Housing and Urban Development.
 8. **"HUD Guidelines"**: shall mean Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing issued by HUD'S Office of Lead-Based Paint Abatement and Poisoning Prevention in June 1995 except as such guidelines are later modified by HUD and/or modified by the Owner in writing pursuant to this contract.
 9. **"Inspector"**: an individual who has completed training from an accredited program and been licensed or certified by the appropriate State or local agency to (1) perform inspections to determine and report the presence of lead-based paint on a surface-by-surface basis through on-site testing, (2) report the findings of such an inspection, (3) collect environmental samples for laboratory analysis, (4) perform clearance testing, and (5) document successful compliance with lead-based paint hazard control requirements or standards.
 10. **"Lead-Based Paint"**: any paint, varnish, shellac, or other coating that contains lead equal to or greater than 1.0 mg/cm² as measured by XRF or laboratory analysis, or 0.5 percent by weight (5,000 µg/g, 5,000 PPM, or 5,000 mg/kg) as measured by laboratory analysis.
 11. **"Lead-Based Paint Hazard"**: a condition in which exposure to lead from lead-contaminated dust, lead-contaminated soil or deteriorated lead-based paint would have an adverse effect on human health (as established by the EPA Administrator under Title IV of the Toxic Substance Control Act). Lead-based paint hazards include for example, deteriorated lead-based paint, leaded dust levels above applicable standards and bare leaded soil above applicable standards.
 12. **"Lead-Based Paint Hazard Control"**: activities to control or eliminate lead-based paint hazards, including interim controls and complete abatement.
 13. **"Lead-Contaminated Dust"**: surface dust in residences that contain an area or mass concentration of lead in excess of the standard established by the EPA Administrator, pursuant to Title IV of the Toxic Substance Control Act. Until the EPA standards are set, the HUD recommended clearance and risk assessment standards for leaded dust are 40 µg/ft² on floors, 250 µg/ft² on interior window sills, and 800 µg/ft² on window troughs.



14. **"Monitoring"**: shall refer to inspection to ensure compliance with all Federal, State and City Standards or guidelines, and contractual specifications.
15. **"Provide"**: shall mean furnish and install.
16. **"Risk Assessor"**: a certified individual who has completed training with an accredited training program and who has been certified to (1) perform risk assessments, (2) identify acceptable abatement and interim control strategies for reducing identified lead-based paint hazards, (3) perform clearance testing and reevaluations, and (4) document the successful completion of lead-based paint hazard control activities.

B. Applicable Regulations/References

1. The work conducted shall comply with all applicable Federal, State and City regulations. Applicable guidelines and standards listed in the scope of work include, but are not limited to:

<p>24 CFR Parts 35,36,37 Guidelines for the Evaluation and Control of Lead-Based Paint in Housing (HUD Guidelines June 1995) & 1997 Revisions</p> <p>29 CFR 1910 29 CFR 1910.1025 29 CFR 1910.134 29 CFR 1910.1200 29 CFR 1910.245 29 CFR 1926 29 CFR 1926.20 29 CFR 1926.21 29 CFR 1926.25 29 CFR 1926.28 29 CFR 1926.51 29 CFR 1926.55 29 CFR 1926.59 29 CFR 1926.62 29 CFR 1926.103 40 CFR 61 Subpart A 40 CFR 241</p> <p>40 CFR 257 40 CFR 261/262 American National Standards Institute (ANSI) Z87.1 ANSI Z88.2-80 American Society For Testing Materials (ASTM)</p>	<p>HUD Lead-Based Paint Regulations</p> <p>General Industry Standard Lead Standard for General Industry Respiratory Protection Hazard Communication Specification for Accident Prevention Construction Industry Standards General Safety & Health Provisions Safety Training & Education Housekeeping Personal Protective Equipment Washing Facilities Gases, Vapors, Fumes, Dusts & Mists Hazard Communication Standard Construction Industry Lead Standard Respiratory Protection General Provisions Guidelines for the Land Disposal of Solid Waste Criteria for the Land Disposal of Solid Waste Waste Disposal Facilities & Practices Eye Protection</p> <p>Practices for Respiratory Protection All Applicable Standards</p>
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2. The contractor shall ensure that any programs, certifications, licenses or other documentation in accordance with the above and/or any other applicable Federal, State, and Local Regulations/Guidelines are provided.

C. Scope Of Work

1. The work shall consist of furnishing labor, materials, insurance and all other incidental items required to perform the following:
 - a. Dust wipe sampling and analysis
 - 1) Collect dust wipe samples from various horizontal surfaces, such as floors, window sills, window troughs, etc., as directed by the Owner.
 - 2) Dust wipe samples shall be collected in accordance with ASTM ES30-94.



- 3) Analyze dust wipe sample in the laboratory using Flame Atomic Absorption Spectrometry ("FAAS") or Graphite Furnace Atomic Absorption Spectrometry("GFAAS").
 - 4) Provide result of analysis in micrograms per square foot.
 - 5) A faxed summary of results must be provided to the Owner within 24 hours after the Owner authorizes the Contractor to perform the laboratory analysis of the collected dust wipe sample. Contractor shall also have the ability to provide results in 4 hours for clearance, following lead-based paint abatement work, if requested by the Owner. The sampling result must be provided in a form approved by the Owner and must include for each dust wipe sample, the Project, the building address, the sample number, the room or room equivalent, the surface type, dimensions of sample areas, total micrograms, micrograms per square feet, and an indication of pass or fail.
 - 6) Turn-around time for results shall be counted from the time the Contractor performs collection of dust wipe samples to the time the results are actually presented to the Owner. This includes travel time from the site to the laboratory of the Contractor and back to the site.
 - 7) A detailed final report covering the results of all dust wipe samples taken and analyzed must be submitted within 5 days from the time the Owner authorizes the performance of the laboratory analysis. The sampling report must include for each dust wipe sample, the Project, the building address, the sample number, the room or room equivalent, the surface type, dimensions of sample areas, total micrograms, micrograms per square feet, and indicate pass or fail in a form approved by the Owner. Also include in the report the method of analysis, i.e. "FAAS" or "GFAAS", and the detection limits. The laboratory test results in the final report must be signed by the Laboratory Director.
 - 8) The sampling data report must contain all required data fields as specified by the Owner. The sampling data report shall be provided to the Owner on 3.5 inch high density diskettes in ASCII file form. The required data fields will be provided by the Owner to the Contractor.
 - 9) The laboratory used for the analysis of the dust wipe samples must be certified by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.
- b. Dust Spiked Samples
- 1) Provide dust spiked samples to the Owner. Dust spiked samples shall be prepared in accordance with the HUD Guidelines.
NOTE: These samples are separate from the ones required by the Contractor for its own QA/QC
 - 2) Prepare dust spiked samples in a manner such that they are indistinguishable from the field samples.
 - 3) Prepare dust spiked samples using the same lot as that to be used in the field.
 - 4) Dust spiked samples shall be inserted into the sample stream, randomly, by the Owner Inspector.
 - 5) Blind analysis of dust spiked samples must fall within 80%-120% of the true value. If the laboratory fails to obtain readings within these limits, two more spiked samples shall be sent immediately to the lab for analysis.
 - 6) If the two additional spiked samples fail, the sample batch shall be considered invalid, and the Owner may, at its sole discretion, terminate this contract as well as withhold payment for services already rendered.
- c. Air Sampling and Analysis



- 1) Collect area air samples at various locations and various projects for personal exposure assessment as directed by the Owner.
 - 2) Air samples shall be collected in accordance with ASTM E1553-93.
 - 3) Prepare air samples for analysis in accordance with ASTM E33-94
 - 4) Analyze air samples using FAAS or GFAAS.
 - 5) All equipment required for personal air sampling, including pumps shall be provided by the Contractor at no extra cost to the Owner.
 - 6) Provide results of air samples in micrograms per cubic meter.
 - 7) A faxed summary of result must be provided to the Owner within 24 hours after the Owner authorizes the Contractor to perform the laboratory analysis of the collected air sample. The sampling result must include for each air sample taken the Project, the building address, the sample number, the room or room equivalent, and the reading.
 - 8) Turn-around time shall start after collection of the air samples, and includes travel time to and from the laboratory.
 - 9) A detailed final report covering the results of all air samples taken and analyzed must be submitted within 5 days from the time the Owner authorizes the performance of the laboratory analysis. The sampling report must include for each air sample, the Project, the building address, the sample number, the room or room equivalent, and the reading. The laboratory report contained in the final report must be signed by the Laboratory Director.
 - 10) The sampling data report must contain all required data fields as specified by the Owner. The sampling data report shall be provided to the Owner on 3.5 inch high density diskettes in ASCII file form. The required data fields will be provided by the Owner to the Contractor.
 - 11) The laboratory used for the analysis of the dust wipe samples must be certified by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.
 - 12) Air sampling technician shall be present during the entire shift of the air sampling.
- d. TCLP Sampling and Analysis
- 1) Take core samples of construction waste as directed by the Owner and analyze by TCLP testing to determine if waste is hazardous.
 - 2) Waste shall be classified as hazardous if the concentration of lead is greater than 5 parts per million by TCLP testing.
 - 3) The laboratory used for the analysis of the TCLP samples must be certified by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.
 - 4) A faxed summary of result must be provided to the Owner within 48 hours after the Owner authorizes the Contractor to perform the TCLP analysis of the waste. Provide results in parts per million (ppm).
 - 5) Final results provided to the Owner by the Contractor must include written sample preparation procedure and laboratory specific written procedures for performing TCLP, including quality control procedures used for performing the TCLP, and a table listing the sample numbers, description of the construction waste, and the



result of the TCLP. The laboratory report contained in the final report must be signed by the Laboratory Director.

- 6) Final report must also specify detection limits.
- 7) Final report must be provided within 5 days from the time the authorization to perform the TCLP is given by the Owner.

D. General Provisions

1. Some of the work of this contract may be in occupied apartments. The Contractor shall perform all of the work of this contract with the least inconvenience to the tenants.
2. The Contractor shall take all necessary precautions to protect the property of the Owner, its residents, and the public. The Contractor must repair any damaged property, whether of the Owner, its residents, or the public, and restore such property to its original condition. If the damage is beyond repair, the Contractor shall replace it with new, that in the judgment of the Owner, match the existing materials and/or of equal quality and workmanship. All such repairs shall be at the Contractor's expense.
3. The Contractor shall develop a work plan to be performed as requested by the Department of Planning and Development. The detailed plan shall include coordination of the monitoring and sampling work with the Contractor in a manner that will be least disruptive to the normal use of the non-work areas in the building. The plan should also include emergency procedures in case of fire.
4. The Contractor shall perform work in accordance with the latest HUD Guidelines, except as such Guidelines are modified by the Owner in writing in this Contract, or any Contract pursuant to this Contract, and in accordance with all applicable Federal, State and Local regulations.
5. The Contractor shall include in the bid price all supplementary miscellaneous items not specified but implied or required in order to complete the work.

E. Submissions

1. Six (6) copies of the submissions listed below must be submitted to the Owner by the Contractor or Subcontractor performing the Work:
 - a. Ability to perform lead dust wipe sampling by submitting evidence of the successful completion of lead inspector and/or risk assessor training by all staff to be assigned to the job including inspector technicians. As stated previously, training must be provided through an approved program.
 - b. Laboratory certification by the State Department of Health (or other responsible agency) through its ELAP program and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided.
 - c. If a subcontractor will be used for any of the laboratory work of this contract, evidence of certification stated in (2) above must also be provided for the subcontractor.

F. Waste Disposal

1. All waste generated must be legally disposed in accordance with the Federal, State and Local Regulations.

END OF SECTION 02 83 19 13c



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Task	Specification	Specification Description
02 83 19 13	02 82 33 00	Removal Of Friable Asbestos-Containing Materials
02 83 19 13	02 82 33 00a	Removal Of Nonfriable Asbestos-Containing Materials
02 83 33 13	02 83 19 13	Removal And Disposal Of Lead-Containing Paint
02 83 33 13	02 83 19 13a	Lead Paint Related Abatement Procedures
02 83 33 13	02 83 19 13b	XRF Testing For Lead-Based Paint
02 83 33 13	02 83 19 13c	Lead Dust Wipe, Air And Tcpl Sampling And Analysis



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SECTION 02 84 16 00 - REMOVAL OF FLUORESCENT LIGHT BALLASTS/CAPACITORS AND FLUORESCENT LIGHT TUBES**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for removal of fluorescent light ballasts/capacitors and fluorescent light tubes. Products shall be as follows or as directed by the the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Before Start of Work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative's approval.
 - a. Copy of State or local license for hazardous waste hauler;
 - b. Certification of at least one on-site supervisor which has satisfactorily completed the OSHA 40 Hour Health and Safety Course for Handling Hazardous Materials;
 - c. Certificates of workers which have successfully completed at least the OSHA 40-Hour Health and Safety Course for Hazardous Materials;
 - d. List of employees scheduled to perform this work;
 - e. Schedule of start and finish times and dates for this work;
 - f. Name and address of landfill where these waste materials are to be deposited (include contact person and telephone numbers);
 - g. Material Safety Data Sheets for all materials requiring removal;
 - h. If contractor introduces any chemical into the work environmental, a MSDS for that chemical is required before use;
 - i. Transporter must have notified the EPA and/or the appropriate local government agency in advance of its intentions to transport PCB's, mercury and cadmium, and receive an identification number pursuant to the Toxic Substance Control Act (TSCA); and
 - j. Contingency Plan for handling emergency spills or leaks.

1.2 PRODUCTS**A. Materials**

1. Polyethylene Sheet: A single polyethylene film in the largest sheet size possible to minimize seams, 4.0 and 6.0 mil thick, clear, frosted, or black.
2. Duct Tape: Provide duct tape in 3" widths, with an adhesive which is formulated to stick aggressively to sheet polyethylene.
3. Spray Cement: Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.
4. Disposal Bays: Provide 6 mil thick leak-tight polyethylene bags.
5. Labels: As required by the EPA and OSHA for handling, transportation, and disposal of hazardous waste.
6. **Drums:** Recovery or salvage drums acceptable for disposal of hazardous waste. Prior approval of drums is required. Drums or containers must meet the required OSHA EPA (40 CFR Parts 264-265 and 300), and DOT regulations (49 CFR Parts 171-178). Use of damaged drums will not be allowed.

1.3 EXECUTION**A. General**Removal of Fluorescent Light Ballasts/Capacitors and
Fluorescent Light Tubes



1. Where necessary, scaffolding shall be erected to fully access all applicable fluorescent light ballasts/capacitors and tubes. At no time will the ballasts/capacitors and tubes be allowed to drop onto the floor. Contractor must take care to protect from dropping the ballasts/capacitors and fluorescent tubes.
2. Prior to removing ballasts/capacitors and fluorescent tubes, contractor shall ensure that all electrical service to lights has been shut off, and locked out. Temporary lighting shall be erected to adequately illuminate work areas.
3. Depending on height of light fixtures, contractor shall utilize at least a 2-person per team system. The fluorescent light tubes shall be removed and passed to the appropriate number of workers required to lower the tubes to the floor without breaking them.
4. The worker on the floor shall lay the tubes in cardboard boxes large enough to hold a small quantity of tubes. Worker shall take care to not damage the tubes while they are lowered into the box. Once the box is full, it shall be wrapped with two layers of 6 mil thick polyethylene sheeting and sealed with duct tape.
5. Contractor may choose to either remove the fluorescent light ballasts/capacitors in-place or lower the lighting fixtures for easy access. The ballasts/capacitors shall be removed from the fixtures. Electrical wiring leading from the ballasts/capacitors shall be cut away. Ballasts/capacitors shall be placed in 55-gallon drums lined with at least two 6 mil thick polyethylene bags. Be careful not to overfill the drums so that they remain manageable. Once the drums have been filled to the acceptable level, seal the lid onto the top of the drum, and affix appropriate labels. Transport drums via hand dollies.

B. Worker Protection

1. As a minimum, while working with the ballasts/capacitors and light tubes, workers shall utilize impervious gloves adequate for the use with hazardous materials. If light ballasts/capacitors and/or light tubes are damaged, and/or exposure to these materials may reach the OSHA PEL or AGGIH threshold limit value (TLV), the contractor shall be required to provide impervious full body protection and respiratory protection. However, contractor is required to verify the type of protection required prior to working with these materials, and have written approval by Owner's Representative prior to beginning.
2. In addition, workers shall not smoke, drink or eat in these areas during work activities.

C. Storage Of Fluorescent Light Ballasts/Capacitors And Light Tubes

1. Once the containers holding the ballasts/capacitors and light tubes have been filled and sealed, they shall be stored in designated areas as agreed upon by the Owners Representative and Contractor. They shall not be allowed to be stored on-site in transportation vehicles until the time for them to be transported to the hazardous waste incinerators or landfill facility.

END OF SECTION 02 84 16 00

**SECTION 02 84 16 00a - INTERIOR LIGHTING**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for interior lighting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Interior lighting fixtures, lamps, and ballasts.
 - b. Emergency lighting units.
 - c. Exit signs.
 - d. Lighting fixture supports.
 - e. Retrofit kits for fluorescent lighting fixtures.

C. Definitions

1. BF: Ballast factor.
2. CCT: Correlated color temperature.
3. CRI: Color-rendering index.
4. HID: High-intensity discharge.
5. LER: Luminaire efficacy rating.
6. Lumen: Measured output of lamp and luminaire, or both.
7. Luminaire: Complete lighting fixture, including ballast housing if provided.

D. Submittals

1. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - a. Physical description of lighting fixture including dimensions.
 - b. Emergency lighting units including battery and charger.
 - c. Ballast, including BF.
 - d. Energy-efficiency data.
 - e. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Division 23 Section "Diffusers, Registers, And Grilles".
 - f. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23 Section "Diffusers, Registers, And Grilles".
 - g. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 - h. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - 1) Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
OR
Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
2. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.



- a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- b. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:
 - a. Lamps and ballasts, installed.
 - b. Cords and plugs.
 - c. Pendant support system.
4. Installation instructions.
5. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - a. Lighting fixtures.
 - b. Suspended ceiling components.
 - c. Partitions and millwork that penetrate the ceiling or extends to within 12 inches (305 mm) of the plane of the luminaires.
 - d. Ceiling-mounted projectors.
 - e. Structural members to which suspension systems for lighting fixtures will be attached.
 - f. Other items in finished ceiling including the following:
 - 1) Air outlets and inlets.
 - 2) Speakers.
 - 3) Sprinklers.
 - 4) Smoke and fire detectors.
 - 5) Occupancy sensors.
 - 6) Access panels.
 - g. Perimeter moldings.
6. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
7. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
8. Field quality-control reports.
9. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
 - a. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.
10. Warranty: Sample of special warranty.

E. Quality Assurance

1. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

OR

1. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.
2. 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.
3. Comply with NFPA 70.
4. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

F. Coordination

1. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.



G. Warranty

1. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Final Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
 - b. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Final Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

1.2 PRODUCTS

A. General Requirements For Lighting Fixtures And Components

1. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
2. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
3. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
4. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
5. Metal Parts: Free of burrs and sharp corners and edges.
6. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
7. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
8. Diffusers and Globes:
 - a. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 1) Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
 - 2) UV stabilized.
 - b. Glass: Annealed crystal glass unless otherwise indicated.
9. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - a. Label shall include the following lamp and ballast characteristics:
 - 1) "USE ONLY" and include specific lamp type.
 - 2) Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
 - 3) Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - 4) Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
 - 5) ANSI ballast type (M98, M57, etc.) for HID luminaires.
 - 6) CCT and CRI for all luminaires.
10. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.
11. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 15 Section "Diffusers, Registers, and Grilles."
 - a. Air-Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.



- b. Heat-Removal Units: Air path leads through lamp cavity.
- c. Combination Heat-Removal and Air-Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air-supply units.
- d. Dampers: Operable from outside fixture for control of return-air volume.
- e. Static Fixture: Air-supply slots are blanked off, and fixture appearance matches active units.

B. Ballasts For Linear Fluorescent Lamps

1. General Requirements for Electronic Ballasts:
 - a. Comply with UL 935 and with ANSI C82.11.
 - b. Designed for type and quantity of lamps served.
 - c. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
 - d. Sound Rating: Class A **OR** Class A except Class B for T8/HO and T12/Slimline lamp ballasts, **as directed**.
 - e. Total Harmonic Distortion Rating: Less than 10 **OR** 20, **as directed**, percent.
 - f. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - g. Operating Frequency: 42 kHz or higher.
 - h. Lamp Current Crest Factor: 1.7 or less.
 - i. BF: 0.88 or higher.
 - j. Power Factor: 0.95 **OR** 0.98, **as directed**, or higher.
 - k. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
2. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.
3. Electronic Programmed-Start Ballasts for T5 **OR** T8 **OR** T5HO **OR** T5 and T5HO, **as directed**, Lamps: Comply with ANSI C82.11 and the following:
 - a. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
 - b. Automatic lamp starting after lamp replacement.
4. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
 - a. Ballast Manufacturer Certification: Indicated by label.
5. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.
6. Ballasts for Low-Temperature Environments:
 - a. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic or electromagnetic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
 - b. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.
7. Ballasts for Residential Applications: Fixtures designated as "Residential" may use low-power-factor electronic ballasts having a Class B sound rating and total harmonic distortion of approximately 30 percent.
8. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.
9. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
 - a. Dimming Range: 100 to 5 percent of rated lamp lumens.
 - b. Ballast Input Watts: Can be reduced to 20 percent of normal.
 - c. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
 - d. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.
10. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.



- a. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - 1) High-Level Operation: 100 percent of rated lamp lumens.
 - 2) Low-Level Operation: 30 percent of rated lamp lumens.
 - b. Ballast shall provide equal current to each lamp in each operating mode.
 - c. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.
11. Ballasts for Tri-Level Controlled Lighting Fixtures: Electronic type.
- a. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - 1) High-Level Operation: 100 percent of rated lamp lumens.
 - 2) Low-Level Operation: 30 and 50 **OR** 30 and 60, **as directed**, percent of rated lamp lumens.
 - b. Ballast shall provide equal current to each lamp in each operating mode.
 - c. Compatibility: Certified by manufacturer for use with specific tri-level control system and lamp type indicated.
- C. Ballasts For Compact Fluorescent Lamps
1. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
 - a. Lamp end-of-life detection and shutdown circuit.
 - b. Automatic lamp starting after lamp replacement.
 - c. Sound Rating: Class A.
 - d. Total Harmonic Distortion Rating: Less than 20 percent.
 - e. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - f. Operating Frequency: 20 kHz or higher.
 - g. Lamp Current Crest Factor: 1.7 or less.
 - h. BF: 0.95 or higher unless otherwise indicated.
 - i. Power Factor: 0.95 **OR** 0.98, **as directed**, except fixtures designated as "Residential" may use low-power-factor electronic ballasts, **as directed**, or higher.
 - j. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
- D. Emergency Fluorescent Power Unit
1. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
 - a. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - b. Nightlight Connection: Operate one fluorescent lamp continuously.
 - c. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - 1) Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 2) Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - d. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - e. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.



- g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
- 2. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.
 - a. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - b. Nightlight Connection: Operate one fluorescent lamp in a remote fixture continuously.
 - c. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - d. Charger: Fully automatic, solid-state, constant-current type.
 - e. Housing: NEMA 250, Type 1 enclosure.
 - f. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - g. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - h. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - i. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

E. Ballasts For HID Lamps

- 1. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:
 - a. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 - b. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
 - c. Rated Ambient Operating Temperature: 104 deg F (40 deg C).
 - d. Open-circuit operation that will not reduce average life.
 - e. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- 2. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
 - a. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
 - b. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
 - c. Lamp end-of-life detection and shutdown circuit.
 - d. Sound Rating: Class A.
 - e. Total Harmonic Distortion Rating: Less than 20 percent.
 - f. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - g. Lamp Current Crest Factor: 1.5 or less.
 - h. Power Factor: 0.90 or higher.
 - i. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 - j. Protection: Class P thermal cutout.
 - k. Bi-Level Dimming Ballast: Ballast circuit and leads provide for remote control of the light output of the associated fixture between high- and low-level and off.
 - 1) High-Level Operation: 100 percent of rated lamp lumens.
 - 2) Low-Level Operation: 35 **OR** 50, **as directed**, percent of rated lamp lumens.
 - 3) Compatibility: Certified by ballast manufacturer for use with specific bi-level control system and lamp type indicated. Certified by lamp manufacturer that ballast operating modes are free from negative effect on lamp life and color-rendering capability.
 - l. Continuous Dimming Ballast: Dimming range shall be from 100 to 35 percent of rated lamp lumens without flicker.



- 1) Ballast Input Watts: Reduced to a maximum of 50 percent of normal at lowest dimming setting.
 3. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
 - a. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 - b. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).
- F. Quartz Lamp Lighting Controller
1. General Requirements for Controllers: Factory installed by lighting fixture manufacturer. Comply with UL 1598.
 2. Standby (Quartz Restrike): Automatically switches quartz lamp on when a HID lamp in the fixture is initially energized and during the HID lamp restrike period after brief power outages.
 3. Connections: Designed for a single branch -circuit connection.
 4. Switching Off: Automatically switches quartz lamp off when HID lamp strikes.
- OR**
- Switching Off: Automatically switches quartz lamp off when HID lamp reaches approximately 60 percent light output.
- G. Exit Signs
1. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
 2. Internally Lighted Signs:
 - a. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.

OR

Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 - b. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - 1) Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 2) Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3) Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4) Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5) LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6) Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - 7) Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
 - c. Master/Remote Sign Configurations:
 - 1) Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply **OR** ballast **OR** battery, **as directed**, for power connection to remote unit.
 - 2) Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.



3. Self-Luminous Signs: Powered by tritium gas, with universal bracket for flush-ceiling, wall, or end mounting. Signs shall be guaranteed by manufacturer to maintain the minimum brightness requirements in UL 924 for 10 **OR** 15 **OR** 20, **as directed**, years.

OR

Self-Luminous Signs: Using strontium oxide aluminate compound to store ambient light and release the stored energy when the light is removed. Provide with universal bracket for flush-ceiling, wall, or end mounting.

H. Emergency Lighting Units

1. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 - a. Battery: Sealed, maintenance-free, lead-acid type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
 - g. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
 - h. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - i. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

I. Fluorescent Lamps

1. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.
2. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.
3. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3000 K, and average rated life of 20,000 hours unless otherwise indicated.
4. T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches (1150 mm), 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 K, and average rated life of 20,000 hours unless otherwise indicated.
5. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts, **as directed**.

J. HID Lamps

1. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.



- a. Dual-Arc Tube Lamps: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
 2. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000 K.
 3. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
 4. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.
 5. Low-Pressure Sodium Lamps: ANSI 78.41, CRI 0, and color temperature 1800 K.
- K. Lighting Fixture Support Components
1. Comply with Division 26 Section "Hangers And Supports For Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
 2. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
 3. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
 4. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
 5. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
 6. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
 7. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- L. Retrofit Kits For Fluorescent Lighting Fixtures
1. Reflector Kit: UL 1598, Type I. Suitable for two- to four-lamp, surface-mounted or recessed lighting fixtures by improving reflectivity of fixture surfaces.
 2. Ballast and Lamp Change Kit: UL 1598, Type II. Suitable for changing existing ballast, lamps, and sockets.

1.3 EXECUTION

- A. Installation
1. Lighting fixtures:
 - a. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 - b. Install lamps in each luminaire.
 2. Temporary Lighting: If it is necessary, and approved by the Owner, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
 3. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
 4. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
 - a. Install ceiling support system rods or wires, independent of the ceiling suspension devices, **as directed**, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
 - b. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - c. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
 - d. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
 5. Suspended Lighting Fixture Support:
 - a. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.



- b. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - c. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - d. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
6. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
 7. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

B. Identification

1. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".

C. Field Quality Control

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
2. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.
3. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

D. Startup Service

1. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by the Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

E. Adjusting

1. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
 - a. Adjust aimable luminaires in the presence of the Owner.

END OF SECTION 02 84 16 00a



SECTION 02 84 16 00b - EXTERIOR LIGHTING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for exterior lighting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Exterior luminaires with lamps and ballasts.
 - b. Luminaire-mounted photoelectric relays.
 - c. Poles and accessories.
 - d. Luminaire lowering devices.

C. Definitions

1. CCT: Correlated color temperature.
2. CRI: Color-rendering index.
3. HID: High-intensity discharge.
4. LER: Luminaire efficacy rating.
5. Luminaire: Complete lighting fixture, including ballast housing if provided.
6. Pole: Luminaire support structure, including tower used for large area illumination.
7. Standard: Same definition as "Pole" above.

D. Structural Analysis Criteria For Pole Selection

1. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
2. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.
3. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.
4. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.
 - a. Basic wind speed for calculating wind load for poles exceeding 49.2 feet (15 m) in height is 100 mph (45 m/s) **OR** 90 mph (40 m/s), **as directed**.
 - 1) Wind Importance Factor: 1.0.
 - 2) Minimum Design Life: 50 years.
 - 3) Velocity Conversion Factors: 1.0.
 - b. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 100 mph (45 m/s) **OR** 90 mph (40 m/s).
 - 1) Wind Importance Factor: 1.0.
 - 2) Minimum Design Life: 25 years.
 - 3) Velocity Conversion Factors: 1.0.

E. Submittals

1. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - a. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - b. Details of attaching luminaires and accessories.
 - c. Details of installation and construction.
 - d. Luminaire materials.
 - e. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.



- 1) Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

OR

Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

- f. Photoelectric relays.
- g. Ballasts, including energy-efficiency data.
- h. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
- i. Materials, dimensions, and finishes of poles.
- j. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
- k. Anchor bolts for poles.
- l. Manufactured pole foundations.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 - c. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
 - d. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For products designated for sample submission in the Exterior Lighting Device Schedule. Each Sample shall include lamps and ballasts.
4. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.
5. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
6. Field quality-control reports.
7. Operation and Maintenance Data: For luminaires and poles **OR** luminaire lowering devices, **as directed**, to include in emergency, operation, and maintenance manuals.
8. Warranty: Sample of special warranty.

F. Quality Assurance

1. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

OR

Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.
2. 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.
3. Comply with IEEE C2, "National Electrical Safety Code."
4. Comply with NFPA 70.

G. Delivery, Storage, And Handling

1. Package aluminum poles for shipping according to ASTM B 660.
2. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
3. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below ground line.



4. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
5. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - a. Warranty Period for Luminaires: Five years from date of Final Completion.
 - b. Warranty Period for Metal Corrosion: Five years from date of Final Completion.
 - c. Warranty Period for Color Retention: Five years from date of Final Completion.
 - d. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Final Completion.

1.2 PRODUCTS

A. General Requirements For Luminaires

1. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
 - a. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
 - b. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
 - c. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.
2. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
3. Metal Parts: Free of burrs and sharp corners and edges.
4. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
5. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
6. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
7. Exposed Hardware Material: Stainless steel.
8. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
9. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
10. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - a. White Surfaces: 85 percent.
 - b. Specular Surfaces: 83 percent.
 - c. Diffusing Specular Surfaces: 75 percent.
11. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
12. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
13. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.



- a. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - b. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - 1) Color: As selected from manufacturer's standard catalog of colors **OR** As selected from manufacturer's full range, **as directed**.
14. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- a. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - b. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 - c. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - d. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - 1) Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black, **as directed**.
15. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
- a. Label shall include the following lamp and ballast characteristics:
 - 1) "USES ONLY" and include specific lamp type.
 - 2) Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
 - 3) Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - 4) Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.
 - 5) ANSI ballast type (M98, M57, etc.) for HID luminaires.
 - 6) CCT and CRI for all luminaires.
- B. Luminaire-Mounted Photoelectric Relays
1. Comply with UL 773 or UL 773A.
 2. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff, **as directed**.
 - a. Relay with locking-type receptacle shall comply with ANSI C136.10.
 - b. Adjustable window slide for adjusting on-off set points.
- C. Fluorescent Ballasts And Lamps
1. Ballasts for Low-Temperature Environments:
 - a. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic or electromagnetic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
 - b. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.
 2. Ballast Characteristics:
 - a. Power Factor: 90 percent, minimum.



- b. Sound Rating: Class A **OR** Class A except Class B for T8/HO ballasts, **as directed**.
 - c. Total Harmonic Distortion Rating: Less than 10 **OR** 20, **as directed**, percent.
 - d. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
 - e. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
 - f. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
3. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F (minus 18 deg C) **OR** minus 20 deg F (minus 29 deg C), **as directed**, and higher.
- D. Ballasts For HID Lamps
1. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:
 - a. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 - b. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
 - c. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
 - d. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.
 2. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.
 3. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
 - a. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 - 1) Restrike Range: 105- to 130-V ac.
 - 2) Maximum Voltage: 250-V peak or 150-V ac rms.
 - b. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).
- E. HID Lamps
1. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), CCT color temperature 1900 K, and average rated life of 24,000 hours, minimum.
 - a. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
 2. Low-Pressure Sodium Lamps: ANSI C78.43.
 3. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.
 4. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and CCT color temperature 4000 K.
 5. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and CCT color temperature 4000 K.
- F. General Requirements For Poles And Support Components
1. Structural Characteristics: Comply with AASHTO LTS-4-M.
 - a. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
 - b. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
 2. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
 3. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.



- a. Materials: Shall not cause galvanic action at contact points.
- b. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
- c. Anchor-Bolt Template: Plywood or steel.
4. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws. Provide on all, except wood poles.
5. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."
6. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.
7. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

G. Steel Poles

1. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
 - a. Shape: Round, tapered **OR** Round, straight **OR** Square, tapered **OR** Square, straight, **as directed**.
 - b. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
2. Steel Mast Arms: Single-arm **OR** Truss **OR** Davit, **as directed**, type, continuously welded to pole attachment plate. Material and finish same as pole.
3. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - a. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless **OR** galvanized, **as directed**,-steel bolts.
 - b. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 - c. Match pole material and finish.
4. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
5. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.
6. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch (76-by-127-mm) handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.
7. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems", listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
8. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
9. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.
10. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
11. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.
12. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."



- b. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
 - c. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - 1) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- H. Aluminum Poles
- 1. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.
 - 2. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.
 - a. Shape: Round, tapered **OR** Round, straight **OR** Square, tapered **OR** Square, straight, **as directed**.
 - b. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
 - 3. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
 - 4. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems", listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
 - 5. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
 - a. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
 - b. Finish: Same as pole **OR** luminaire, **as directed**.
 - 6. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
 - 7. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - b. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 - c. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - d. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - 1) Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from manufacturer's full range, **as directed**.
- I. Fiberglass Poles
- 1. Poles: Designed specifically for supporting luminaires, with factory-formed cable entrance and handhole. Not less than 65 percent fiberglass, with resin and pigment making up the remainder.
 - a. Resin Color: Dark bronze; provide uniform coloration throughout entire wall thickness.
 - b. Surface Finish: Pigmented polyurethane, with a minimum dry film thickness of 1.5 mils (0.04 mm). Polyurethane may be omitted if the surface layer of pole is inherently UV inhibited.
- J. Decorative Poles
- 1. Pole Material:
 - a. Cast ductile iron.
 - b. Cast gray iron, according to ASTM A 48/A 48M, Class 30.
 - c. Cast aluminum.
 - d. Cast concrete.



- e. Spun concrete.
- f. Steel tube, covered with closed-cell polyurethane foam, with a polyethylene exterior.
- 2. Mounting Provisions:
 - a. Bolted to concrete foundation.
 - b. Embedded.
- 3. Fixture Brackets:
 - a. Cast ductile iron.
 - b. Cast gray iron.
 - c. Cast aluminum.
- 4. Pole Finish: <Insert finish>.

K. Laminated Wood Poles

1. Species and Grades for Structural Glulam Timber: Engineer and fabricate structural laminated wood poles, complying with ANSI A190.1. Use southern pine **OR** Douglas fir **OR** Alaska cedar **OR** any species listed in AITC 117, **as directed**, to withstand indicated structural loads without exceeding allowable design working stresses according to AITC 117.
2. Features: Include wood bracket **OR** wood crossarm **OR** pole-top adapter, **as directed**, for mounting luminaire(s), metal pole cap, **as directed**, and concealed raceway path connected to access handhole.
3. Mounting Provisions: Embedded.
4. Appearance Grade: Architectural appearance grade complying with AITC 110.
5. Preservative Treatment: Pressure treat lumber before gluing according to AWWA C28 for waterborne preservatives. After dressing and end-cutting each member to final size and shape, apply a field-treatment preservative to comply with AWWA M4 to surfaces cut to a depth of more than 1/16 inch (1.6 mm).
6. Adhesive: Wet-use type complying with ASTM D 2559.
7. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
8. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.
9. Finish: Natural, unstained wood **OR** Semitransparent stain applied after erection **OR** Semitransparent stain applied at factory, **as directed**, color as selected.

L. Wood Poles

1. Poles: Douglas fir **OR** Southern yellow pine, **as directed**, machine trimmed by turning, **as directed**, complying with ANSI O5.1 and with AWWA C4 for wood species used; and bored, roofed, and galled before treatment.
 - a. Mounting Provisions: Embedded.
2. Preservative Treatment: Pressure treat poles with creosote **OR** pentachlorophenol **OR** ammoniacal copper arsenate, **as directed**, according to AWWA C1 and AWWA C4.
3. Luminaire Brackets: Comply with ANSI C136.13.

M. Prestressed Concrete Poles

1. Poles: Manufactured by centrifugal spin-casting process **OR** of cast concrete, **as directed**.
 - a. Shape: Round, tapered **OR** Round, straight **OR** Square, tapered **OR** Square, straight, **as directed**.
 - b. Mounting Provisions: Steel butt flange for bolted mounting to foundation or breakaway support **OR** Embedded, **as directed**.
 - c. Finishing: Capped at top and plugged at bottom. Seat each steel reinforcing strand with epoxy adhesive.
 - d. Grounding: Continuous copper ground wire cast into pole. Terminate at top of pole and attach to 24-inch (610-mm) lightning rod, **as directed**.
2. Cure with wet steam and age for a minimum of 15 days before installation.
3. Fabricate poles with a hard, nonporous surface that is resistant to water, frost, and road and soil chemicals and that has a maximum water-absorption rate of 3 percent.



4. Cast aluminum nameplate into pole wall at approximately 5 feet (1.5 m) above ground line, listing name of manufacturer, Project identifier, overall height, and approximate weight.
5. Pole Brackets: Comply with ANSI C136.13.
6. Finish Color: Provided by color material complying with ASTM C 979, uniformly impregnated throughout the pole concrete. Color material shall provide a uniform, stable, permanent color and be as follows:
 - a. Inert, and carbon free.
 - b. Unaffected by environmental conditions and contaminants including, but not limited to, UV solar radiation, salts, and alkalis.
7. Finish Texture: Standard form **OR** Polished exposed aggregate **OR** Etched exposed aggregate, **as directed**.
 - a. Exposed aggregate shall be of **<Insert aggregate type selected from manufacturers' lists>** type.

N. Pole Accessories

1. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 16 Section "Wiring Devices" for ground-fault circuit-interrupter type.
 - a. Surface mounted **OR** Recessed, **as directed**, 12 inches (300 mm) above finished grade.
 - b. Nonmetallic polycarbonate plastic or reinforced fiberglass, weatherproof in use, cover, that when mounted results in NEMA 250, Type 3R **OR** Type 4X, **as directed**, enclosure.
 - c. With cord opening.
 - d. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.
2. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.
3. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.
4. Transformer Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and accept ballast(s) **OR** indicated accessories, **as directed**.
5. Decorative accessories, supplied by decorative pole manufacturer, include the following:
 - a. Banner Arms: **<Insert material>**.
 - b. Flag Holders: **<Insert material>**.
 - c. Ladder Rests: **<Insert material>**.

O. Lowering System For Luminaires

1. Arrange system to lower luminaire **OR** luminaire assembly, **as directed**, to a servicing position within 36 inches (900 mm) of finished grade in winds up to 30 mph (49 km/h) and to provide for manual plug connection to electrical power in the lowered position for testing.
2. Coordinate with luminaire and pole manufacturers for assembly details, wind-load and vibration analysis, and compatibility of materials for electrolysis-free attachment and connection for luminaire mounting assembly, lowering device, lowering cable, and portable winch.
3. Structural and Mechanical Design: Use a minimum safety factor of 5.0 for static and dynamic loads of load-bearing components, including cable.
4. Luminaire Mounting and Disconnect Arrangement: Multiple ring **OR** carriage, **as directed**, -mounted luminaires, arranged for lowering and rising as a group.
 - a. Electrical cable for normal operating power to luminaires manually disconnects inside pole base, using weatherproof multipin connector, and shall be arranged to move within the pole during lowering and rising of luminaire assembly.
OR
Electrical cable for normal operating power to luminaires automatically disconnects at a weatherproof multipin connector within the pole-top lowering head at the beginning of the lowering cycle and reconnects when luminaire or luminaire assembly is raised to the operating position.
5. Lowering Device: Weatherproof, cast-aluminum housing and multiple mechanical latches. Moving parts of latching assembly shall be located in the portion of the unit that is lowered to the servicing position. Positive latching in the operating position shall be indicated to the operator at the base of the pole by a clear visual signal, or by other means acceptable to the Owner or authorities having jurisdiction.



6. Lowering Cable: Zinc-electroplated- or stainless-steel aircraft cable.
7. Portable Winch: Manual **OR** 120-V electric, **as directed**, type. One required.
 - a. Winch Power Connection: Cord and plug.
 - b. Winch Raise-Lower Control: Remote-control station with 15 feet (5 m) of cable.
8. Winch Transformer: Portable, totally enclosed, encapsulated, single-phase, dry type. Primary rated at lighting-circuit voltage; secondary rated at 120 V. Permanent, primary and secondary, twist-locking plug connectors on pigtails shall match pole-base power outlet and winch plug.

1.3 EXECUTION

A. Luminaire Installation

1. Install lamps in each luminaire.
2. Fasten luminaire to indicated structural supports.
 - a. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
3. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation, **as directed**.

B. Pole Installation

1. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
2. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
 - a. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
 - b. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
 - c. Trees: 15 feet (5 m) from tree trunk.
3. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-place Concrete".
4. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 - a. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 - b. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 - c. Install base covers unless otherwise indicated.
 - d. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
5. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
 - a. Dig holes large enough to permit use of tampers in the full depth of hole.
 - b. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.
6. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
 - a. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
 - b. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
 - c. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
 - d. Cure concrete a minimum of 72 hours before performing work on pole.
7. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent



- concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
8. Raise and set poles using web fabric slings (not chain or cable).
- C. Bollard Luminaire Installation
1. Align units for optimum directional alignment of light distribution.
 2. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-place Concrete".
- D. Installation Of Individual Ground-Mounting Luminaires
1. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-place Concrete".
- E. Corrosion Prevention
1. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
 2. Steel Conduits: Comply with Division 26 Section "Raceway And Boxes For Electrical Systems". In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.
- F. Grounding
1. Ground metal poles and support structures according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 - a. Install grounding electrode for each pole unless otherwise indicated.
 - b. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
 2. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 - a. Install grounding electrode for each pole.
 - b. Install grounding conductor and conductor protector.
 - c. Ground metallic components of pole accessories and foundations.
- G. Field Quality Control
1. Inspect each installed fixture for damage. Replace damaged fixtures and components.
 2. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 - a. Verify operation of photoelectric controls.
 3. Illumination Tests:
 - a. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
 - 1) IESNA LM-5, "Photometric Measurements of Area and Sports Lighting Installations."
 - 2) IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
 - 3) IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
 - 4) IESNA LM-64, "Photometric Measurements of Parking Areas."
 - 5) IESNA LM-72, "Directional Positioning of Photometric Data."
 4. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- H. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.



END OF SECTION 02 84 16 00b



SECTION 02 84 33 00 - OVERHEAD ELECTRICAL DISTRIBUTION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for overhead electrical distribution. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Conductors, connectors, and splices.
 - b. Poles and crossarms.
 - c. Hardware and accessories.
 - d. Surge arresters.
 - e. Cutouts, switches, and fuses.
 - f. Pole-mounted distribution transformers.
 - g. Primary metering equipment.

C. Definitions

1. BIL: Basic impulse level, stated in kilovolts.
2. RUS: Department of Agriculture, Rural Utilities Service.
3. Sag: The distance measured vertically from a conductor to the straight line joining its two points of support, measured at the midpoint of the span, unless otherwise indicated.
 - a. Final Sag: The sag of a conductor under specified conditions of loading and temperature applied after it has been subjected, for an appreciable period, to the loading prescribed for the loading district in which it is situated, or equivalent loading, and the loading removed. Final sag includes the effect of inelastic deformation (creep).
 - b. Initial Unloaded Sag: The sag of a conductor before the application of an external load.
4. Secondary: Conductors and components for circuits operating at the utilization voltage of 600 V or less.
5. Service: Set of insulated conductors extending from a pole to the metering point or service entrance connection at the location of utilization of electricity.

D. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Qualification Data: For qualified manufacturer **OR** testing agency, **as directed**.
3. Material Certificates: For the following items, from manufacturers:
 - a. Wood poles.
 - b. Concrete poles.
 - c. Wood crossarms.
4. Listing Documentation: Indicate that products comply with RUS listing requirements specified in "Quality Assurance" Article.
 - a. Time-Current Coordination Curves: Illustrate optimum coordination of protective devices involved in the Work of this Section.
 - b. Source quality-control test reports.
5. Field quality-control reports.
6. Operation and Maintenance Data: For switches **OR** transformers, **as directed**, to include in emergency, operation, and maintenance manuals.
7. Survey records for locations of pole, anchors, and other features for inclusion in Project Record Documents.



E. Quality Assurance

1. Concrete Pole Manufacturer Qualifications: Certified by PCI as a qualified manufacturer of concrete utility poles of type and size indicated for this Project.
2. Inspection Agency Qualifications for Pole and Crossarm Inspection: An independent agency, acceptable to authorities having jurisdiction, qualified to conduct inspections indicated.
3. Testing Agency Qualifications: Member company of NETA or an NRTL.
4. Testing Agency's Field Supervisor: Currently certified by NETA or an NRTL.
5. Treatment Technician Qualifications for Field Treatment of Wood Poles and Crossarms: Certified by authorities having jurisdiction over environmental protection at the location of Project for field application of chemicals required.
6. 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.
7. Overhead-Line Components, Devices, and Accessories: Currently listed in RUS Informational Publication 202-1 without restriction for the intended application.
8. Comply with IEEE C2 **OR** CPUC General Order 95, **as directed**, except where stricter requirements are indicated or where local requirements that are stricter apply.
9. Strength of Line and Line Components Selected by Contractor: Provide grades of construction and strength required by IEEE C2 for conditions encountered at Project site for heavy **OR** medium **OR** light, **as directed**, line loading unless otherwise indicated.

F. Delivery, Storage, And Handling

1. Wood Pole Storage and Handling: Comply with ATIS O5.1. Do not use pointed handling tools capable of producing indentations greater than 1 inch (25 mm).

G. Project Conditions

1. Interruption of Existing Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify Owner no fewer than two days in advance of proposed interruption of service.
 - b. Do not proceed with interruption of service without Owner's written permission.

H. Coordination

1. Coordinate with utility supplying electricity to lines specified in this Section, and make final connections **OR** arrangements for final connections by utility, **as directed**.
2. Coordinate with those responsible for voice **OR** data **OR** video, **as directed**, systems that will have cables supported by poles installed according to this Section.

1.2 PRODUCTS

A. Conductors, Connectors, And Splices

1. Conductor Type AAC: Bare **OR** Bare and covered, **as directed**, all-aluminum, Alloy 1350-H19, complying with ASTM B 230/B 230M and ASTM B 231/B 231M.
OR
Conductor Type AAAC: Bare **OR** Bare and covered, **as directed**, all-aluminum-alloy, Alloy 6201-T81, complying with ASTM B 398/B 398M and ASTM B 399/B 399M.
OR
Conductor Type ACSR: Bare **OR** Bare and covered, **as directed**, aluminum conductor, steel reinforced, complying with ASTM B 232/B 232M.
OR
Conductor Type CU: Bare **OR** Bare and covered, **as directed**, hard-drawn copper, complying with ASTM B 1 and ASTM B 8.
2. Conductor Covering: UV resistant, complying with ICEA-S-70-547. HDPE **OR** XLP, **as directed**, 150 mils (3.81 mm) thick.



3. Self-Supported, Multiconductor, Insulated Medium-Voltage Wiring: Factory-assembled, messenger-supported type, listed under UL 1072 as sunlight-resistant Type MV cable for cable tray use.
 - a. Conductors: Aluminum, Alloy 1350, complying with ASTM B 230/B 230M and ASTM B 231/B 231M **OR** Hard-drawn copper, complying with ASTM B 1 and ASTM B 8, **as directed**; stranded for No. 2 AWG and larger.
 - b. Conductor Insulation: XLP, complying with NEMA WC 70/ICEA S-95-658 **OR** EPR, complying with NEMA WC 70/ICEA S-95-658, **as directed**.
 - c. Insulation Level: 100 **OR** 133, **as directed**, percent of rated circuit line-to-line voltage.
 - d. Conductor Shield: Extruded, nonconducting, thermoset material, complying with NEMA WC 70/ICEA S-95-658; 18-mil (0.046-mm) minimum thickness.
 - e. Insulation Shield: Include the following two components:
 - 1) Nonmetallic conducting, material complying with NEMA WC 70/ICEA S-95-658 and UL 1072, extruded over, and free stripping from the insulation.
 - 2) Metallic Tape Shield: Bare copper, 5-mil (0.127-mm) minimum thickness, helically applied with a 15 percent minimum overlap.
 - f. Conductor Jacket: Extruded, chlorosulfonated-polyethylene-based material, complying with NEMA WC 70/ICEA S-95-658.
 - g. Messenger: Copper **OR** Composite copper and copper, **as directed**, -clad steel.
 - h. Conductor Support Strap: Copper strap, wound around conductors and messenger the full length of the cable.
4. Secondary-Voltage Line Conductors: Aluminum conductor, steel **reinforced**, complying with ASTM B 232/B 232M **OR** Covered aluminum conductor, steel reinforced, complying with ICEA S-70-547, with HDPE or XLP covering, **as directed**, 60 mils (1.52 mm) thick.

OR

Secondary-Voltage Line Conductors: Bare hard-drawn copper, complying with ASTM B 1 and ASTM B 8 **OR** Covered hard-drawn copper, complying with ICEA S-70-547, with HDPE or XLP covering, **as directed**, 60 mils (1.52 mm) thick. Neutral-supported, secondary service-drop cable, **as directed**.

OR

Racked Secondary Conductors, 600 V and Less: Copper, insulated with XLP, complying with NEMA WC 70/ICEA S-95-658, **as directed**.
5. Neutral-Supported, Secondary Service-Drop Cable, 600 V and Less: Insulated conductors with bare neutral, complying with ICEA S-76-474, and using the following combination of materials:
 - a. Conductors and Neutral: Copper with copper-clad-steel neutral **OR** Aluminum with bare Alloy 1350 aluminum neutral **OR** Aluminum with ACSR neutral, **as directed**.
 - b. Insulation: XLP, complying with NEMA WC 70/ICEA S-95-658 **OR** High-modular-weight, low-density polyethylene **OR** Weather-resistant polyolefin, complying with ICEA S-70-547, **as directed**.
6. Connectors, Splices, and Conductor Securing and Protecting Components: Items include wire clamps, ties, conductor armor, fittings, connectors, and terminals. Listed for the specific applications and conductor types and combinations of materials used. Descriptions as follows for various applications:
 - a. Copper to Copper: Copper alloy, complying with UL 486A-486B.
 - b. Aluminum Composition to Aluminum Composition: Aluminum alloy, complying with UL 486A-486B.
 - c. Copper to Aluminum Composition: Type suitable for this purpose, complying with UL 486A-486B.
 - d. Connectors and Splices for Secondary Conductors: Listed and labeled for the conditions and materials involved in each application.
 - e. Taps for Medium-Voltage Line Conductors: Hot-line clamps, screw type, with concealed threads and bare, hard-drawn copper stirrups. Listed for the combination of materials being connected.
 - f. Splices under Tension: Compression type with strength exceeding the conductors spliced.



- g. Splices and Terminations for Covered Conductors: As recommended by conductor manufacturer for conductor and covering combination and for specific materials and physical arrangement of each splice.
- h. Splices and Terminations for Insulated Medium-Voltage Conductors: Comply with requirements in Division 26 Section "Medium-voltage Cables".

B. Wood Poles

- 1. Comply with ATIS O5.1 and RUS Bulletin 1728F-700, for wood poles pressure treated with creosote **OR** pentachlorophenol, **as directed**, **OR** ammoniacal copper arsenate, **OR** ammoniacal copper zinc arsenate **OR** chromated copper arsenate, **as directed**.
- 2. Wood Species: Douglas fir **OR** Lodgepole pine **OR** Western larch **OR** Southern yellow pine, **as directed**.
- 3. Pole Marking:
 - a. Manufacturer's Mark: Comply with ATIS O5.1; locate 10 feet (3 m) from the pole butt for poles 50 feet (15 m) long or less.
 - b. Pole Number: Machine-embossed aluminum, alphanumeric characters not less than 2-1/2 inches (65 mm) high, with aluminum nails.
- 4. Factory Operations: Machine trim poles by turning smooth, full length. Roof, gain, and bore poles before pressure treatment.

C. Concrete Poles

- 1. Description: Spun-cast prestressed concrete, complying with requirements of ASTM C 1089.
 - a. Comply with requirements of RUS Bulletin 1724E-216.
- 2. Design: Base design on calculation of strength required by IEEE C2 or indicated on Drawings, whichever is greater. Design shall be suitable for installation at a location where annual temperature range is between minus 4 deg F and plus 100 deg F (minus 20 deg C and plus 38 deg C). Include pole design for embedded attachments matching fittings, brackets, and other items installed in the field.
- 3. Shaft: Hollow, for poles at overhead-to-underground connections. Provide 3-1/2-inch- (89-mm-) minimum cable raceway capacity, with conduit elbow **OR** cable entry port, **as directed**, at base.
- 4. Water Absorption: Not more than 3 percent.
- 5. Surface: Smooth, hard, nonporous, and resistant to soil acids **OR** road salts **OR** frost and freezing damage, **as directed**.
- 6. Pole Marking:
 - a. Manufacturer's Mark: Comply with ATIS O5.1; locate 10 feet (3 m) from the pole butt for poles 50 feet (15 m) long or less.
 - b. Pole Number: Machine-embossed aluminum, alphanumeric characters not less than 2-1/2 inches (65 mm) high.

D. Crossarms

- 1. Description: Solid-wood distribution type, complying with RUS Bulletin 1728H-701 for specified construction grade **OR** Galvanized, steel angles, **as directed**, and complying with IEEE C2 for required climbing space and wire clearances.
- 2. Braces: Galvanized, flat, ferrous-metal units; 1/4 inch (6 mm) thick by 1-1/4 inches (30 mm) wide, minimum, with length to suit crossarm dimensions.

E. Guys And Anchors

- 1. Guy Strand Assemblies: Cable and attachment assemblies shall have uniform minimum breaking strength of the cable.
- 2. Cable: Seven strands. Zinc-coated steel, complying with ASTM A 475 **OR** Aluminum-clad steel, complying with ASTM B 416 **OR** Copper-clad steel, complying with ASTM B 228, **as directed**. Breaking strength shall be not less than 10,000 lb (45 kN).
- 3. Cable Termination:
 - 1) Thimble eye.**OR**



- 2) Hooks and guy strain plates, complying with IEEE C135.1.
 - 2) Preformed galvanized-steel guy grips, matching material, galvanizing, and strength of the guy strand assembly.
 4. Anchor and Anchor-Rod Assemblies: Hot-dip galvanized steel.
 - a. Power-installed screw-type anchors.
 - 1) 15-inch (380-mm) screw; with rod 96 inches (2400 mm) long by 1-1/2 inches (38 mm) in diameter. Rated at 10,000 lb (45 kN) when installed.
 - 2) Guy anchors shall have strength and holding area as required for anchor load and soil conditions at location of that anchor.
 5. Strain Insulators: Epoxy-bonded fiberglass of length to meet clearance requirements specified in "Guy Installation" Article.
 6. Guy Markers: Round, of vinyl or PVC material, white **OR** yellow, **as directed**, color, 96 inches (2440 mm) long. Shatter resistant at temperatures below 0 deg F (minus 18 deg C).
- F. Hardware And Accessories
1. Description: Ferrous-metal items include, but are not limited to, bolts, nuts, washers, crossarm gains and braces, insulator pins, anchor rods, anchors, eyebolts, staples, and transformer brackets.
 - a. Comply with IEEE C135.1, IEEE C135.2, ANSI C135.4, ANSI C135.22, and RUS Informational Publication 202-1 listings with the exception that base material shall be malleable iron or ductile iron, and finish shall be hot-dip galvanized, **as directed**.
 2. Insulator Brackets: Hot-dip galvanized steel, style as indicated, designed to hold vertical-post-type or pin-type insulators, with one **OR** two, **as directed**, -bolt attachment to pole.
 3. Secondary Insulator Racks: Hot-dip galvanized steel, style as indicated, with smooth, rounded 12-gage struts designed to support two **OR** three **OR** four, **as directed**, spool insulators for attachment of secondary drop conductors. Spool spacing of 4 inches (100 mm) **OR** 8 inches (200 mm) **OR** 12 inches (300 mm), **as directed**.
 4. Pole Riser Shields: Galvanized steel with boot **OR** backplate **OR** vent, **as directed**.
 5. Padlocks: ASTM F 883.
 - a. Class: PO1 **OR** PO2, **as directed**.
 - b. Grade: 1 **OR** 2 **OR** 3 **OR** 4 **OR** 5 **OR** 6, **as directed**.
 - c. Option: A **OR** B **OR** C **OR** D **OR** E **OR** F **OR** G, **as directed**.
 6. Insulators: Units rated 6 kV and above shall be free from radio interference.
 - a. Porcelain insulators shall be wet-process type, complying with the following:
 - 1) Pin: ANSI C29.5.
 - 2) Line Post: ANSI C29.7. Include mounting stud of length suitable for each mounting arrangement used.
 - 3) Suspension: ANSI C29.2.
 - 4) Guy Strain: ANSI C29.4.
 - 5) Secondary Spool: ANSI C29.3, Class 53-2.
 - b. Polymer-composite, fiberglass-reinforced insulators shall comply with the following:
 - 1) Line Post: CEA LWIWG-02.
 - 2) Dead End/Suspension: CEA LWIWG-01.
 - 3) Guy Strain: Fiberglass reinforced, epoxy finished. Designed specifically for use in guy assemblies.
 7. Grounding Materials: Comply with Division 26 Section "Grounding And Bonding For Electrical Systems", using materials listed by RUS for the intended purpose without restriction.
 - a. Conductors: No. 4 AWG, minimum; bare, solid, annealed copper, complying with ASTM B 8 unless otherwise indicated.
 - b. Ground Conductor Protectors: PVC or half-round wood molding, fir, pressure treated according to AWPAC 25 **OR** cypress **OR** cedar, **as directed**.
- G. Surge Arresters
1. Distribution-Class Surge Arresters: Porcelain **OR** Polymer, **as directed**, -enclosed, gapless, metal-oxide type with automatic-indicating type, ground-lead disconnection feature, **as directed**, complying with IEEE C62.11 and NEMA LA 1.



2. Intermediate-Class Surge Arresters: Porcelain **OR** Polymer, **as directed**,-enclosed, gapless, metal-oxide type, complying with IEEE C62.11 and NEMA LA 1.
 - a. Voltage Rating: 3 **OR** 6 **OR** 9 **OR** 10 **OR** 12 **OR** 15 **OR** 27 **OR** 30 **OR** 36, **as directed**, kV, at the altitude of Project, unless otherwise indicated.

H. Cutouts, Switches, And Fuses

1. Description: Medium-voltage disconnect, protective, and bypass, **as directed**, units shall be rated for the line-to-line voltage of the systems in which installed, unless higher ratings are indicated. BIL ratings are 45 **OR** 60 **OR** 75 **OR** 95 **OR** 150 **OR** 200, **as directed**, kV.
 - a. Momentary Current Rating of Switching Devices: 20 **OR** 40, **as directed**, kA, asymmetrical at nominal system operating voltage.
 - b. Fuse Characteristics: Time-current characteristics for each set of fuses selected according to written recommendations of manufacturer of component protected by the fuses and coordinated with upstream and downstream protective devices. Prepare time-current coordination curves according to IEEE 242 that illustrate optimum coordination of devices in this Project.
 - c. Interrupting Rating of Fuses: **<Insert value>** symmetrical A at nominal system operating voltage.
2. Fuse Cutouts: Open **OR** enclosed, **as directed**, type, rated 100 **OR** 200, **as directed**, A, continuous, complying with ANSI C37.42.
 - a. Fuses: Enclosed link, Type K **OR** Type T, **as directed**, complying with ANSI C37.42.
 - b. Fuse Current Rating: 150 percent of the transformer full-load current unless otherwise indicated.
 - c. Switching Application: Include switch link instead of fuse.
 - d. Switch Current Interrupting Rating: Transformer magnetizing current.
3. Fused Switches: Single-pole, manual units.
 - a. Switch Rating: 400 **OR** 600, **as directed**,-A rms continuous and load-current interrupting.
 - b. Fuses: Dropout-type power fuses.
4. Nonfused Switches: Single-pole, manual units, rated 100 **OR** 200 **OR** 400 **OR** 600, **as directed**, -A rms continuous.
5. Group-Operated, Load-Interrupter Switches: Fused **OR** Nonfused, **as directed**, three-pole, single-throw units, manually operated by handle through insulated mechanical linkage.
 - a. High-pressure contact type, complying with ANSI C37.32.
 - b. Factory assembled to suit specific configuration and mounting conditions for this Project.
 - c. Operating Handle: Padlock equipped.
 - d. Current Interrupting Rating: Equal to continuous current rating of switch.
 - e. Fuses: Nondropout power type.
6. Group-Operated, Air-Break (Nonloadbreak) Switches: Three-pole, single-throw units, manually operated by handle through insulated mechanical linkage.
 - a. Comply with ANSI C37.32.
 - b. Factory assembled to suit specific configuration and mounting conditions for this Project.
 - c. Operating Handle: Padlock equipped.
 - d. Suitable for field conversion to load-interrupter switch by adding interrupter modules.

I. Distribution Transformers

1. Description: Single-phase, two-winding, single **OR** two, **as directed**,-bushing, liquid-filled, self-cooled, pole-mounting distribution type, suitable for external fuse and surge suppressor protection; complying with IEEE C 57.12.00, and tested according to IEEE C 57.12.90 and with the following additional requirements, **as directed**:
 - a. Cooling Class: OA.
 - b. Temperature Rise: 65 deg C.
 - c. Insulating Liquid: Mineral oil, ASTM D 3487, Type II.
OR
Insulating Liquid: High molecular weight, mineral oil based, and UL listed as less-flammable type.

**OR**

Insulating Liquid: Biodegradable insulating and cooling liquid, UL listed as less flammable type.

- d. Identification: Label the transformer as "non-PCB" and place manufacturer's name and type of fluid on the nameplate.
 2. BIL: 95 **OR** 75 **OR** 60, **as directed**, kV.
 3. Taps: Two, 2.5 percent above and below **OR** Four, 2.5 percent below, **as directed**, high-voltage and full-load rated. Tap changer shall have an external operating handle, **as directed**.
 4. Mounting Brackets: Single **OR** Double, **as directed**, integral; suitable for pole mounting, individually or in cluster, or on crossarm.
 5. Minimum Efficiency: Class 1, as defined by NEMA TP 1, based on test results that comply with requirements of NEMA TP 2.
 6. Bushings: Creepage distance shall exceed nominal value standard for unit rating by at least 75 percent.
 7. Hardware: Stainless steel.
 8. Tank and Cover: Stainless steel, complying with ASTM A 167, Type 304 or 304L, with paint coating exterior finish system complying with IEEE C57.12.28, including manufacturer's standard color finish coat.
 9. Show transformer kiloampere capacity using 2-1/2-inch (65-mm) numerals placed near the low-voltage bushings.
- J. Primary Metering Equipment
1. Metering Transformers: Outdoor current and potential transformers, designed for crossarm mounting, complying with IEEE C57.13, and having the following features:
 - a. BIL: 45 **OR** 60 **OR** 75 **OR** 95 **OR** 150 **OR** 200, **as directed**, kV.
 - b. Secondary connection box arranged for conduit connection.
 - c. Potential-Transformer Voltage Rating: 2.4 **OR** 4.16 **OR** 7.2 **OR** 12.0 **OR** 12.47, **as directed**, kV to 120-V ac, 60 Hz.
 - d. Potential-Transformer Accuracy Class: Minimum 0.3 at 75-VA burden.
 - e. Voltage Rating: 2.4 **OR** 4.16 **OR** 7.2 **OR** 12.0 **OR** 12.47, **as directed**, kV.
 - f. Current Rating: **<Insert value>** to 5 A.
 - g. Accuracy Class: Minimum 0.2 at 50-VA burden.
 2. Watt-Hour Meter: Outdoor solid-state unit, with demand register, **OR** arranged for pulse initiation, **as directed**, complying with ANSI C12.10, and including the following ratings and features:
 - a. Form: 8S **OR** 9S, **as directed**.
 - b. Element: 2 **OR** 2-1/2 **OR** 3, **as directed**.
 - c. Voltage: 120 V.
 - d. Current: 2-1/2 A.
 - e. Frequency: 60 Hz.
 - f. Kilowatt-Hour Register: Five-digit type.
 - g. Demand-Register Multiplier: A quantity in even hundreds, indicated on meter face.
 - h. Demand-Register Interval: 15 **OR** 30, **as directed**, minutes.
 - i. Mounting: On matching socket, complying with ANSI C12.7, and complete with automatic current short-circuiting device.
 - j. Meter Test Block: Matched to meter, and furnished and equipped with open knife switches designed to isolate each metering component for test.
 - k. Meter Cabinet: Galvanized steel; weatherproof enclosure with pole-mounting bracket and the following features:
 - 1) Hinged Door: Arranged for padlocking in closed position.
 - 2) Size: Adequate to house meter and other equipment indicated, but not less than 20 by 30 by 11 inches (510 by 760 by 280 mm) deep.
- K. Source Quality Control
1. Factory Tests: Conduct routine tests of transformers **OR** medium-voltage switches **OR** metering equipment, **as directed**, according to referenced standards.



2. Testing Agency: Engage a qualified testing agency to inspect poles and crossarms before and after preservative treatment for compliance of wood poles and crossarms with requirements indicated. RUS quality mark "WQC" on each item is acceptable in place of inspection as evidence of compliance.
3. Poles and crossarms will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

1.3 EXECUTION

A. Right-Of-Way Clearance And Tree Trimming

1. Clear right of way according to Division 01 Section(s) "Temporary Tree And Plant Protection" AND Division 31 Section(s) "Site Clearing".
2. Clear right of way to maintain minimum clearances required by IEEE C2, unless Drawings indicate greater clearances or greater clearances are required by state or local codes or regulations. If no minimum requirements are mandated, maintain a minimum of 15 feet (4.5 m) on both sides horizontally and below medium-voltage conductors and 60 inches (1500 mm) on both sides horizontally and below secondary-voltage conductors. Remove overhanging branches.

B. General Installation Requirements

1. Install underground power and metering circuits and those circuits indicated to be in raceways according to Division 26 Section "Underground Ducts And Raceways For Electrical Systems" and Division 26 Section "Medium-voltage Cables", and make splices and terminations for those circuits according to the applicable Sections.
2. Engage the services of a licensed surveyor to verify dimensions by field measurement, to identify locations of poles, anchors, and other features, and to verify all clearances. The survey document shall also identify locations of connections to new and existing supply lines and to primary and secondary services. Notify the Owner of discrepancies and field conditions that are not indicated and that will affect installation.
3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
4. Apply warning signs and equipment labels according to Division 26 Section "Identification For Electrical Systems".

C. Conductor Installation, General

1. Handle and string conductors to prevent cuts, gouges, scratches, kinks, flattening, or deformation. Remove damaged sections and splice conductors.
 - a. String new conductors to "initial" sag values recommended by manufacturer for type and size of conductor except as otherwise indicated.
 - b. Conductors Reinstalled or Resagged: String to "final" sag values recommended by manufacturer for type and size of conductor except as otherwise indicated.
2. Connections, Splices, and Terminations: Use kits listed for the specific type of connection and combination of materials in the connection or recommended for the specific use by manufacturer of material on which applied.
 - a. Splice Location: Do not install within 10 feet (3 m) of a support.
 - b. Line Conductors and Service Drops: Install so strength exceeds ultimate rated strength of conductor.
 - c. Splices and Terminations of Covered Conductors: Comply with manufacturer's written instructions.
 - d. Splices and Terminations of Insulated Conductors of Self-Supported, Medium-Voltage Cable: Comply with manufacturer's written instructions.

D. Medium-Voltage Line Conductor Installation

1. Application: Install bare conductors unless otherwise indicated.



2. Armor Rod: Install to protect conductors if line conductors are supported by insulators.
 3. Flat Aluminum Armor Wire: Install to protect conductors if they are supported by, or attached to, galvanized or coated iron or steel clamps or fittings.
 4. Support line conductors and taps as follows:
 - a. Use wire ties for conductor attachment to pin and vertical post insulators unless otherwise indicated.
 - b. Install wire ties tight against conductor and insulator, and turn ends back and flat against conductor, to eliminate exposed wire ends.
 - c. Use wire clamps on horizontal post, dead end, and suspension insulators unless otherwise indicated.
- E. Pole And Crossarm Installation
1. Pole Orientation: Align curve of curved wood poles with straight-line runs of three or more poles. Align gained surfaces perpendicular to runs.
 2. Elevation of Line above Grade: Install poles with top at same elevation, unless grade changes dictate elevation change in poles, and according to the following:
 - a. On level ground, set poles so tops of consecutive poles vary not more than 60 inches (1500 mm) in elevation.
 - b. Shorten wood poles by cutting off the top and make cuts to shed water. Apply preservative to cuts.
 3. Set poles according to the following:
 - a. Make pole holes vertical, uniform in diameter, and large enough to permit effective use of tamping bars all around. Bore or excavate holes with an average diameter at grade less than twice the diameter of the pole at the same grade.
 - b. Use minimum depths indicated, except at locations where hole is partly or entirely in rock and if hole is not vertical or has a diameter at grade more than two times the pole diameter at the same level; in these conditions, increase the depth of the hole by the following increments before setting the pole:
 - 1) Poles up to 35 Feet (10.6 m) Long: 24 inches (600 mm).
 - 2) Poles 36 to 60 Feet (11 to 18.3 m) Long: 30 inches (760 mm).
 - 3) Poles 61 to 75 Feet (18.6 to 22.9 m) Long: 36 inches (900 mm).
 - c. For poles on slopes, indicated hole depth is from finished grade at lowest side of hole.
 - d. Set poles in alignment and plumb except at dead ends, angles, and points of extra strain; rake poles against conductor strain 1 inch (25 mm) minimum, 2 inches (51 mm) maximum, (after conductors are installed at required tension) for each 10 feet (3 m) of pole length. Rake poles so they will not lean or bend in direction of strain when loaded.
 - e. Backfill holes in 6-inch (150-mm) maximum lifts, and thoroughly tamp each layer before starting the next.
 - f. Place surplus earth around pole in a conical shape, and tamp thoroughly to provide drainage away from pole.
 - g. Set poles so alternate crossarm gains face in alternate directions, except at terminals and dead ends; place gains on last two poles on side facing terminal or dead end.
 - h. Poles Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
 4. Field treat factory-treated poles and crossarms as follows:
 - a. Poles Treated More Than One Year before Installation: Treat portion from 24 inches (600 mm) above ground line to butt.
 - b. Field-Bored Holes and Field-Cut Gains and Pole Tops: Treat cut portions.
 - c. Unused Holes: Treat and plug with treated-wood-dowel drive pins.
 - d. Engage the services of a technician certified according to "Quality Assurance" Article to apply treatment. Comply with requirements in AWPA standards that govern original factory treatment for field-applied treatment and application of chemicals.
 5. Crossarm Installation: Set line crossarms at right angle to line for straight runs and for angles 45 degrees and more. Bisect angles less than 45 degrees.
 - a. Buck Arms: Install at corners and junction poles unless otherwise indicated.



- b. Double Crossarms: Install at dead ends, corners, angles, and line crossings.
 - c. Equipment Arms: Locate below lines and set parallel or at right angles to them, whichever provides best climbing space.
 - d. Gains: Install factory-cut or metal-pole gains only. Do not cut gains in field without specific written approval.
6. Locate pole numbers to provide maximum visibility from the road or patrol route.
- F. Guy Installation
1. Install guys to resist unbalanced loads, including those developed at angles, corners, and dead ends. Install two or more guys if a single guy will not provide adequate strength. Install separate guys if unbalanced loads are separated by 36 inches (900 mm) or more. Comply with IEEE C2.
 - a. Unless a thimble eye is used, at the pole end, install a minimum of two guy hooks and two guy strain plates.
 - b. At the anchor end, attach guy strand assembly with preformed grips.
 2. Protect guy strands from damage. Replace damaged guy strands. Install guy insulators where required to comply with IEEE C2 clearance requirements.
 3. Install guys with a lead-to-height ratio of 1 to 1 unless otherwise indicated. The minimum lead-to-height ratio shall be 1/2 to 1. When less than 1 to 1, increase guy strength by the ratio of the sine of the lead angle indicated to the sine of the lead angle provided.
 4. Install screw-type guy anchors aligned in soil with guy. Set with anchor rod pointing at guy attachment on pole and rod projecting 6 to 9 inches (150 to 230 mm) from ground.
 5. Install strain insulators to provide a minimum of 12 inches (300 mm) of clearance between the nearest energized surface and the strain insulator fitting farthest from the pole. When loaded to the tension indicated, fiberglass strain insulators shall be loaded to not more than two-thirds of manufacturer's published rating.
 6. Guy Markers: Install at anchor end of guys to visually mark the guy wire at all accessible locations. Clamp to guy strand or anchor at top and bottom of marker.
- G. Hardware And Accessories Installation
1. Install washers against wood and under nuts, including eyenuts and locknuts.
 2. Install nuts and locknuts wrench-tight on threaded connections.
- H. Insulator Installation
1. Medium-Voltage Line Application: Install pin **OR** post, **as directed**, type, except install suspension type at corners, angles, dead ends, and other locations where horizontal forces exceed rated values for pin or line-post-type units.
 - a. Install suspension insulators and hardware that have mechanical strength exceeding rated breaking strength of attached conductors.
 - b. Install horizontal line-post insulators for armless construction.
 2. Post-Insulator Conductor Support: Where installed horizontally and for line angles more than 15 degrees, install clamp-top conductor clamps.
 3. Install spool-type insulators for secondary lines mounted on clevis attachments or secondary racks.
 4. Guy Strain Type: Install porcelain **OR** fiberglass-reinforced, **as directed**, units.
- I. Surge Arresters
1. Install surge arresters to protect distribution **OR** metering equipment **OR** reclosers, **as directed**, group-operated, load-interrupter switches, **as directed**, aerial-to-underground transitions, **as directed**, and other items indicated.
 - a. Units Installed 6000 Feet (1800 m) or More above Sea Level: Use arresters specifically rated for this service.
- J. Cutout, Switch, And Fuse Installation
1. Hook-Stick-Operated Switches: Install to maximize safe operating access.



2. Group-Operated, Load-Interrupter Switches and Air-Break Switches: Install operating handle 42 inches (1067 mm) above finished grade.
 - a. Locking Provisions: Install padlock at hasp.
- K. Metering Component Installation
1. Current and Voltage Transformers: Install secondary conductors between transformers and cabinet in sleeves made of galvanized rigid steel **OR** intermediate metal **OR** PVC, **as directed**, conduit. Install to prevent collection of moisture in raceway and cabinet system.
 2. Meter Cabinet: Mount on pole, 72 inches (1825 mm) above finished grade to center of cabinet.
 - a. Make conduit connections with raintight hubs.
 - b. Install metering transformer secondary leads without splices. Train leads at sides and bottom of enclosure, and secure with wire ties.
 - c. Install meter and meter test block within cabinet.
 - d. Install identical phase sequence, and color-code for both potential and current leads.
 - e. Identify leads using designations consistent with marking on transformer terminals.
- L. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 2. Perform tests and inspections.
 3. Tests and Inspections:
 - a. Furnish instruments and equipment required for tests that comply with NETA Acceptance Testing Specification.
 - b. Guy Anchors: Test one of each type and capacity installed, plus additional units specifically indicated for testing, **as directed**. Apply rated pull-out force in the same pull direction applied by the guy at the test location.
 - 1) Acceptable Test Results: Denoted by movement of less than 3/8 inch (10 mm) by the holding component of the anchor in the earth or other medium in which it is installed.
 - 2) Replace or reinstall, at the Owner 's option, all anchors of same type and capacity as anchor type that fails this test.
 - c. Ground Resistance: Comply with Division 26 Section "Grounding And Bonding For Electrical Systems". Measure resistance of each separate grounding electrode, including pole grounds. Also measure resistance of separate grounding electrode systems before bonding together.
 - 1) Perform tests and obtain acceptable results before energizing any portion of overhead electrical distribution system.
 - 2) Results and Follow-up: If ground resistance for a single ground electrode or pole ground, tested individually, exceeds 25 ohms, add a ground electrode not less than 10 feet (3 m) away and interconnect with No. 2 AWG, minimum, bare conductor buried at least 12 inches (300 mm) below furnished grade.
 - d. Aerial Conductor Sag and Tension: Observe procedures used by Contractor to verify that initial stringing sags and tensions comply with IEEE C2 and conductor manufacturer's product data and written recommendations.
 - e. Self-Supported, Medium-Voltage Cable: After installation, while cable is isolated, and after terminations are installed and before connecting or energizing, apply dc voltage between each phase conductor and grounding connections of sheath or metallic shield. Comply with NEMA WC 70/ICEA S-95-658 for method, voltage, duration, pass-fail performance, and other test criteria. Perform other field inspections and tests recommended by manufacturer.
 - f. Neutral-Supported, Secondary Service-Drop Cable: Test for insulation resistance while cable is isolated, before connecting or energizing. Minimum acceptable resistance is 100 megohms.
 - g. Existing Surge Arresters: Disconnect and measure resistance between line and ground terminals with a megger test rated 600 V or more. Acceptable resistance values are 300 megohms and more.



- h. New Surge Arresters, Cutouts, and Switches: Inspect after installation and connection to wiring. Verify that ratings and characteristics match approved submittals and comply with system requirements. Verify that installation complies with requirements and that clearances of units and connecting wiring comply with IEEE C2 requirements.
 - 1) Verify proper grounding of metallic equipment parts.
 - 2) Fuses and Disconnect Links: Verify that ratings and characteristics match submittals and comply with system requirements.
 - 3) Switches:
 - a) Manually operate each cutout and switch at least three times, to verify proper operation.
 - b) Verify correct contact alignment, blade penetration, travel stops, and arc interrupter operation.
 - 4) Group-Operated, Load-Interrupter Switches and Air-Break Switches:
 - a) Perform mechanical operator tests according to manufacturer's written instructions.
 - b) Test resistance to ground of parts to be energized. Acceptable value is 200,000 megohms.
 - c) Perform contact-resistance test across all switch blade contacts. Refer to manufacturer's data for acceptable contact resistance.
 - 5) Verify that clearances of energized parts and connecting wires comply with IEEE C2 requirements.
 - i. Distribution Transformers: Inspect after installation and connection to wiring and verify that ratings and characteristics match approved submittals and comply with system requirements. Verify the integrity and good condition of unit.
 - 1) Inspect for physical damage, cracked insulators, leaks, tightness of connections, and overall mechanical and electrical integrity.
 - 2) Perform preenergizing inspections and tests recommended by manufacturer.
 - 3) Verify proper equipment grounding.
 - 4) Verify that clearances of terminals and connecting wires comply with IEEE C2.
 - j. Metering Transformers: Inspect after installation and connection to wires, and verify that ratings and characteristics match approved submittals and comply with system requirements. Verify the integrity and good condition of unit.
 - 1) Verify proper connections, tightness of bolted connections, and integrity of mounting provisions.
 - 2) Verify that required grounding and shorting connections provide good contact.
 - 3) Verify that clearances of terminals and connecting wires comply with IEEE C2.
 - 4) Perform electrical tests according to manufacturer's written instructions, including insulation-resistance tests, polarity tests, and turns-ratio and ratio-verification tests.
 - k. Meters: Inspect after installation and connection to wiring and verify that ratings and characteristics match approved submittals and comply with system requirements. Verify the integrity and good condition of unit.
 - 1) Verify tightness of electrical connections.
 - 2) Verify accuracy at 25, 50, 75, and 100 percent of full-rated load and verify all instrument multipliers according to manufacturer's written instructions.
4. Prepare test and inspection reports.
- M. Adjusting
- 1. Distribution Transformers: Set voltage taps as directed by the Owner.
- N. Cleaning
- 1. After completing equipment installation, inspect equipment. Remove spots, dirt, and debris. Repair damaged finish to match original finish. For distribution transformer, use tank touchup paint provided by manufacturer.
 - a. Clean enclosures internally, on completion of installation, according to manufacturer's written instructions.



- O. Demonstration
 - 1. Train Owner's maintenance personnel to adjust, operate, and maintain overhead electrical distribution.

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SECTION 02 87 13 33 - MOLD REMEDIATION**1.1 GENERAL****A. Description Of Work**

1. This specification covers the removal and disposal of mold. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. List of all personnel to be involved in the work with their training and certifications.
2. List of all products and procedures proposed for use in performance of the work.
3. Test reports.
4. Certificates.

C. References

1. U.S. EPA "Mold Remediation in Schools and Commercial Buildings"
2. U.S. EPA "A Brief Guide to Mold, Moisture, and Your Home"

D. Quality Assurance

1. Conform to all Federal, State, and Local regulations which govern the handling and disposal of mold materials.

1.2 PRODUCT - (Not Used)**1.3 EXECUTION**

- A. Environmental Assessment:** The presence of mold, water damage, or musty odors shall be addressed immediately. In all instances, any source(s) of water must be stopped and the extent of water damaged determined. Water damaged materials shall be dried and repaired. Mold damaged materials shall be remediated in accordance with this document.

1. **Visual Inspection:** A visual inspection is the most important initial step in identifying a possible contamination problem. The extent of any water damage and mold growth shall be visually assessed. This assessment is important in determining remedial strategies. Ventilation systems shall also be visually checked, particularly for damp filters but also for damp conditions elsewhere in the system and overall cleanliness. Ceiling tiles, gypsum wallboard (sheetrock), cardboard, paper, and other cellulosic surfaces shall be given careful attention during a visual inspection. The use of equipment such as a boroscope, to view spaces in ductwork or behind walls, or a moisture meter, to detect moisture in building materials, may be helpful in identifying hidden sources of fungal growth and the extent of water damage.
2. **Bulk/Surface Sampling**
 - a. Bulk or surface sampling is not required to undertake a remediation. Remediation of visually identified fungal contamination shall proceed without further evaluation.
 - b. Bulk or surface samples may need to be collected to identify specific fungal contaminants as part of a medical evaluation if occupants are experiencing symptoms which may be related to fungal exposure or to identify the presence or absence of mold if a visual inspection is equivocal (e.g., discoloration, and staining).
 - c. An individual trained in appropriate sampling methodology shall perform bulk or surface sampling. Bulk samples shall be collected from visibly moldy surfaces by scraping or cutting materials with a clean tool into a clean plastic bag. Surface samples shall be collected by wiping a measured area with a sterile swab or by stripping the suspect surface



with clear tape. Surface sampling is less destructive than bulk sampling. Other sampling methods may also be available. A laboratory specializing in mycology shall be consulted for specific sampling and delivery instructions.

3. Air Monitoring
 - a. Air sampling for fungi shall not be part of a routine assessment. This is because decisions about appropriate remediation strategies can usually be made on the basis of a visual inspection. In addition, air-sampling methods for some fungi are prone to false negative results and therefore cannot be used to definitively rule out contamination.
 - b. Air monitoring may be necessary if an individual(s) has been diagnosed with a disease that is or may be associated with a fungal exposure (e.g., pulmonary hemorrhage/hemosiderosis, and aspergillosis).
 - c. Air monitoring may be necessary if there is evidence from a visual inspection or bulk sampling that ventilation systems may be contaminated. The purpose of such air monitoring is to assess the extent of contamination throughout a building. It is preferable to conduct sampling while ventilation systems are operating.
 - d. Air monitoring may be necessary if the presence of mold is suspected (e.g., musty odors) but cannot be identified by a visual inspection or bulk sampling (e.g., mold growth behind walls). The purpose of such air monitoring is to determine the location and/or extent of contamination.
 - e. If air monitoring is performed, for comparative purposes, outdoor air samples shall be collected concurrently at an air intake, if possible, and at a location representative of outdoor air. For additional information on air sampling, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."
 - f. Personnel conducting the sampling shall be trained in proper air sampling methods for microbial contaminants. A laboratory specializing in mycology shall be consulted for specific sampling and shipping instructions.
4. Analysis of Environmental Samples
 - a. Microscopic identification of the spores/colonies requires considerable expertise. These services are not routinely available from commercial laboratories. Documented quality control in the laboratories used for analysis of the bulk/surface and air samples is necessary. The American Industrial Hygiene Association (AIHA) offers accreditation to microbial laboratories (Environmental Microbiology Laboratory Accreditation Program (EMLAP)). Accredited laboratories must participate in quarterly proficiency testing (Environmental Microbiology Proficiency Analytical Testing Program (EMPAT)).
5. Evaluation of bulk/surface and air sampling data shall be performed by an experienced health professional. The presence of few or trace amounts of fungal spores in bulk/surface sampling shall be considered background. Amounts greater than this or the presence of fungal fragments (e.g., hyphae, and conidiophores) may suggest fungal colonization, growth, and/or accumulation at or near the sampled location. Air samples shall be evaluated by means of comparison (i.e., indoors to outdoors) and by fungal type (e.g., genera, and species). In general, the levels and types of fungi found should be similar indoors (in non-problem buildings) as compared to the outdoor air. Differences in the levels or types of fungi found in air samples may indicate that moisture sources and resultant fungal growth may be problematic.

B. Remediation

1. General
 - a. **In all situations, the underlying cause of water accumulation must be rectified or fungal growth will recur.** Any initial water infiltration shall be stopped and cleaned immediately. An immediate response (within 24 to 48 hours) and thorough clean up, drying, and/or removal of water damaged materials will prevent or limit mold growth. If the source of water is elevated humidity, relative humidity shall be maintained at levels below 60% to inhibit mold growth. Emphasis shall be on ensuring proper repairs of the building infrastructure, so that water damage and moisture buildup does not recur.
 - b. Five different levels of abatement are described below. The size of the area impacted by fungal contamination primarily determines the type of remediation. The sizing levels below



are based on professional judgment and practicality; currently there is not adequate data to relate the extent of contamination to frequency or severity of health effects. **The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement.** The listed remediation methods were designed to achieve this goal, however, due to the general nature of these methods it is the responsibility of the people conducting remediation to ensure the methods enacted are adequate. The listed remediation methods are not meant to exclude other similarly effective methods. Any changes to the remediation methods listed in these guidelines, however, shall be carefully considered prior to implementation.

- c. Non-porous (e.g., metals, glass, and hard plastics) and semi-porous (e.g., wood, and concrete) materials that are structurally sound and are visibly moldy can be cleaned and reused. Cleaning shall be done using a detergent solution. Porous materials such as ceiling tiles and insulation, and wallboards with more than a small area of contamination shall be removed and discarded. Porous materials (e.g., wallboard, and fabrics) that can be cleaned, can be reused, but should be discarded if possible. A professional restoration consultant shall be contacted when restoring porous materials with more than a small area of fungal contamination. All materials to be reused shall be dry and visibly free from mold. Routine inspections shall be conducted to confirm the effectiveness of remediation work.
 - d. The use of gaseous, vapor-phase, or aerosolized biocides for remedial purposes is **not** recommended. The use of biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space if used improperly. Furthermore, the effectiveness of these treatments is unproven and does not address the possible health concerns from the presence of the remaining non-viable mold. For additional information on the use of biocides for remedial purposes, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."
2. **Level I: Small Isolated Areas** (10 sq. ft or less) - e.g., ceiling tiles, small areas on walls
 - a. Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - c. The work area shall be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons recovering from recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - d. Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - e. Contaminated materials that cannot be cleaned shall be removed from the building in a sealed plastic bag. There are no special requirements for the disposal of moldy materials.
 - f. The work area and areas used by remedial workers for egress shall be cleaned with a damp cloth and/or mop and a detergent solution.
 - g. All areas shall be left dry and visibly free from contamination and debris.
 3. **Level II: Mid-Sized Isolated Areas** (10 - 30 sq. ft.) - e.g., individual wallboard panels.
 - a. Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.



- c. The work area shall be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
- d. The work area shall be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
- e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
- f. Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
- g. The work area and areas used by remedial workers for egress shall be HEPA vacuumed (a vacuum equipped with a High-Efficiency Particulate Air filter) and cleaned with a damp cloth and/or mop and a detergent solution.
- h. All areas shall be left dry and visibly free from contamination and debris.
- 4. **Level III: Large Isolated Areas** (30 - 100 square feet) - e.g., several wallboard panels.
 - a. A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for the project.
 - b. The following procedures *at a minimum* are recommended:
 - 1) Personnel trained in the handling of hazardous materials and equipped with respiratory protection, (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - 2) The work area and areas directly adjacent shall be covered with a plastic sheet(s) and taped before remediation, to contain dust/debris.
 - 3) Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.
 - 4) The work area and areas directly adjacent shall be unoccupied. Further vacating of people from spaces near the work area is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - 5) Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - 6) Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
 - 7) The work area and surrounding areas shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.
 - 8) All areas shall be left dry and visibly free from contamination and debris.
 - c. If abatement procedures are expected to generate a lot of dust (e.g., abrasive cleaning of contaminated surfaces, demolition of plaster walls) or the visible concentration of the fungi is heavy (blanket coverage as opposed to patchy), then it is recommended that the remediation procedures for Level IV are followed.
- 5. **Level IV: Extensive Contamination** (greater than 100 contiguous square feet in an area)
 - a. A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for the project. The following procedures are recommended:
 - 1) Personnel trained in the handling of hazardous materials equipped with:
 - a) Full-face respirators with high efficiency particulate air (HEPA) cartridges
 - b) Disposable protective clothing covering both head and shoes
 - c) Gloves
 - 2) Containment of the affected area:



- a) Complete isolation of work area from occupied spaces using plastic sheeting sealed with duct tape (including ventilation ducts/grills, fixtures, and any other openings)
 - b) The use of an exhaust fan with a HEPA filter to generate negative pressurization
 - c) Airlocks and decontamination room
- 3) Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - 4) Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. The outside of the bags shall be cleaned with a damp cloth and a detergent solution or HEPA vacuumed in the decontamination chamber prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.
 - 5) The contained area and decontamination room shall be HEPA vacuumed and cleaned with a damp cloth and/or mop with a detergent solution and be visibly clean prior to the removal of isolation barriers.
 - 6) Air monitoring shall be conducted prior to occupancy to determine if the area is fit to reoccupy.
6. **Level V: Remediation of HVAC Systems**
- a. A Small Isolated Area of Contamination (<10 square feet) in the HVAC System
 - 1) Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - 2) Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - 3) The HVAC system shall be shut down prior to any remedial activities.
 - 4) The work area shall be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
 - 5) Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - 6) Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, shall be removed. Other contaminated materials that cannot be cleaned shall be removed in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
 - 7) The work area and areas immediately surrounding the work area shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.
 - 8) All areas shall be left dry and visibly free from contamination and debris.
 - 9) A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers shall be consulted for the products they recommend for use in their systems.
 - b. Areas of Contamination (>10 square feet) in the HVAC System: A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for remediation projects involving more than a small isolated area in an HVAC system. The following procedures are recommended:
 - 1) Personnel trained in the handling of hazardous materials equipped with:
 - a) Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended.
 - b) Gloves and eye protection



- c) Full-face respirators with HEPA cartridges and disposable protective clothing covering both head and shoes shall be worn if contamination is greater than 30 square feet.
 - 2) The HVAC system shall be shut down prior to any remedial activities.
 - 3) Containment of the affected area:
 - a) Complete isolation of work area from the other areas of the HVAC system using plastic sheeting sealed with duct tape.
 - b) The use of an exhaust fan with a HEPA filter to generate negative pressurization.
 - c) Airlocks and decontamination room if contamination is greater than 30 square feet.
 - 4) Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, shall be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. When a decontamination chamber is present, the outside of the bags shall be cleaned with a damp cloth and a detergent solution or HEPA vacuumed prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.
 - 5) The contained area and decontamination room shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution prior to the removal of isolation barriers.
 - 6) All areas shall be left dry and visibly free from contamination and debris.
 - 7) Air monitoring shall be conducted prior to re-occupancy with the HVAC system in operation to determine if the area(s) served by the system are fit to reoccupy.
 - 8) A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers shall be consulted for the products they recommend for use in their systems.
7. Hazard Communication: When fungal growth requiring large-scale remediation is found, the building owner, management, and/or employer shall notify occupants in the affected area(s) of its presence. Notification shall include a description of the remedial measures to be taken and a timetable for completion. Group meetings held before and after remediation with full disclosure of plans and results can be an effective communication mechanism. Individuals with persistent health problems that appear to be related to bioaerosol exposure should see their physicians for a referral to practitioners who are trained in occupational/environmental medicine or related specialties and are knowledgeable about these types of exposures. Individuals seeking medical attention shall be provided with a copy of all inspection results and interpretation to give to their medical practitioners.

END OF SECTION 02 87 13 33



SECTION 02 87 16 13 - BIRD AND BIRD WASTE ABATEMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for bird and bird waste abatement. Products shall be as follows or as directed by the the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary Of Work

1. Work Included - Conventional Enclosure for Removal of Birds and Bird Waste
 - a. Seal off penetrations on perimeter walls into the work area (critical barriers) and establish a decontamination facility for workers.
 - b. Coordinate activities with the demolition and well capping activities.
2. Work Included - Removal and disposal of birds and bird waste.
 - a. Establish work area by installing construction barrier tape around removal area.
 - b. Remove and properly dispose of bulk contamination debris.
 - c. Mist bird waste and contaminated material with Biocide or the equivalent (i.e. Sanogene, Oxine, or Envirocon).
 - d. Remove and properly dispose of contaminated waste material from all building components.
 - e. Utilize low pressure washers or scrub brushes to clean all wall surfaces of bird waste.

C. Quality Criteria

1. Qualifications for Performance of Work
 - a. Contractor (or subcontractor engaged to perform the Work of this Section) shall:
 - 1) Be a licensed bird waste abatement contractor in accordance with the Statutes of the State in which the work is to be performed. Submit notarized documentation confirming current licensure.
 - 2) Have a record of not less than five years successful experience in bird waste removal or asbestos removal.
2. Reference Standards
 - a. Acknowledge, by the executing of the Contract, awareness and familiarity with the contents and requirements of the following regulations, codes, and standards, and assume responsibility for the performance of the Work in strict compliance therewith and for every instance of failure to comply therewith.
 - b. Where conflict among requirements or with the Contract Documents exists, the more stringent requirements shall apply.
 - 1) USEPA Regional National Emissions Standards for Hazardous Air Pollutants (NESHAPS)
 - 2) U.S. Occupational and Safety and Health Administration (OSHA)
 - 3) U.S. EPA Office of Pesticide and Toxic Substances Guidance Document
 - 4) U.S. Department of Transportation, Hazardous Substances: Final Rule (49 CFR 171 and 172), Federal Register November 21, 1986 and corrected February 17, 1987.
 - 5) Statutes of the State in which the Work is to be Performed: Licensure for Asbestos Consultants and Contractors.
 - 6) All state, county, and city codes and ordinances as applicable. Make available for review at the site one copy of EPA, OSHA, and applicable State, County, and City Regulations governing the Work.
3. Patent/Copyright Compliance: Contractor shall determine the applicability of any process patents that may be employed and shall be responsible for the payment of all fees, royalties and licenses that may be required for the use of any patented or licensed process. Contractor shall hold the Owner, Engineer and Testing Laboratory harmless for failure to obtain any licenses and to pay any applicable fees and royalties.



- D. Product Handling
1. Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.
 2. Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.
 3. Remove from the premises all damaged or deteriorating materials. Dispose of materials that become contaminated with waste in accordance with applicable regulatory standards.
- E. Worksite Conditions
1. Worker and Visitor Procedures: The Contractor is hereby advised that the birds and bird wastes have been determined to cause diseases by inhalation and Contractor shall provide workers and qualified visitors with respirators that, as a minimum, shall meet the requirements of current applicable OSHA regulations, and protective clothing during preparation of system of enclosures, prior to commencing, during actual removal, and until final clean-up is completed. Also all personnel assigned to work on this project shall attend a training/awareness class for the purpose of explaining the hazards of improperly handling these materials and proper control measures to take in order to protect themselves.
- F. Personnel Protection
1. General
 - a. Provide respiratory protection in accordance with OSHA regulations 29 CFR 1910-134 and in accordance with the following paragraphs.
 - 1) Prior to commencement of work, all workers shall be instructed by the Contractor and shall be knowledgeable in the appropriate procedures of personnel protection and waste removal.
 - 2) Where respirators with disposable filters are used, provide sufficient filters for replacement as necessary by the workers, or as required by applicable regulations.
 - 3) Permit no visitors, except for governmental inspectors having jurisdiction, or as authorized by Engineer or the Owner, in the work areas after commencement of waste disturbance or removal. Provide authorized visitors with suitable respirators.
 - 4) Provide workers with sufficient sets of protective disposable clothing, consisting of full-body coveralls, head covers, gloves, and foot covers, of sizes to properly fit individual workers.
 - 5) Provide authorized visitors with a set of suitable protective disposable clothing, headgear, eye protection, and/or footwear of sizes to properly fit visitors whenever they are required to enter the work area, to a maximum of six sets per day.
 - 6) Provide, in addition to respirators and protective clothing provided for authorized visitors, protective clothing and respirators for use by Testing Laboratory's representative. Furnish protective clothing in as many sets as required for full-time monitoring by Testing Laboratory.
 - 7) Provide and post the decontamination and work procedures to be followed by workers.
 2. Respiratory Protection Program
 - a. Maintain a respiratory protection program that contains all the elements of the OSHA regulations. Provide a copy to the Engineer for approval.
 - b. Appoint a respiratory protection program administrator, who shall be responsible for the program, maintaining all documentation, instructing workers and providing fit tests. Respiratory protection administrator is to be qualified under OSHA requirements and to have attended and passed, as a minimum, OSHA training institute 2-week course on respiratory protection or NIOSH course "Occupational Respiratory Protection." Respiratory protection program administrator is to be on-site daily during abatement activities. All written programs and directions are to be in English and/or the language of the abatement workers if they are not fluent in English.
 - c. The Contractor is advised that the minimum respiratory requirements as called for in this section and on any drawings/sketches shall be applied unless reported measures indicate



that a lower form of respiratory protection is acceptable according to the appropriate OSHA regulations and the more strict sections of the specification.

3. Respiratory Protection Requirements
 - a. Workers shall be provided with respiratory protection equipment. The respirators are to be sanitized and maintained in accordance with the manufacturer's specification. Appropriate respirator selection will be dependent upon the work to be performed and the level of exposure, as given below.
 - b. For the clean-up, as a minimum, the use of full-faced air-purifying respirators is required for all preparation, removal and cleaning work.
 - c. This specification requires that workers shall wear suitable respiratory protection at all times whenever a potential for exposure to bird and bird waste exists.

1.2 PRODUCTS

A. Materials

1. Polyethylene/Plastic sheeting shall be of the thicknesses specified, in sizes to minimize the frequency of joints. Utilize reinforced plastic sheeting in specified thicknesses on floors.
2. Tape shall be glass fiber or other type capable of sealing joints of adjacent sheets of plastic and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials under both dry and wet conditions.
3. Sodium Hypochlorite ("bleach")
4. Impermeable Containers shall be suitable to receive and retain contaminated materials until disposal at an approved site and shall be labeled in accordance with U.S. DOT 49 CFR 171 and 172, and containers shall be both air- and water-tight. Use a minimum of two types of impermeable containers: 1) six millimeter-thick (mil) plastic bags sized to fit within the drum; and 2) metal or fiber drums with tightly fitting lids.
5. Other Materials: Provide all other materials, such as lumber, nails, and hardware, that may be required to construct and dismantle the decontamination area and the barriers that isolate the work area(s).
6. Caulking shall be non-shrinking caulk to be used where insulated pipes continue through areas such as walls and ceilings. Contractor shall determine and submit proof that caulk proposed for use is compatible with the temperature conditions of the surfaces to which it is to be applied.
 - a. Tools And Equipment
 - 1) Water Sprayer - utilize airless or other low pressure sprayer for amended water application.
 - 2) Air Purifying Equipment (for internal recirculation in the work area) shall be HEPA Filtration Systems or Electronic Precipitators. Ensure that no internal air movement system or purification equipment exhausts contaminated air from the work area(s) outside the work area.
 - 3) Diminished Air Pressure Equipment shall comply with ANSI 29.2-7, local exhaust ventilation.
 - 4) Scaffolding shall be as required to accomplish the specified work and shall meet all applicable safety regulations.
 - 5) Transportation - as required for loading, temporary storage, transit, and unloading of contaminated waste without exposure to persons or property.

1.3 EXECUTION

A. Procedures

1. All personnel assigned to perform the work shall attend a training/awareness class for the purpose of explaining the hazards of improperly handling the waste and the proper control measures to take in order to protect themselves. These work procedures shall be discussed with each individual followed by the individual acknowledging receipt of this training by completing the pertinent information on a Hazardous Awareness Training Form



2. The majority of diseases related to bird waste is related to the inhalation of the airborne dust released by the waste. All personnel performing removal/decontamination waste shall therefore wear Powered Air Purifying Respirators (PAPR) equipped with combination Organic Vapor and High Efficiency Particulate Air (HEPA) filters while handling the waste.
3. Workers shall wear non-porous gloves and boots during all preparatory and removal operations.
4. When entering the building, the removal/decontamination personnel shall mist all surfaces having visible remnants of waste, using a diluted sodium hypochlorite ("bleach") and water solution. This solution shall be diluted at a ratio of 10 parts water to 1 part bleach for a 10 to 1 ration (10:1). The waste shall be continuously misted during occupancy in order to keep airborne dust emissions from the waste to a minimum.
5. Remove all birds from the building and seal all openings into the building. The main purpose of this is to eliminate the availability for future bird access into the building. The openings may be temporarily sealed or closed up in many ways, including boarding up windows/doors, polyethylene sheeting, or other convenient and cost effective means. It is not the intention of this task to complete seal the building airtight.
6. Designate an area of the facility for the purpose of storing the waste prior to loading for transportation to the appropriate landfill. The area designated shall have easy access to the door which will be utilized as the waste load-out.

END OF SECTION 02 87 16 13



Task	Specification	Specification Description
02 89 00 00	01 22 16 00	No Specification Required
02 89 00 00	02 83 19 13	Removal And Disposal Of Lead-Containing Paint
02 89 00 00	02 83 19 13a	Lead Paint Related Abatement Procedures
02 89 00 00	02 83 19 13b	XRF Testing For Lead-Based Paint
02 89 00 00	02 83 19 13c	Lead Dust Wipe, Air And Tcpl Sampling And Analysis



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**SECTION 09 01 30 91 - CERAMIC TILE**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for ceramic tile. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Ceramic tile.
 - b. Stone thresholds.
 - c. Waterproof membrane.
 - d. Crack isolation membrane.
 - e. Tile backing panels.
 - f. Metal edge strips.

C. Definitions

1. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
2. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
3. Module Size: Actual tile size plus joint width indicated.
4. Face Size: Actual tile size, excluding spacer lugs.

D. Performance Requirements

1. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - a. Level Surfaces: Minimum 0.6.
 - b. Step Treads: Minimum 0.6.
 - c. Ramp Surfaces: Minimum 0.8.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
4. Samples:
 - a. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
OR
Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.



- b. Full-size units of each type of trim and accessory for each color and finish required.
- c. Stone thresholds in 6-inch (150-mm) lengths.
- d. Metal edge strips in 6-inch (150-mm) lengths.
- 5. Qualification Data: For qualified Installer.
- 6. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- 7. Product Certificates: For each type of product, signed by product manufacturer.
- 8. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

F. Quality Assurance

- 1. Source Limitations for Tile: Obtain tile of each type and color or finish **OR** tile of each type **OR** tile of each color or finish **OR** tile, **as directed**, from one source or producer.
 - a. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- 2. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- 3. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - a. Stone thresholds.
 - b. Waterproof membrane.
 - c. Crack isolation membrane.
 - d. Joint sealants.
 - e. Cementitious backer units.
 - f. Metal edge strips.
- 4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

- 1. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- 2. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- 3. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- 4. Store liquid materials in unopened containers and protected from freezing.
- 5. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

H. Project Conditions

- 1. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.2 PRODUCTS

A. Products, General

- 1. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - a. Provide tile complying with Standard grade requirements unless otherwise indicated.
- 2. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 1.2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.



3. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
4. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - a. Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
5. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

B. Tile Products

1. Tile Type: Factory-mounted unglazed **OR** glazed, **as directed**, ceramic mosaic tile.
 - a. Composition: Porcelain **OR** Impervious natural clay or porcelain **OR** Vitreous or impervious natural clay or porcelain, **as directed**.
 - b. Module Size: 1 by 1 inch (25.4 by 25.4 mm) **OR** 1 by 2 inches (25.4 by 50.8 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - c. Thickness: 1/4 inch (6.35 mm).
 - d. Face: Plain **OR** Pattern of design indicated, **as directed**, with cushion edges.
 - e. Surface (for unglazed tile): Smooth, without **OR** Slip-resistant, with, **as directed**, abrasive admixture.
 - f. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - g. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - h. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - i. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base Cove: Cove, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 2) Base Cap for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 3) Base Cap for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - 4) Wainscot Cap for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 5) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - 6) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - 7) External Corners for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 8) External Corners for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - 9) Internal Corners: Cove, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.

OR



- Internal Corners: Field-butteted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.
- 10) Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.
2. Tile Type: Unglazed **OR** Glazed, **as directed**, square-edged quarry tile.
 - a. Face Size: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm) **OR** 6 by 3 inches (152 by 76 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm) **OR** 8 by 8 inches (203 by 203 mm), **as directed**.
 - b. Thickness: 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm) **OR** 3/4 inch (19 mm), **as directed**.
 - c. Wearing Surface (for unglazed tile): Nonabrasive, smooth **OR** Abrasive aggregate embedded in surface, **as directed**.
 - d. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - e. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - f. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - g. For furan-grouted quarry tile, precoat with temporary protective coating.
 - h. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base: Coved with surface bullnose top edge, **as directed**, face size 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm), **as directed**.
 - 2) Wainscot Cap: Surface bullnose, face size 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm), **as directed**.
 - 3) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 3. Tile Type: Unglazed **OR** Glazed, **as directed**, paver tile.
 - a. Composition: Porcelain **OR** Impervious natural clay or porcelain **OR** Vitreous or impervious natural clay or porcelain **OR** Natural clay or porcelain, **as directed**.
 - b. Face Size: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 7-3/4 by 3-7/8 inches (197 by 98 mm) **OR** 7-7/8 by 7-7/8 inches (200 by 200 mm) **OR** 11-13/16 by 11-13/16 inches (300 by 300 mm) **OR** 165 by 333 mm **OR** 200 by 250 mm **OR** 250 by 250 mm **OR** 165 by 333 mm **OR** 333 by 333 mm **OR** 400 by 400 mm, **as directed**.
 - c. Thickness: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
 - d. Face: Plain with square or cushion edges **OR** Plain with square edges **OR** Plain with cushion edges **OR** Pattern of design indicated, with square or cushion edges **OR** As indicated, **as directed**.
 - e. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - f. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - g. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 4. Tile Type: Glazed wall tile **OR** Decorative thin wall tile, **as directed**.
 - a. Module Size: 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 4-1/4 inches (152 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 200 by 200 mm **OR** 250 by 250 mm **OR** 200 by 300 mm, **as directed**.
 - b. Thickness: 5/16 inch (8 mm).



- c. Face: Plain with modified square edges or cushion edges **OR** Plain with modified square edges **OR** Plain with cushion edges **OR** Pattern of design indicated, with manufacturer's standard edges, **as directed**.
 - d. Finish: Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - e. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - f. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - g. Mounting: Factory, back mounted.
 - h. Mounting: PregROUTED sheets of tiles factory assembled and grouted with manufacturer's standard white silicone rubber.
 - i. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base for Portland Cement Mortar Installations: Coved, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 3-3/4 inches (152 by 95 mm), **as directed**.
 - 2) Base for Thin-Set Mortar Installations: Straight, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
 - 3) Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
 - 4) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
 - 5) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - 6) External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch (19 mm) unless otherwise indicated.
 - 7) External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
 - 8) Internal Corners: Field-buttet square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.
5. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as adjoining wall tile.
- a. One soap holder with grab handle, **as directed**, for each shower and tub indicated.
 - b. One paper holder at each water closet.
 - c. Color and Finish: Match adjoining glazed wall tile **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** White, bright glaze, **as directed**.

C. Thresholds

- 1. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - a. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
- 2. Granite Thresholds: ASTM C 615, with polished **OR** honed, **as directed**, finish.
 - a. Description: Uniform, fine **OR** medium, **as directed**, -grained, white **OR** gray **OR** black, **as directed**, stone without veining.
OR
Description: Match sample.



3. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 **OR** 12, **as directed**, per ASTM C 1353 or ASTM C 241 and with honed finish.
 - a. Description: Uniform, fine- to medium-grained white stone with gray veining.
OR
Description: Match sample.
 4. Slate Thresholds: ASTM C 629, Classification I Exterior **OR** II Interior, **as directed**, with fine, even grain and honed finish.
 - a. Description: Uniform, black **OR** blue-black **OR** gray **OR** blue-gray **OR** green, **as directed**, stone and unfading.
OR
Description: Match sample.
- D. Tile Backing Panels
1. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.
 - a. Thickness: 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm) **OR** 5/8 inch (15.9 mm) **OR** As indicated, **as directed**.
 2. Fiber-Cement Underlayment: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.
 - a. Thickness: 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm) **OR** As indicated, **as directed**.
- E. Waterproof Membrane
1. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 2. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
 3. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.
 4. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.
 5. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with woven reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
 6. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
 7. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
 8. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
 9. Urethane Waterproofing and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.
- F. Crack Isolation Membrane
1. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard **OR** high, **as directed**, performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 2. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
 3. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.
 4. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.
 5. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.



6. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
7. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
8. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
9. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
10. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

G. Setting Materials

1. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
 - a. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
 - b. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
 - c. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.
 - 1) Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - 2) Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.
 - 3) Configuration over Studs and Furring: Flat.
 - 4) Configuration over Solid Surfaces: Self furring.
 - 5) Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - d. Latex Additive: Manufacturer's standard, acrylic resin or styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
2. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
 - a. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
3. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
OR
Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
 - b. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
4. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm).
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
OR
Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
5. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thin Set): ANSI A118.11.
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - b. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
6. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



- a. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.
7. Chemical-Resistant Furan Mortar: ANSI A118.5, with carbon filler.
8. Organic Adhesive: ANSI A136.1, Type I, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Grout Materials

1. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
 2. Standard Cement Grout: ANSI A118.6.
 3. Polymer-Modified Tile Grout: ANSI A118.7.
 - a. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

OR

Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
4. Water-Cleanable Epoxy Grout: ANSI A118.3.
 - a. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.
 5. Chemical-Resistant Furan Grout: ANSI A118.5, with carbon filler.
 6. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

I. Elastomeric Sealants

1. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 7 Section "Joint Sealants."
 - a. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
2. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
3. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
4. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
5. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout.

J. Miscellaneous Materials

1. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
2. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; half-hard brass **OR** white zinc alloy **OR** nickel silver **OR** stainless-steel, ASTM A 666, 300 Series, **as directed**, exposed-edge material.



3. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - a. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
 - b. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
4. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
5. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

K. Mixing Mortars And Grout

1. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
2. Add materials, water, and additives in accurate proportions.
3. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - a. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - b. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - 1) Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - 2) Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - c. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - d. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
2. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
3. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.



4. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

C. Tile Installation

1. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - a. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - 1) Exterior tile floors.
 - 2) Tile floors in wet areas.
 - 3) Tile swimming pool decks.
 - 4) Tile floors in laundries.
 - 5) Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - 6) Tile floors composed of rib-backed tiles.
2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
4. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
5. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - a. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
 - b. Quarry Tile: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
 - c. Paver Tile: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
 - d. Glazed Wall Tile: 1/16 inch (1.6 mm).
 - e. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).
6. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
7. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - a. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
8. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - a. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
 - b. Do not extend cleavage membrane, waterproofing or crack isolation membrane under thresholds set in dry-set portland cement or latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproofing or crack isolation membrane with elastomeric sealant.



9. Metal Edge Strips: Install at locations indicated **OR** where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile **OR** where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated, **as directed**.
 10. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- D. Tile Backing Panel Installation
1. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.
- E. Waterproofing Installation
1. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
 2. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.
- F. Crack Isolation Membrane Installation
1. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
 2. Do not install tile or setting materials over crack isolation membrane until membrane has cured.
- G. Cleaning And Protecting
1. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - a. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
 - b. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - c. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
 2. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
 3. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
 4. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.
- H. Exterior Tile Installation Schedule
1. Exterior Floor Installations:
 - a. Tile Installation F101: Cement mortar bed (thickset) bonded to concrete **OR** over waterproof membrane on concrete **OR** over waterproof membrane on concrete where indicated and bonded to concrete where membrane is not indicated, **as directed**; TCA F101 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- b. Tile Installation F102: Thin-set mortar on concrete **OR** over waterproof membrane on concrete **OR** over waterproof membrane on concrete where indicated and on concrete where membrane is not indicated, **as directed**; TCA F102.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
2. Exterior Wall Installations, Masonry or Concrete:
 - a. Tile Installation W201: Cement mortar bed (thickset) on metal lath over waterproof membrane; TCA W201 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation W202: Thin-set mortar; TCA W202.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- I. Interior Tile Installation Schedule
 1. Interior Floor Installations, Concrete Subfloor:
 - a. Tile Installation F111: Cement mortar bed (thickset) with cleavage membrane; TCA F111 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation F112: Cement mortar bed (thickset) bonded to concrete; TCA F112 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation F113: Thin-set mortar; TCA F113.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - d. Tile Installation F114: Cement mortar bed (thickset) with cleavage membrane; epoxy **OR** furan, **as directed**, grout; TCA F114 and ANSI A108.1B.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Water-cleanable epoxy **OR** Chemical-resistant furan, **as directed**, grout.
 - e. Tile Installation F115: Thin-set mortar; epoxy **OR** furan, **as directed**, grout; TCA F115.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Water-cleanable epoxy **OR** Chemical-resistant furan, **as directed**, grout.
 - f. Tile Installation F116: Organic adhesive **OR** Water-cleanable, tile-setting epoxy, **as directed**; TCA F116.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - g. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - h. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Polymer-modified sanded **OR** unsanded, **as directed**, grout.
 - i. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCA F125A.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - j. Tile Installation F131: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F131.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
 - k. Tile Installation F132: Water-cleanable, tile-setting epoxy on cured cement mortar bed bonded to concrete subfloor **OR** installed over cleavage membrane, **as directed**; epoxy grout; TCA F132.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
 - l. Tile Installation F133: Chemical-resistant furan mortar **OR** Water-cleanable, tile-setting epoxy, **as directed**; furan grout. TCA F133 except use water-cleanable, tile-setting epoxy instead of chemical-resistant furan mortar for setting tile.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Chemical-resistant furan grout.
2. Interior Floor Installations, Wood Subfloor:
 - a. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.



- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- b. Tile Installation F141: Cement mortar bed (thickset) with cleavage membrane; TCA F141 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- c. Tile Installation F142: Organic adhesive; TCA F142.
- 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- d. Tile Installation F143: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F143.
- 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
- e. Tile Installation F144: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA F144.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- f. Tile Installation F150/160: Thin-set mortar on exterior-glye plywood; TCA F150 or TCA F160.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: EGP latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
3. Interior Radiant Heat Floor Installations, Concrete Subfloor:
- a. Tile Installation RH110: Thin-set mortar on crack isolation membrane; hydronic piping installed in concrete; TCA RH110.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- b. Tile Installation RH115: Thin-set mortar; electric radiant system encapsulated in thin-set mortar; TCA RH115.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.



- c. Tile Installation RH116: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH116.
 - 1) Tile Type: as directed by the Owner.
 - 2) Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment".
 - 3) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- 4. Interior Radiant Heat Floor Installations, Wood Subfloor:
 - a. Tile Installation RH130: Thin-set mortar on exterior-glue plywood; electric radiant system encapsulated in thin-set mortar; TCA RH130.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: EGP latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - b. Tile Installation RH135: Thin-set mortar on cementitious backer units or fiber cement underlayment; electric radiant system encapsulated in thin-set mortar; TCA RH135.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - c. Tile Installation RH140: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH140.
 - 1) Tile Type: as directed by the Owner.
 - 2) Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment".
 - 3) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- 5. Interior Wall Installations, Masonry or Concrete:
 - a. Tile Installation W202: Thin-set mortar; TCA W202.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - b. Tile Installation W211: Cement mortar bed (thickset) bonded to substrate; TCA W211 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.



- c. Tile Installation W221: Cement mortar bed (thickset) on metal lath over waterproof membrane, **as directed**; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- d. Tile Installation W222: One-coat cement mortar bed (thickset) on metal lath over waterproof membrane, **as directed**; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation W223: Organic adhesive; TCA W223.
- 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
6. Interior Wall Installations, Wood Studs or Furring:
- a. Tile Installation W221: Cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- b. Tile Installation W222: One-coat cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- c. Tile Installation W223: Organic adhesive on solid backing; TCA W223.
- 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.



- d. Tile Installation W231: Cement mortar bed (thickset); TCA W231 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- f. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane, **as directed**; TCA W244.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- g. Tile Installation W245: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant gypsum backer board; TCA W245.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- 7. Interior Wall Installations, Metal Studs or Furring:
 - a. Tile Installation W221: Cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - b. Tile Installation W222: One-coat cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - c. Tile Installation W223: Organic adhesive on solid backing; TCA W223.
 - 1) Tile Type: as directed by the Owner.



- 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- d. Tile Installation W241: Cement mortar bed (thickset); TCA W241 and ANSI A108.1B.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation W242: Organic adhesive on gypsum board; TCA W242.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- f. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- g. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane, **as directed**; TCA W244.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- h. Tile Installation W245: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant gypsum backer board; TCA W245.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
8. Bathtub Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
 - a. Tile Installation B413: Thin-set mortar **OR** Organic adhesive, **as directed**, on water-resistant gypsum board; TCA B413.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
9. Bathtub/Shower Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
 - a. Tile Installation B411: Cement mortar bed (thickset); TCA B411 and ANSI A108.1A.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B412: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B412.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - c. Tile Installation B419: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant backer board; TCA B419.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
10. Shower Receptor and Wall Installations, Concrete or Masonry:
- a. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B421: Thin-set mortar on waterproof membrane; TCA B421.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation B422: Thin-set mortar on waterproof membrane with integrated bonding flange for bonded membranes; TCA B422.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
11. Shower Receptor and Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
- a. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B415: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B415.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation B420: Thin-set mortar on coated glass-mat, water-resistant backer board; TCA B420.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- d. Tile Installation B421: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment; TCA B421.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation B422: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment with integrated bonding flange for bonded membranes; TCA B422.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

END OF SECTION 09 01 30 91



SECTION 09 01 60 91 - JOINT SEALANTS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for joint sealants. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Silicone joint sealants.
 - b. Urethane joint sealants.
 - c. Polysulfide joint sealants.
 - d. Latex joint sealants.
 - e. Solvent-release-curing joint sealants.
 - f. Preformed joint sealants.
 - g. Acoustical joint sealants.

C. Preconstruction Testing

1. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - a. Use ASTM C 1087 **OR** manufacturer's standard test method, **as directed**, to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - b. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - c. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - d. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - e. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
2. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - a. Locate test joints where indicated on Project or, if not indicated, as directed by the Owner.
 - b. Conduct field tests for each application indicated below:
 - 1) Each kind of sealant and joint substrate indicated.
 - c. Notify the Owner seven days in advance of dates and times when test joints will be erected.
 - d. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - 1) Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - e. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - f. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with



requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

D. Submittals

1. Product Data: For each joint-sealant product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.
3. Samples: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
4. Joint-Sealant Schedule: Include the following information:
 - a. Joint-sealant application, joint location, and designation.
 - b. Joint-sealant manufacturer and product name.
 - c. Joint-sealant formulation.
 - d. Joint-sealant color.
5. Qualification Data: For qualified Installer and testing agency.
6. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
7. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
8. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
9. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - a. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - b. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
10. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
11. Field-Adhesion Test Reports: For each sealant application tested.
12. Warranties: Sample of special warranties.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
3. Product Testing: Test joint sealants using a qualified testing agency.
 - a. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - b. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
4. Preinstallation Conference: Conduct conference at Project site.

F. Project Conditions

1. Do not proceed with installation of joint sealants under the following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C, **as directed**).
 - b. When joint substrates are wet.
 - c. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.



- d. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

G. Warranty

1. Special Installer's Warranty: Manufacturer's standard form in which 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.
 - a. Warranty Period: Two years from date of Final Completion.
2. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - a. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - b. Disintegration of joint substrates from natural causes exceeding design specifications.
 - c. Mechanical damage caused by individuals, tools, or other outside agents.
 - d. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

1.2 PRODUCTS

A. Materials, General

1. 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.
2. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 - a. Architectural Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L.
3. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - a. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
4. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
5. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
6. Colors of Exposed Joint Sealants: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

B. Silicone Joint Sealants

1. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
2. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
3. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
4. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.



5. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
6. Single-Component, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade P, Class 100/50, for Use T.
7. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
8. Multicomponent, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade P, Class 100/50, for Use T.
9. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
10. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

C. Urethane Joint Sealants

1. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
2. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
3. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
4. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use T.
5. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.
6. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
7. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
8. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.
9. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
10. Immersible, Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses T and I.
11. Immersible, Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Uses T and I.
12. Immersible Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Uses T and I.
13. Immersible Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T and I.

D. Polysulfide Joint Sealants

1. Single-Component, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
2. Multicomponent, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
3. Multicomponent, Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
4. Multicomponent, Pourable, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.
5. Immersible, Multicomponent Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T and Use I.

E. Latex Joint Sealants

1. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.



- F. Solvent-Release-Curing Joint Sealants
 - 1. Acrylic-Based Joint Sealant: ASTM C 1311.
 - 2. Butyl-Rubber-Based Joint Sealant: ASTM C 1311.
- G. Preformed Joint Sealants
 - 1. Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
 - 2. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.
- H. Acoustical Joint Sealants
 - 1. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- I. Joint Sealant Backing
 - 1. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 - 2. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) **OR** Type O (open-cell material) **OR** Type B (bicellular material with a surface skin) **OR** or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, **as directed**, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 3. 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.
- J. Miscellaneous Materials
 - 1. 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.
 - 2. 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.
 - 3. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

1.3 EXECUTION

- A. Examination
 - 1. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Preparation
 - 1. 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:



- a. 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.
 - b. 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:
 - 1) Concrete.
 - 2) Masonry.
 - 3) Unglazed surfaces of ceramic tile.
 - 4) Exterior insulation and finish systems.
 - c. Remove laitance and form-release agents from concrete.
 - d. 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:
 - 1) Metal.
 - 2) Glass.
 - 3) Porcelain enamel.
 - 4) Glazed surfaces of ceramic tile.
2. 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.
 3. 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.

C. Installation Of Joint Sealants

1. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
2. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
3. 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.
 - a. Do not leave gaps between ends of sealant backings.
 - b. Do not stretch, twist, puncture, or tear sealant backings.
 - c. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
4. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
5. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - a. Place sealants so they directly contact and fully wet joint substrates.
 - b. Completely fill recesses in each joint configuration.
 - c. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
6. 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.
 - a. Remove excess sealant from surfaces adjacent to joints.



- b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - c. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - d. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - e. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - 1) Use masking tape to protect surfaces adjacent to recessed tooled joints.
7. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
- a. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 - b. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
 - c. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 - d. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
8. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.
9. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.
- D. Field Quality Control
1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
- a. Extent of Testing: Test completed and cured sealant joints as follows:
 - 1) Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - 2) Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.
 - b. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - c. Inspect tested joints and report on the following:
 - 1) Whether sealants filled joint cavities and are free of voids.
 - 2) Whether sealant dimensions and configurations comply with specified requirements.
 - 3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 - e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.



2. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
- E. Cleaning
1. 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.
- F. Protection
1. 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 Final Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.
- G. Joint-Sealant Schedule
1. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 - a. Joint Locations:
 - 1) Control and expansion joints in brick pavers.
 - 2) Isolation and contraction joints in cast-in-place concrete slabs.
 - 3) Joints between plant-precast architectural concrete paving units.
 - 4) Joints in stone paving units, including steps.
 - 5) Tile control and expansion joints.
 - 6) Joints between different materials listed above.
 - 7) Other joints as indicated.
 - b. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing **OR** Single component, pourable, traffic grade, neutral curing **OR** Multicomponent, pourable, traffic grade, neutral curing, **as directed**.
 - c. Urethane Joint Sealant: Single component, nonsag, traffic grade **OR** Single component, pourable, traffic grade **OR** Multicomponent, nonsag, traffic grade, Class 50 **OR** Multicomponent, nonsag, traffic grade, Class 25, **as directed**.
 - d. Polysulfide Joint Sealant: Multicomponent, nonsag, traffic grade **OR** Multicomponent, pourable, traffic grade, **as directed**.
 - e. Preformed Joint Sealant: Preformed foam sealant.
 - f. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
 2. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion.
 - a. Joint Locations:
 - 1) Joints in pedestrian plazas.
 - 2) Joints in swimming pool decks.
 - 3) Other joints as indicated.
 - b. Urethane Joint Sealant: Immersible, single component, nonsag, traffic grade **OR** Immersible, single component, pourable, traffic grade **OR** Immersible, multicomponent, nonsag, traffic grade **OR** Immersible, multicomponent, pourable, traffic grade, **as directed**.
 - c. Polysulfide Joint Sealant: Immersible, multicomponent, nonsag, traffic grade.
 - d. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
 3. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - a. Joint Locations:
 - 1) Construction joints in cast-in-place concrete.
 - 2) Joints between plant-precast architectural concrete units.
 - 3) Control and expansion joints in unit masonry.
 - 4) Joints in dimension stone cladding.



- 5) Joints in glass unit masonry assemblies.
- 6) Joints in exterior insulation and finish systems.
- 7) Joints between metal panels.
- 8) Joints between different materials listed above.
- 9) Perimeter joints between materials listed above and frames of doors, windows and louvers.
- 10) Control and expansion joints in ceilings and other overhead surfaces.
- 11) Other joints as indicated.
- b. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50 **OR** Single component, nonsag, neutral curing, Class 50 **OR** Single component, nonsag, neutral curing, Class 25 **OR** Single component, nonsag, acid curing **OR** Multicomponent, nonsag, neutral curing, **as directed**.
- c. Urethane Joint Sealant: Single component, nonsag, Class 100/50 **OR** Single component, nonsag, Class 50 **OR** Single component, nonsag, Class 25 **OR** Multicomponent, nonsag,, Class 50 **OR** Multicomponent, nonsag,, Class 25, **as directed**.
- d. Polysulfide Joint Sealant: Single component, nonsag **OR** Multicomponent, nonsag, **as directed**.
- e. Preformed Joint Sealant: Preformed silicone **OR** Preformed foam, **as directed**.
- f. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
4. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - a. Joint Locations:
 - 1) Isolation joints in cast-in-place concrete slabs.
 - 2) Control and expansion joints in stone flooring.
 - 3) Control and expansion joints in brick flooring.
 - 4) Control and expansion joints in tile flooring.
 - 5) Other joints as indicated.
 - b. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing **OR** Single component, pourable, traffic grade, neutral curing **OR** Multicomponent, pourable, traffic grade, neutral curing, **as directed**.
 - c. Urethane Joint Sealant: Single component, nonsag, traffic grade **OR** Single component, pourable, traffic grade **OR** Multicomponent, nonsag, traffic grade, Class 50 **OR** Multicomponent, nonsag, traffic grade, Class 25, **as directed**.
 - d. Polysulfide Joint Sealant: Multicomponent, nonsag, traffic grade **OR** Multicomponent, pourable, traffic grade, **as directed**.
 - e. Preformed Joint Sealant: Preformed foam.
 - f. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
5. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - a. Joint Locations:
 - 1) Control and expansion joints on exposed interior surfaces of exterior walls.
 - 2) Perimeter joints of exterior openings where indicated.
 - 3) Tile control and expansion joints.
 - 4) Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - 5) Joints on underside of plant-precast structural concrete beams and planks.
 - 6) Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
 - 7) Other joints as indicated.
 - b. Joint Sealant: Latex **OR** Acrylic based **OR** Butyl rubber based, **as directed**.
 - c. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
6. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - a. Joint Sealant Location:
 - 1) Joints between plumbing fixtures and adjoining walls, floors, and counters.



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- 2) Tile control and expansion joints where indicated.
 - 3) Other joints as indicated.
 - b. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone **OR** Single component, nonsag, mildew resistant, acid curing, **as directed**.
 - c. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
7. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
- a. Joint Location:
 - 1) Acoustical joints where indicated.
 - 2) Other joints as indicated.
 - b. Joint Sealant: Acoustical.
 - c. Joint-Sealant Color: As selected from manufacturer's full range.

END OF SECTION 09 01 60 91



SECTION 09 01 60 91a - PORTLAND CEMENT TERRAZZO FLOORING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for portland cement terrazzo flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Poured-in-place portland cement terrazzo flooring and base.
 - b. Poured-in-place rustic terrazzo flooring.
 - c. Precast terrazzo units.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For marble chips, aggregates, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement that indicates cost for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work.
4. Samples: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected
5. Qualification data.
6. Material certificates.
7. Maintenance data.

D. Quality Assurance

1. Installer Qualifications: An installer who is a contractor member of NTMA.
2. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
2. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

F. Project Conditions

1. Environmental Limitations: Maintain temperature above 50 deg F (10 deg C) for 48 hours before and during terrazzo installation.
2. Weather Limitations: Proceed with rustic terrazzo installation only when forecasted weather conditions permit work to be performed according to NTMA's written recommendations and temperatures remain above 45 deg F (7.2 deg C).
3. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.



4. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.
 - a. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

1.2 PRODUCTS

A. Portland Cement Terrazzo

1. Portland Cement Terrazzo Type: Sand cushion **OR** Structural **OR** Bonded **OR** Monolithic **OR** Installed over metal deck, **as directed**.
2. Materials:
 - a. Portland Cement: ASTM C 150, Type 1.
 - 1) Color for Exposed Matrix: As required by mix indicated **OR** White **OR** Gray, **as directed**.
 - b. Water: Potable.
 - c. Sand: ASTM C 33.
 - d. Marble Chips **OR** Aggregates, **as directed**: Complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.
 - 1) Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131 and ASTM C 535, **as directed**.
 - 2) 24-Hour Absorption Rate: Less than 0.75 percent.
 - 3) Dust Content: Less than 1.0 percent by weight.
 - e. Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight, and compatible with terrazzo matrix.
 - f. Bonding Agent: Neat portland cement or epoxy or acrylic bonding agents formulated for use with topping indicated.
 - g. Underbed Reinforcement: Galvanized welded-wire reinforcement, 2 by 2 inches (51 by 51 mm) by 0.062-inch- (1.57-mm-) diameter wire, complying with ASTM A 185 and ASTM A 82, except for minimum wire size.
 - h. Isolation Membrane: Polyethylene sheeting, ASTM D 2103, Type 13300, 4 mils (0.1 mm) thick; or unperforated asphalt felt, ASTM D 226, Type I (No. 15).
3. Mixes:
 - a. Underbed (for structural portland cement terrazzo or portland cement terrazzo installed over metal deck): Structural-concrete underbed as specified in Division 03 Section "Cast-in-place Concrete".
 - b. Underbed (for sand-cushion or bonded portland cement terrazzo): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for component proportions and mixing.
 - c. Portland Cement Terrazzo (below for NTMA-formulated design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip proportions and mixing.
 - 1) Formulated Mix Color and Pattern: As selected from NTMA standard-terrazzo plates **OR** As selected from NTMA Venetian-terrazzo plates, **as directed**.
 - d. Portland Cement Terrazzo (for custom design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip **OR** aggregate, **as directed**, proportions and mixing.
 - 1) Custom Mix Color and Pattern: Match sample **OR** Match existing, **as directed**.

B. Rustic Terrazzo

1. Rustic Terrazzo Type: Structural **OR** Bonded **OR** Monolithic **OR** Unbonded, **as directed**.
2. Materials:
 - a. Portland Cement: ASTM C 150, Type 1.
 - 1) Color for Exposed Matrix: As required by mix indicated.
 - b. Water: Potable.



- c. Sand: ASTM C 33.
 - d. Marble Chips **OR** Aggregates, **as directed**: As required for mix indicated, sizes complying with NTMA gradation standards, 0.25 percent maximum 24-hour absorption rate, and containing no deleterious or foreign matter.
 - e. Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight and weather, and compatible with matrix binder.
 - f. Air-Entraining Agent (for underbed of structural, bonded, or unbonded rustic terrazzo): Complying with NTMA's written recommendations and recommended by supplier for intended use.
 - g. Underbed Bonding Agent (for bonded rustic terrazzo): Neat portland cement.
 - h. Topping Bonding Agent (for monolithic rustic terrazzo): Neat portland cement, or epoxy or acrylic bonding agents formulated for use with topping indicated.
 - i. Isolation Membrane (for unbonded rustic terrazzo): Polyethylene sheeting, ASTM D 2103, Type 13300, 4 mils (0.1 mm) thick.
3. Mixes:
- a. Underbed (for structural or unbonded rustic terrazzo): Structural-concrete underbed as specified in Division 03 Section "Cast-in-place Concrete".
 - b. Underbed (for bonded rustic terrazzo): Comply with NTMA's "Terrazzo Specifications and Design Guide" for component proportions and mixing.
 - 1) Exterior Applications: Provide air-entraining agent.
 - c. Rustic Terrazzo (for NTMA-formulated design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip proportions and mixing.
 - 1) Formulated Mix Color and Pattern: As selected from NTMA rustic-terrazzo plates.
 - d. Rustic Terrazzo (for custom design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip **OR** aggregate, **as directed**, proportions and mixing.
 - 1) Custom Mix Color and Pattern: Match sample **OR** Match existing, **as directed**.
- C. Strip Materials
1. Standard Divider Strips: One-piece, flat-type strips for grouting into sawed joints prepared in concrete slab or underbed.
 - a. Material: As indicated **OR** White-zinc alloy **OR** Brass, **as directed**.
 - b. Depth: As indicated **OR** 3/4 inch (19 mm) **OR** 1-1/4 inches (32 mm) **OR** 2 inches (51 mm), **as directed**.
 - c. Width: As indicated **OR** 0.05 inch (1.27 mm) **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
 2. Heavy-Top Divider Strips: One-piece, flat-type strips for grouting into sawed joints prepared in concrete slab or underbed.
 - a. Base-Section Material: As indicated **OR** White-zinc alloy **OR** Galvanized steel, **as directed**.
 - b. Top-Section Material: As indicated **OR** White-zinc alloy **OR** Brass **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
 - c. Depth: As indicated **OR** 3/4 inch (19 mm) **OR** 1-1/4 inches (32 mm) **OR** 2 inches (51 mm), **as directed**.
 - d. Top-Section Width: As indicated **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
 3. Heavy-Top Angle Divider Strips: One-piece, L-type angle strips with anchoring device and in depth required for topping thickness indicated.
 - a. Material: As indicated **OR** White-zinc alloy **OR** Brass **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
 - b. Top-Section Width: As indicated **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
 4. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.



5. Expansion-Joint Strips (for structural portland cement terrazzo or for any type of rustic terrazzo): Brass **OR** Plastic strips in color selected from manufacturer's full range, **as directed**, with removable zip-strip top for installing sealant; in width indicated **OR** minimum 1/2 inch (12.7 mm) wide, **as directed**.
 6. Accessory Strips: Match divider strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
 - a. Base-bead strips for exposed top edge of terrazzo base.
 - b. Edge-bead strips for exposed edges of terrazzo.
 - c. Nosings for terrazzo stair treads and landings.
 7. Abrasive Strips (for terrazzo stair treads and landings): Silicon carbide or aluminum oxide, or combination of both, in epoxy-resin binder and set in channel.
 - a. Width: 1/2 inch (12.7 mm).
 - b. Depth: As required by terrazzo thickness.
 - c. Length: 4 inches (100 mm) less than stair width **OR** As indicated, **as directed**.
 - d. Color: As selected from manufacturer's full range.
- D. Miscellaneous Accessories
1. Strip Adhesive: Adhesive recommended by manufacturer for this use.
 - a. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Anchoring Devices:
 - a. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
 - b. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.
 3. Isolation and Expansion-Joint Material: Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, and nonoutgassing in unruptured state; butyl rubber; rubber; or cork; in width indicated **OR** minimum 1/2 inch (12.7 mm) wide, **as directed**.
 4. Portland Cement Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.
 5. Rustic Terrazzo Cleaner: Solution of muriatic acid and water for use on terrazzo type indicated.
 6. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
 - a. Rustic Terrazzo: Use solvent acrylic-type sealer.
- E. Precast Terrazzo
1. Precast Terrazzo Base Units: Minimum 3/4-inch- (19-mm-) thick, reinforced portland cement terrazzo units cast in maximum lengths possible, but not less than 36 inches (900 mm).
 - a. Type: As indicated **OR** Coved with minimum 3/4-inch (19-mm) radius **OR** Straight **OR** Splayed, **as directed**.
 - b. Top Edge: Straight, unfinished if top edge is concealed **OR** Beveled with polished top surface **OR** Radius edge with polished top surface, **as directed**.
 - c. Metal Toe Strip (for coved-toe bases): Zinc **OR** Brass, **as directed**.
 - d. Outside Corner Units: With finished returned edges at outside corner.
 - e. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.
 2. Precast Terrazzo Units for Stair Treads, Thresholds, Sills, Benches and Planters: Comply with NTMA's written recommendations for fabricating precast terrazzo units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer.
 - a. Stair Treads: Three-line **OR** Two-line **OR** One-line **OR** Abrasive nosing strip and two-line, **as directed**, abrasive inserts at nosings.



- b. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.
3. Precast Terrazzo Finishing (for custom precast terrazzo components):
 - a. Finish exposed-to-view edges or reveals to match face finish.
 - b. Ease exposed edges to 1/8-inch (3-mm) radius.

1.3 EXECUTION

A. Preparation

1. Clean substrates to produce clean, dry, and neutral substrate for terrazzo application.
 - a. Remove substances, including oil, grease, and curing compounds, that might impair bond of terrazzo system.
 - b. Roughen concrete substrates before installing terrazzo system according to NTMA's written recommendations.
2. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
 - a. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

B. Installation, General

1. Comply with NTMA's written recommendations for terrazzo and accessory installation.
2. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet (6 mm in 3 m); noncumulative.
3. Structural Portland Cement **OR** Structural Rustic **OR** Bonded Rustic **OR** Monolithic Rustic **OR** Unbonded Rustic, **as directed**, Terrazzo: Install isolation and expansion material where terrazzo and underbed abut **OR** terrazzo abuts, **as directed**, adjacent construction and directly above substrate expansion joints.
4. Underbed (for structural portland cement terrazzo or portland cement terrazzo installed over metal deck, or for structural or unbonded rustic terrazzo): Install structural-concrete underbed according to requirements specified in Division 03 Section "Cast-in-place Concrete".
5. Underbed (for sand-cushion or bonded portland cement terrazzo or for bonded rustic terrazzo):
 - a. Comply with NTMA's "Terrazzo Specifications and Design Guide" for underbed installation.
 - b. For sand-cushion portland cement terrazzo only:
 - 1) Cover entire surface to receive terrazzo with dusting of sand.
 - 2) Install isolation membrane over sand, overlapping ends and edges a minimum of 3 inches (75 mm).
 - 3) Install welded wire reinforcement, overlapping at edges and ends at least two squares. Stop mesh a minimum of 1 inch (25 mm) short of expansion joints.
 - c. Place underbed and screed to elevation indicated below finished floor elevation.
6. Strip Materials:
 - a. Divider and Control-Joint Strips:
 - 1) Locate divider strips over each edge of steel beams and girders **OR** centered over steel beams and joists **OR** directly over control joints, breaks, and saw cuts in concrete slabs **OR** in locations indicated, **as directed**.
 - 2) Install control-joint strips back to back and directly above concrete-slab control joints **OR** in locations indicated, **as directed**.
 - 3) Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.
 - 4) Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
 - b. Expansion-Joint Strips (for structural portland cement terrazzo or for any type of rustic terrazzo): Form expansion joints using divider strips and install directly above concrete-slab expansion joints.



- c. Accessory Strips: Install accessory strips as required to provide a complete installation.
 - d. Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch (1.6 mm) **OR** 1/32 inch (0.8 mm), **as directed**, higher than terrazzo surface.
7. Repair: Cut out and replace terrazzo areas that evidence lack of bond with substrate or underbed, including areas that emit a "hollow" sound if tapped. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by the Owner.

C. Portland Cement Terrazzo Installation

- 1. Pour in place, cure, and finish portland cement terrazzo according to NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
- 2. Terrazzo Topping Thickness: As indicated.
- 3. Finishing:
 - a. Seed additional marble chips **OR** aggregates, **as directed**, in matrix to uniformly distribute granular material on surface.
 - b. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
 - c. Fine Grinding: Grind with stones 120 grit or finer until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.

D. Rustic Terrazzo Installation

- 1. Pour in place, cure, and finish rustic terrazzo according to NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
- 2. Terrazzo Topping Thickness: As indicated.
- 3. Finishing:
 - a. Seed additional marble chips **OR** aggregates, **as directed**, in matrix to uniformly distribute granular material on surface.

E. Precast Terrazzo Installation

- 1. Install precast terrazzo units using method recommended by NTMA and manufacturer unless otherwise indicated.
- 2. Installation Tolerance: Set units with alignment level and true to dimensions, varying 1/8 inch (3.2 mm) maximum in length, height, or width; noncumulative.
- 3. Do not install units that are chipped, cracked, discolored, or improperly finished.
- 4. Seal joints between units with cement grout matching precast terrazzo matrix **OR** joint sealant, **as directed**.

F. Cleaning And Protection

- 1. Portland Cement Terrazzo and Precast Terrazzo Cleaning:
 - a. Remove grinding dust from installation and adjacent areas.
 - b. Wash surfaces with cleaner immediately after grouting precast terrazzo units and final cleaning of terrazzo flooring.
 - c. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.
- 2. Rustic Terrazzo Cleaning: Clean surfaces with 1:10 solution of muriatic acid in water. Legally contain and dispose of runoff from cleaning operations. Rinse surfaces with water and allow to dry thoroughly.
- 3. Sealing:
 - a. Seal surfaces according to NTMA's written recommendations.
 - b. Apply sealer according to sealer manufacturer's written instructions.
- 4. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Final Completion.



END OF SECTION 09 01 60 91a



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**SECTION 09 01 60 91b - CARPET**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for carpet. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Tufted carpet.
 - b. Woven carpet.
 - c. Carpet cushion.

C. Submittals

1. Product Data: For each product indicated.
2. Shop Drawings: Show the following:
 - a. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - b. Existing flooring materials to be removed.
 - c. Existing flooring materials to remain.
 - d. Carpet type, color, and dye lot.
 - e. Locations where dye lot changes occur.
 - f. Seam locations, types, and methods.
 - g. Type of subfloor.
 - h. Type of installation.
 - i. Pattern type, repeat size, location, direction, and starting point.
 - j. Pile direction.
 - k. Type, color, and location of insets and borders.
 - l. Type, color, and location of edge, transition, and other accessory strips.
 - m. Transition details to other flooring materials.
 - n. Type of carpet cushion.
3. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - a. Carpet: 12-inch- (300-mm-) square Sample.
 - b. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.
 - c. Carpet Cushion: 6-inch- (150-mm-) square Sample.
 - d. Carpet Seam: 6-inch (150-mm) Sample.
 - e. Mitered Carpet Border Seam: 12-inch- (300-mm-) square Sample. Show carpet pattern alignment.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.3:
 - 1) For carpet, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
 - 2) For carpet cushion, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label" program.
 - 3) For installation adhesive, including printed statement of VOC content.
5. Product Schedule: For carpet and carpet cushion. Use same designations indicated on Drawings.
6. Maintenance data.



- D. Quality Assurance
1. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
 2. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 1.2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
 3. Preinstallation Conference: Conduct conference at Project site.
- E. Delivery, Storage, And Handling
1. Comply with CRI 104, Section 5, "Storage and Handling."
- F. Project Conditions
1. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
 2. Environmental Limitations: Do not install carpet and carpet cushion until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 3. Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
 4. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.
- G. Warranty
1. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - a. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - b. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
 - c. Warranty Period: 10 years from date of Final Completion.
 2. Special Warranty for Carpet Cushion: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet cushion installation that fail in materials or workmanship within specified warranty period.
 - a. Warranty includes consequent removal and replacement of carpet and accessories.
 - b. Warranty does not include deterioration or failure of carpet cushion due to unusual traffic, failure of substrate, vandalism, or abuse.
 - c. Failure includes, but is not limited to, permanent indentation or compression.
 - d. Warranty Period: 10 years from date of Final Completion.

1.2 PRODUCTS

- A. Tufted Carpet
1. Fiber Content: 100 percent nylon 6, 6 **OR** 100 percent nylon 6 **OR** 100 percent polypropylene, **as directed**.
 2. Pile Characteristic: Level-loop **OR** Cut **OR** Cut-and-loop **OR** Multilevel-loop **OR** Level tip shear **OR** Random shear **OR** Frieze **OR** Sculptured, **as directed**, pile.
 3. Yarn Twist: as directed by the Owner.
 4. Yarn Count: as directed by the Owner.
 5. Density: as directed by the Owner.
 6. Pile Thickness: finished carpet per ASTM D 6859.
 7. Stitches: as directed by the Owner.
 8. Gage: as directed by the Owner.
 9. Face Weight: as directed by the Owner.



10. Total Weight: for finished carpet.
 11. Primary Backing: Manufacturer's standard material **OR** Woven polypropylene **OR** Nonwoven, polypropylene or polyester, **as directed**.
 12. Secondary Backing: Manufacturer's standard material **OR** Woven polypropylene **OR** Nonwoven, polypropylene or polyester **OR** Woven jute **OR** Fiberglass, **as directed**.
 13. Backcoating: Manufacturer's standard material **OR** SBR latex **OR** PVC **OR** Thermoplastic copolymer, **as directed**.
 14. Width: 12 feet (3.7 m) **OR** 6 feet (1.8 m) **OR** 13.5 feet (4.1 m) **OR** 15 feet (4.6 m), **as directed**.
 15. Applied Soil-Resistance Treatment: Manufacturer's standard material.
 16. Antimicrobial Treatment: Manufacturer's standard material.
 17. Performance Characteristics: As follows:
 - a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
 - b. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
 - c. Tuft Bind: Not less than 3 lbf (13 N) **OR** 5 lbf (22 N) **OR** 6.2 lbf (28 N) **OR** 8 lbf (36 N) **OR** 10 lbf (45 N), **as directed**, per ASTM D 1335.
 - d. Delamination: Not less than 2.5 lbf/in. (12 N/mm) **OR** 3.5 lbf/in. (15 N/mm) **OR** 4 lbf/in. (18 N/mm), **as directed**, per ASTM D 3936.
 - e. Resistance to Insects: Comply with AATCC 24.
 - f. Noise Reduction Coefficient (NRC): per ASTM C 423.
 - g. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
 - h. Colorfastness to Light: Not less than 4 after 40 **OR** 60, **as directed**, AFU (AATCC fading units) per AATCC 16, Option E.
 - i. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
 - j. Electrostatic Propensity: Less than 3.5 **OR** 2, **as directed**, kV per AATCC 134.
 - k. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
- B. Woven Carpet
1. Fiber Content: 100 percent wool **OR** 80 percent wool; 20 percent nylon 6, 6 **OR** 80 percent wool; 20 percent nylon 6, **as directed**.
 2. Face Construction: Axminster **OR** Wilton **OR** Velvet, **as directed**.
 3. Pile Characteristic: Level-loop **OR** Cut **OR** Cut-and-loop, **as directed**, pile.
 4. Yarn Twist: as directed by the Owner.
 5. Yarn Count: as directed by the Owner.
 6. Density: as directed by the Owner.
 7. Pile Thickness: for finished carpet per ASTM D 6859.
 8. Rows: as directed by the Owner.
 9. Pitch: as directed by the Owner.
 10. Face Weight: as directed by the Owner.
 11. Total Weight: as directed by the Owner., for finished carpet.
 12. Backing: Manufacturers standard **OR** As follows, **as directed**:
 - a. Chain Warp: as directed by the Owner.
 - b. Stuffer Warp: as directed by the Owner.
 - c. Shot or Fill Weft: as directed by the Owner.
 - d. Backcoating: as directed by the Owner.
 13. Applied Soil-Resistance Treatment: Manufacturer's standard material.
 14. Performance Characteristics: As follows:
 - a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
 - b. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
 - c. Resistance to Insects: Comply with AATCC 24.
 - d. Noise Reduction Coefficient (NRC): per ASTM C 423.
 - e. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.



- f. Colorfastness to Light: Not less than 4 after 40 **OR** 60, **as directed**, AFU (AATCC fading units) per AATCC 16, Option E.
- g. Electrostatic Propensity: Less than 3.5 **OR** 2, **as directed**, kV per AATCC 134.
- h. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

C. Carpet Cushion

1. Traffic Classification: CCC Class I, moderate **OR** II, heavy **OR** III, extra-heavy, **as directed**, traffic.
2. Fiber Cushion: Rubberized hair, mothproofed and sterilized **OR** Rubberized jute, mothproofed and sterilized **OR** Synthetic **OR** Resinated, recycled textile, **as directed**.
 - a. Weight: as directed by the Owner.
 - b. Thickness: as directed by the Owner.plus 5 percent maximum.
 - c. Density: as directed by the Owner.
3. Rubber Cushion: Flat **OR** Rippled waffle **OR** Textured flat **OR** Reinforced, **as directed**.
 - a. Weight: as directed by the Owner.
 - b. Thickness: as directed by the Owner.plus 5 percent maximum.
 - c. Compression Resistance: at 25 **OR** 65, **as directed**, percent per ASTM D 3676.
 - d. Density: as directed by the Owner.
4. Polyurethane-Foam Cushion: Grafted prime **OR** Densified **OR** Bonded **OR** Mechanically frothed, **as directed**.
 - a. Compression Force Deflection at 65 Percent: per ASTM D 3574.
 - b. Thickness: as directed by the Owner.
 - c. Density: as directed by the Owner.
5. Performance Characteristics: As follows:
 - a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
 - b. Noise Reduction Coefficient (NRC): per ASTM C 423.
 - c. Environmental Requirements: Provide carpet cushion that complies with testing and product requirements of Carpet and Rug Institute's "Green Label" program.

D. Installation Accessories

1. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet **OR** carpet cushion, **as directed**, manufacturer.
2. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer **OR** carpet and carpet cushion manufacturers, **as directed**.
 - a. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
3. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.
4. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
5. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

1.3 EXECUTION

A. Preparation

1. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.



2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.
3. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet **OR** carpet cushion, **as directed**, manufacturer.
4. Broom and vacuum clean substrates to be covered immediately before installing carpet.

B. Installation

1. Comply with CRI 104 and carpet manufacturer's **OR** carpet and carpet cushion manufacturers', **as directed**, written installation instructions for the following:
 - a. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
 - b. Double-Glue-Down Installation: Comply with CRI 104, Section 10, "Double Glue-Down Installation."
 - c. Carpet with Attached-Cushion Installation: Comply with CRI 104, Section 11, "Attached-Cushion Installations."
 - d. Preapplied Adhesive Installation: Comply with CRI 104, Section 11.4, "Pre-Applied Adhesive Systems (Peel and Stick)."
 - e. Hook-and-Loop Installation: Comply with CRI 104, Section 11.5, "Hook and Loop Technology."
 - f. Stretch-in Installation: Comply with CRI 104, Section 12, "Stretch-in Installation."
 - g. Stair Installation: Comply with CRI 104, Section 13, "Carpet on Stairs" for stretch-in **OR** glue-down, **as directed**, installation.
2. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
 - a. Bevel adjoining border edges at seams with hand shears **OR** Level adjoining border edges, **as directed**.
3. Do not bridge building expansion joints with carpet.
4. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
5. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
6. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
7. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.
8. Comply with carpet cushion manufacturer's written recommendations. Install carpet cushion seams at 90-degree angle with carpet seams.

C. Cleaning And Protecting

1. Perform the following operations immediately after installing carpet:
 - a. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - b. Remove yarns that protrude from carpet surface.
 - c. Vacuum carpet using commercial machine with face-beater element.
2. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."
3. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet cushion manufacturer **OR** and carpet adhesive manufacturer **OR** and carpet cushion and adhesive manufacturers, **as directed**.



END OF SECTION 09 01 60 91b

**SECTION 09 01 60 91c - CARPET TILE**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for carpet tile. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes modular, fusion-bonded **OR** tufted, **as directed**, carpet tile.

C. Submittals

1. Product Data: For each product indicated.
2. Shop Drawings: Show the following:
 - a. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - b. Existing flooring materials to be removed.
 - c. Existing flooring materials to remain.
 - d. Carpet tile type, color, and dye lot.
 - e. Type of subfloor.
 - f. Type of installation.
 - g. Pattern of installation.
 - h. Pattern type, location, and direction.
 - i. Pile direction.
 - j. Type, color, and location of insets and borders.
 - k. Type, color, and location of edge, transition, and other accessory strips.
 - l. Transition details to other flooring materials.
3. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - a. Carpet Tile: Full-size Sample.
 - b. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.
4. LEED Submittal:
 - a. Product Data for Credit EQ 4.3:
 - 1) For carpet tile, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
 - 2) For installation adhesive, including printed statement of VOC content.
5. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
6. Maintenance data.

D. Quality Assurance

1. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
2. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Comply with CRI 104, Section 5, "Storage and Handling."



F. Project Conditions

1. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
2. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
3. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
4. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

G. Warranty

1. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - a. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - b. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excess static discharge, and delamination.
 - c. Warranty Period: 10 years from date of Final Completion.

1.2 PRODUCTS

A. Carpet Tile

1. Fiber Content: 100 percent nylon 6, 6 **OR** 100 percent nylon 6 **OR** 100 percent polypropylene **OR** 100 percent wool **OR** 80 percent wool; 20 percent nylon 6, 6 **OR** 80 percent wool; 20 percent nylon 6, 6 **as directed**.
2. Fiber Type: **<Insert proprietary fiber type.>**
3. Pile Characteristic: Level-loop **OR** Cut **OR** Cut-and-loop, **as directed**, pile.
4. Yarn Twist: **<Insert twist in TPI (TPCM).>**
5. Yarn Count: **<Insert yarn count.>**
6. Density: **<Insert oz./cu. yd. (g/cu. cm).>**
7. Pile Thickness: **<Insert inches (mm)>** for finished carpet tile per ASTM D 6859.
8. Stitches: **<Insert stitches per inch (mm).>**
9. Gage: **<Insert gage in ends per inch (mm).>**
10. Surface Pile Weight: **<Insert oz./sq. yd. (g/sq. m).>**
11. Total Weight: **<Insert oz./sq. yd. (g/sq. m)>** for finished carpet tile.
12. Primary Backing/Backcoating: Manufacturer's standard composite materials **OR** PVC **OR** Fiberglass-reinforced PVC **OR** Fiberglass-reinforced amorphous resin **OR** Reinforced polyurethane composite cushion **OR** Reinforced polyurethane composite **OR** Reinforced thermoplastic copolymer, **as directed**.
13. Secondary Backing: Manufacturer's standard material.
14. Backing System: **<Insert proprietary name.>**
15. Size: 18 by 18 inches (457 by 457 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 18 by 36 inches (457 by 914 mm) **OR** 36 by 36 inches (914 by 914 mm), **as directed**.
16. Applied Soil-Resistance Treatment: Manufacturer's standard material.
17. Antimicrobial Treatment: Manufacturer's standard material.
18. Performance Characteristics: As follows:
 - a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
 - b. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
 - c. Tuft Bind: Not less than 3 lbf (13 N) **OR** 5 lbf (22 N) **OR** 6.2 lbf (28 N) **OR** 8 lbf (36 N) **OR** 10 lbf (45 N), **as directed**, per ASTM D 1335.



- d. Delamination: Not less than 3.5 lbf/in. (15 N/mm) **OR** 4 lbf/in. (18 N/mm), **as directed**, per ASTM D 3936.
- e. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
- f. Dimensional Stability: 0.2 percent or less per ISO 2551 (Aachen Test).
- g. Resistance to Insects: Comply with AATCC 24.
- h. Noise Reduction Coefficient (NRC): **<Insert NRC>** per ASTM C 423.
- i. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
- j. Colorfastness to Light: Not less than 4 after 40 **OR** 60, **as directed**, AFU (AATCC fading units) per AATCC 16, Option E.
- k. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
- l. Electrostatic Propensity: Less than 3.5 **OR** 2, **as directed**, kV per AATCC 134.
- m. Environmental Requirements: Provide carpet tile that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

B. Installation Accessories

1. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
2. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - a. VOC Limits: Provide adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.3 EXECUTION

A. Preparation

1. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.
3. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
4. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
5. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

B. Installation

1. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
2. Installation Method: As recommended in writing by carpet tile manufacturer **OR** Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive **OR** Partial glue down; install periodic tiles with releasable, pressure-sensitive adhesive **OR** Free lay; install carpet tiles without adhesive, **as directed**.
3. Maintain dye lot integrity. Do not mix dye lots in same area.
4. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.



5. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
6. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
7. Install pattern parallel to walls and borders.
8. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

C. Cleaning And Protection

1. Perform the following operations immediately after installing carpet tile:
 - a. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - b. Remove yarns that protrude from carpet tile surface.
 - c. Vacuum carpet tile using commercial machine with face-beater element.
2. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."
3. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 01 60 91c



Task	Specification	Specification Description
09 01 60 91	01 22 16 00	No Specification Required



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SECTION 09 22 13 00 - GYPSUM PLASTER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum plaster. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Gypsum plasterwork on expanded-metal lath, unit masonry and monolithic concrete.
 - b. Solid-plaster partitions.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

D. Quality Assurance

1. Fire-Resistance Ratings: Where indicated, provide gypsum plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Sound Transmission Characteristics: Where indicated, provide gypsum plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.

E. Delivery, Storage, And Handling

1. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

F. Project Conditions

1. Comply with ASTM C 842 requirements or gypsum plaster manufacturer's written recommendations, whichever are more stringent.
2. Room Temperatures: Maintain temperatures at not less than 55 deg F (13 deg C) or greater than 80 deg F (27 deg C) for at least seven days before application of gypsum plaster, continuously during application, and for seven days after plaster has set or until plaster has dried.
3. Avoid conditions that result in gypsum plaster drying out too quickly.
 - a. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
 - b. Maintain relative humidity levels for prevailing ambient temperature that produce normal drying conditions.
 - c. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.



1.2 PRODUCTS

A. Steel Framing For Solid-Plaster Partitions

1. Components, General: Comply with ASTM C 841. For steel sheet components not included in ASTM C 841, comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Channel Studs: Cold-rolled channels, 3/4 inch (19.1 mm) **OR** 1-1/2 inches (38.1 mm), **as directed**, deep.
3. Runners: L-runners with perforated or plain legs to suit lath attachment requirements, in 0.033-inch (0.84-mm) base-metal thickness where attached to overhead support and in 0.043-inch (1.1-mm) base-metal thickness where attached to floor.

B. Expanded-Metal Lath

1. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet, ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coated.
 - a. Recycled Content: Provide steel products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - b. Paper Backing: Kraft paper factory bonded to back of lath.
 - c. Diamond-Mesh Lath: Flat **OR** Self-furring, **as directed**, 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - d. Flat Rib Lath: Rib depth of not more than 1/8 inch (3.1 mm), 2.75 lb/sq. yd. (1.5 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - e. 3/8-Inch (9.5-mm) Rib Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m) **OR** 4 lb/sq. yd. (2.2 kg/sq. m), **as directed**.

C. Accessories

1. General: Comply with ASTM C 841 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
2. Metal Accessories:
 - a. Cornerite: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - b. Striplath: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - c. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
 - 1) Small nose cornerbead with expanded flanges; use unless otherwise indicated.
 - 2) Small nose cornerbead with perforated flanges; use on curved corners.
 - 3) Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
 - 4) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum, with expanded flanges; use at locations indicated on Drawings.
 - d. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
 - e. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - f. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
 - g. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6 to 16 mm) wide; with perforated flanges.
3. Plastic Accessories: Fabricated from high-impact PVC.
 - a. Cornerbeads: With perforated flanges.
 - 1) Small nose cornerbead; use unless otherwise indicated.
 - 2) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.



- b. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
 - 1) Square-edge style; use unless otherwise indicated.
 - 2) Bull-nose style, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
 - c. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - d. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1/2-inch- (13-mm-) **OR** 1-inch- (25.4-mm-) **OR** 1-1/2-inch- (38.1-mm-), **as directed**, wide reveal; with perforated concealed flanges.
4. Aluminum Trim: Extruded accessories of profiles and dimensions indicated on Drawings.
- a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - b. Finish: Mill **OR** Chemical-conversion coating, ASTM D 1730, Type B, compatible with field-applied finish coatings specified, **as directed**.
- D. Miscellaneous Materials
1. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
 2. Bonding Compound: ASTM C 631.
 3. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
 4. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 841.
 5. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.
 6. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of rated assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
 7. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Base-Coat Plaster Materials
1. Base-Coat Plasters, General: ASTM C 28/C 28M.
 2. Lightweight Gypsum Ready-Mixed Plaster: With mill-mixed perlite aggregate.
 3. Gypsum Neat Plaster: For use with job-mixed aggregates.
 4. Gypsum Wood-Fibered Plaster:
 5. High-Strength Gypsum Neat Plaster: With a minimum, average, dry compressive strength of 2800 psi (19 MPa) per ASTM C 472 for a mix of 100 lb (45 kg) of plaster and 2 cu. ft. (0.06 cu. m) of sand.
 6. Aggregates for Base-Coat Plasters: ASTM C 35, sand and perlite.
- F. Finish-Coat Plaster Materials
1. Gypsum Gaging Plaster: ASTM C 28/C 28M.
 2. Gypsum Ready-Mixed Finish Plaster: Manufacturer's standard, mill-mixed, gaged, interior finish.
 3. High-Strength Gypsum Gaging Plaster: ASTM C 28/C 28M, with a minimum, average, dry compressive strength of 5000 psi (34 MPa) per ASTM C 472 for a neat mix.
 4. Gypsum Keene's Cement: ASTM C 61/C 61M.
 5. Lime: ASTM C 206, Type S, special finishing hydrated lime.



6. Lime: ASTM C 206, Type N, normal finishing hydrated lime.
7. Aggregates for Float Finishes: ASTM C 35, sand **OR** perlite, **as directed**; graded per ASTM C 842.

G. Plaster Mixes

1. Mixing: Comply with ASTM C 842 and manufacturer's written instructions for applications indicated.

1.3 EXECUTION

A. Examination

1. Examine nonstructural and structural metal framing, substrates, and hollow-metal frames, for compliance with requirements and other conditions affecting performance of the Work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

C. Installation, General

1. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
2. STC-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
 - a. Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations.
 - b. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
3. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.
4. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

D. Installing Steel Framing For Solid-Plaster Partitions

1. Install according to ASTM C 841.
2. Framing for Solid-Plaster Partitions: Provide channel stud to support expanded-metal lath construction.
 - a. Space channel studs at 16 inches (406 mm) **OR** 24 inches (610 mm), **as directed**, o.c. unless otherwise indicated.
3. Framing for Studless Solid-Plaster Partition: Provide top and bottom L-track runners to support expanded-metal lath.

E. Installing Expanded-Metal Lath

1. Expanded-Metal Lath: Install according to ASTM C 841.
 - a. Partition Framing and Vertical Furring: Install flat diamond-mesh **OR** flat rib, **as directed**, lath.
 - b. Flat-Ceiling and Horizontal Framing: Install flat diamond-mesh **OR** flat rib, **as directed**, lath.
 - c. Curved-Ceiling Framing: Install flat diamond-mesh lath.
 - d. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.
 - e. Solid-Plaster Partitions: Where supported by channel studs, install flat rib **OR** flat diamond-mesh, **as directed**, lath.



- f. Studless Solid-Plaster Partitions: Install 3/8-inch (9.5-mm) rib lath.

F. Installing Accessories

1. General: Install according to ASTM C 841.
2. Cornerbeads: Install at external corners.
3. Casing Beads: Install at terminations of plasterwork, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or frames act as casing beads.
4. Control Joints: Install control joints at locations indicated on Drawings **OR** with spacing between joints in either direction not exceeding the following and in specific locations approved by Architect for visual effect, **as directed**:
 - a. Partitions: 30 feet (9 m).
 - b. Ceilings: 50 feet (15 m) **OR** 30 feet (9 m), **as directed**.

G. Plaster Application

1. General: Comply with ASTM C 842.
 - a. Do not deviate more than plus or minus 1/8 inch in 10 feet (3.1 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
 - b. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches (152 mm) at each jamb anchor.
 - c. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - d. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
2. Bonding Compound: Apply on unit masonry and concrete plaster bases.
3. Base Coats:
 - a. Base Coats over Expanded-Metal Lath: High-strength gypsum **OR** Gypsum neat, **as directed**, plaster with job-mixed sand for scratch and brown coats.
 - b. Base Coats over Expanded-Metal Lath:
 - 1) Scratch Coat: Gypsum wood-fibered plaster; neat or with job-mixed sand.
 - 2) Brown Coat: Gypsum wood-fibered plaster with job-mixed sand **OR** neat plaster with job-mixed sand **OR** lightweight ready-mixed plaster **OR** neat plaster with job-mixed perlite, **as directed**.
 - c. Base Coats over Unit Masonry: Gypsum wood-fibered plaster with job-mixed sand **OR** neat plaster with job-mixed sand **OR** lightweight ready-mixed plaster, **as directed**.
 - d. Base-Coat Mix over Monolithic Concrete: Gypsum neat plaster with job-mixed sand.
4. Finish Coats:
 - a. Finish-Coat Mix for Smooth-Troweled Finishes: Gypsum gaging plaster **OR** Gypsum ready-mixed finish plaster **OR** High-strength gypsum gaging plaster **OR** Gypsum Keene's cement, **as directed**.
 - b. Finish-Coat Mix for Float Finishes: Gypsum gaging plaster **OR** Gypsum Keene's cement, **as directed**.
 - c. Finish-Coat Mix for Sprayed Finishes: Gypsum ready-mixed finish plaster.
 - d. Finish-Coat Mix for Textured Finishes: Gypsum ready-mixed finish plaster.
5. Plaster Finishes:
 - a. Provide troweled finish unless otherwise indicated **OR** where indicated, **as directed**.
 - b. Provide float finish unless otherwise indicated **OR** where indicated, **as directed**.
 - c. Provide sprayed finish unless otherwise indicated **OR** where indicated, **as directed**.
 - 1) Sprayed Finish: Match sample.
 - d. Provide textured finish where indicated.
 - 1) Textured Finish: Match sample.
6. Concealed Plaster:



-
- a. Where plaster application will be concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
 - b. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
 - c. Where plaster application will be used as a base for adhesive application of tile and similar finishes, finish coat may be omitted.

H. Plaster Repairs

- 1. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

I. Cleaning And Protection

- 1. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 22 13 00



SECTION 09 22 13 00a - GYPSUM VENEER PLASTER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum veneer plastering. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Gypsum veneer plaster and gypsum base for veneer plaster.
 - b. Gypsum veneer plaster over cementitious backer units.
 - c. Gypsum veneer plaster over masonry surfaces.
 - d. Gypsum veneer plaster over monolithic concrete surfaces.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show locations, fabrication, and installation of control joints, and reveals and trim; include plans, elevations, sections, details of components, and attachments to other work.
3. Samples: For the following products:
 - a. Trim Accessories: Full-size Sample in 12-inch (300-mm) length for each trim accessory.
 - b. Textured Finishes: Manufacturer's standard size for each textured finish and on rigid backing.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
 - b. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.

D. Quality Assurance

1. Source Limitations: Obtain gypsum veneer plaster products, including gypsum base for veneer plaster, **OR** cementitious base units, **as directed**, joint reinforcing tape, and embedding material, from a single manufacturer.
2. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by a testing and inspecting agency.
3. STC-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

E. Delivery, Storage, And Handling

1. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
2. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
3. Stack panels flat on leveled supports off floor or slab to prevent sagging.

F. Project Conditions

1. Environmental Limitations: Comply with ASTM C 843 requirements or gypsum veneer plaster manufacturer's written recommendations, whichever are more stringent.



2. Room Temperatures: Maintain not less than 55 deg F (13 deg C) or more than 80 deg F (27 deg C) for 7 days before application of gypsum base and gypsum veneer plaster, continuously during application, and after application until veneer plaster is dry.
3. Avoid conditions that result in gypsum veneer plaster drying too rapidly.
 - a. Distribute heat evenly; prevent concentrated or uneven heat on veneer plaster.
 - b. Maintain relative humidity levels, for prevailing ambient temperature, that produce normal drying conditions.
 - c. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during veneer plaster application until it is dry.
4. Do not install panels that are wet, moisture damaged, or mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.2 PRODUCTS

A. Gypsum Veneer Plaster Materials

1. One-Component Gypsum Veneer Plaster: ASTM C 587, formulated for application directly over substrate without use of separate base-coat material.
2. High-Strength, One-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, smooth, finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi (20 MPa) when tested according to ASTM C 472; and formulated for application directly over substrate without use of separate base-coat material.
3. Two-Component Gypsum Veneer Plaster: ASTM C 587, with separate formulations; one for base-coat and one for finish-coat application over substrates.
4. High-Strength, Two-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, base-coat plaster and smooth finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi (20 MPa) when tested according to ASTM C 472.
5. Radiant-Heat, Two-Component Gypsum Veneer Plaster: ASTM C 587, and approved in writing by gypsum veneer plaster manufacturer for application with embedded electric heating cables.
 - a. Provide ready-mixed **OR** job-aggregated, **as directed**, components, as standard for manufacturer, to comply with manufacturer's written recommendations.
 - b. Aggregate: For job-aggregated base coat and texture finish coat, provide white silica sand passing a No. 30 (0.6-mm) sieve.

B. Panel Products

1. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
2. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
3. Gypsum Base for Veneer Plaster: ASTM C 588/C 588M.
 - a. Regular Type: In thickness indicated **OR** 1/2 inch (13 mm) thick, unless otherwise indicated, **as directed**.
 - b. Type X: In thickness indicated **OR** 5/8 inch (16 mm) thick, **as directed**.
 - c. Foil-Backed, Regular-Type Core: In thickness indicated **OR** 1/2 inch (13 mm) thick, unless otherwise indicated, **as directed**.
 - d. Type C: In thickness indicated **OR** 5/8 inch (16 mm) thick **OR** 1/2 inch (13 mm) thick, **as directed**.
 - e. Abuse-Resistant Base: With specially reinforced core for greater resistance to surface indentation, 5/8-inch (16-mm) thick, Type X core **OR** 1/2-inch (13-mm) thick, regular-type core, **as directed**.



- f. High-Impact Base: With Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance), and in thickness indicated **OR** 5/8 inch (16 mm) thick, **as directed**.
 - 1) Plastic-Film Thickness: 0.010 inch (0.254 mm) **OR** 0.020 inch (0.508 mm) **OR** 0.030 inch (0.762 mm) **OR** 0.081 inch (2.057 mm), **as directed**.
 - g. Moisture- and Mold-Resistant Base: With moisture- and mold-resistant core, glass-mat facing on both sides of panel, and in thickness indicated **OR** 5/8-inch (16-mm) thick, Type X core **OR** 1/2-inch (13-mm) thick, regular-type core, **as directed**.
 - 1) Mold Resistance: ASTM D 3273; no mold growth after four weeks' exposure.
 4. Backing Panels for Multilayer Applications: ASTM C 588/C 588M gypsum base or ASTM C 36/C 36M gypsum board, as recommended by gypsum veneer plaster manufacturer, for application method and thicknesses indicated.
 - a. Core: Matching face layer, unless otherwise indicated.
 - b. Thickness: Matching face layer, unless otherwise indicated.
 5. Cementitious Backer Units: ANSI A118.9, in thickness indicated **OR** 1/2 inch (13 mm) thick, **as directed**.
- C. Trim Accessories
1. Standard Trim: ASTM C 1047, provided or approved by manufacturer for use in gypsum veneer plaster applications indicated.
 - a. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet **OR** Galvanized or aluminum-coated steel sheet or rolled zinc **OR** Plastic **OR** Paper-faced galvanized steel sheet, **as directed**.
 - b. Shapes:
 - 1) Cornerbead.
 - 2) Bullnose bead.
 - 3) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - 4) L-Bead: L-shaped; exposed long flange receives joint compound.
 - 5) U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - 6) Curved-Edge Cornerbead: With notched or flexible flanges.
 - 7) Control joints.
 2. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - b. Finish: Manufacturer's standard Architectural Class II, Clear Anodic Finish AA-M12C22A31, complying with AAMA 611 **OR** chemical conversion coat finish **OR** prime paint finish, **as directed**.
- D. Joint Reinforcing Materials
1. General: Comply with joint strength requirements in ASTM C 587 and with gypsum veneer plaster manufacturer's written recommendations for each application indicated.
 2. Joint Tape:
 - a. Gypsum Base for Veneer Plaster: As recommended by gypsum veneer plaster manufacturer for applications indicated **OR** Paper **OR** Open-mesh, glass fiber, **as directed**.
 - b. Cementitious Backer Units: As recommended by cementitious backer unit manufacturer.
 3. Embedding Material for Joint Tape:
 - a. Gypsum Base for Veneer Plaster: As recommended by gypsum veneer plaster manufacturer for use with joint-tape material and gypsum veneer plaster applications indicated.
 - b. Cementitious Backer Units: As recommended by cementitious backer unit manufacturer for applications indicated.
- E. Auxiliary Materials
1. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.



2. Bonding Agent: ASTM C 631, polyvinyl acetate.
3. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum base face-layer panels to backing-layer panels in multilayer construction.
 - a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - a. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
5. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
6. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
7. Acoustical Sealant: As specified in Division 07 Section "Thermal Insulation".
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Patching Mortar: Dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

F. Gypsum Veneer Plaster Mixes

1. Mechanically mix gypsum veneer plaster materials to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.

1.3 EXECUTION

A. Preparation

1. Monolithic Concrete Substrates: Prepare according to gypsum veneer plaster manufacturer's written recommendations and as follows:
 - a. Clean surfaces to remove dust, loose particles, grease, oil, incompatible curing compounds, form-release agents, and other foreign matter and deposits that could impair bond with gypsum veneer plaster.
 - b. Remove ridges and protrusions greater than 1/8 inch (3 mm) and fill depressions greater than 1/4 inch (6 mm) with patching mortar. Allow to set and dry.
 - c. Apply bonding agent on dry and cured concrete substrates.
2. Masonry Substrates: Prepare according to gypsum veneer plaster manufacturer's written recommendations and as follows:
 - a. Clean surfaces to remove dirt, grease, oil, and other foreign matter and deposits that could impair bond with gypsum veneer plaster.
 - b. Apply bonding agent on dry masonry substrates.

B. Installing Panels, General

1. Gypsum Base for Veneer Plaster: Apply according to ASTM C 844 unless manufacturer's written recommendations are more stringent.
 - a. Do not allow gypsum base to degrade from exposure to sunlight as evidenced by fading of paper facing.
 - b. Erection Tolerance: No more than 1/16-inch (1.6-mm) offsets between planes of gypsum base panels, and 1/8 inch in 8 feet (3 mm in 2.4 m) noncumulative, for level, plumb, warp, and bow.



2. Install sound attenuation blankets before installing gypsum base for veneer plaster unless blankets are readily installed after panels have been installed on one side.
3. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
4. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.6 mm) of open space between panels. Do not force into place.
5. Locate edge and end joints over supports except in ceiling applications where intermediate supports or 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.
6. Attach panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
7. Attach panels to framing provided at openings and cutouts.
8. Form control joints with space between edges of adjoining panels.
9. Cover both sides of steel stud partition framing with panels in concealed spaces, including above ceilings, except in internally braced chases.
 - a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.74 sq. m) in area.
 - b. Fit panels around ducts, pipes, and conduits.
 - c. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints; seal joints with acoustical sealant.
10. Wood Framing: Install panels over wood framing, with "floating" internal corner construction. Do not attach panels across the flat grain of wide-dimension lumber, including floor joists and headers. "Float" panels over these members or provide control joints to counteract wood shrinkage.
11. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
12. Fastener Spacing: Comply with ASTM C 844, manufacturer's written recommendations, and fire-resistance-rating requirements.
 - a. Space screws a maximum of 12 inches (305 mm) o.c. along framing members for wall or ceiling application.
 - b. Space fasteners in cementitious backer units a maximum of 8 inches (200 mm) o.c. along framing members for wall applications and 6 inches (150 mm) o.c. along framing members for ceiling applications.

C. Installing Panels

1. Install gypsum base panels for veneer plaster in the following locations:
 - a. Regular Type: As indicated on Drawings **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
 - b. Ceiling Type: As indicated on Drawings **OR** Ceiling surfaces, **as directed**.
 - c. Type X: As indicated on Drawings **OR** Where required for fire-resistance-rated assembly **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
 - d. Type C: As indicated on Drawings **OR** Where required for specific fire-resistance-rated assembly indicated, **as directed**.
 - e. Foil-Backed, Regular-Type Core: As indicated on Drawings **OR as directed**.
 - f. Abuse-Resistant Base: As indicated on Drawings **OR as directed**.
 - g. High-Impact Base: As indicated on Drawings **OR as directed**.
 - h. Moisture- and Mold-Resistant Base: As indicated on Drawings **OR as directed**.
2. Single-Layer Application:



- a. On ceilings, apply gypsum base panels before wall panels, to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - b. On walls, apply gypsum base panels vertically and parallel **OR** horizontally and perpendicular, **as directed**, to framing, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - 1) Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 2) At stairwells and other walls higher than 30 feet (9.0 m), install gypsum base panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - c. On Z-furring, apply gypsum base panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
3. Multilayer Application on Ceilings: Apply backing panels for ceilings before applying backing panels for partitions; apply gypsum-base face layers in same sequence. Apply backing panels at right angles to framing members and offset gypsum-base face-layer joints a minimum of 16 inches (400 mm) from parallel backing panel joints, unless otherwise required by fire-resistance-rated assembly.
 4. Multilayer Application on Partitions: Apply backing panels indicated and gypsum-base face layers vertically (parallel to framing) with joints of backing panels located over stud or furring members and gypsum-base face-layer joints offset at least one stud or furring member from backing-panel joints, unless otherwise required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - a. Z-Furring: Apply backing panels vertically (parallel to framing) and gypsum-base face layer either vertically or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of backing panels over furring members.
 5. Single-Layer Fastening Methods: Apply gypsum base panels to supports with steel drill screws.
 6. Multilayer Fastening Methods: Fasten backing panels and gypsum-base face layers separately to supports with screws **OR** with screws; fasten gypsum-base face layers with adhesive and supplementary fasteners, **as directed**.
 7. Curved Partitions: Comply with gypsum base manufacturer's written installation recommendations.
 8. Cementitious Backer Units: Install according to ANSI A108.11.
 - a. Where cementitious backer units abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- D. Installing Trim Accessories
1. 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.
 2. Control Joints: Install at locations indicated on Drawings **OR** according to ASTM C 844 and in specific locations approved by the Owner, **as directed**.
 3. Trim: Install in the following locations:
 - a. Cornerbead: Use at outside corners, unless otherwise indicated.
 - b. Bullnose Bead: Use at outside corners **OR** where indicated, **as directed**.
 - c. LC-Bead: Use at exposed panel edges.
 - d. L-Bead: Use where indicated.
 - e. U-Bead: Use at exposed panel edges **OR** where indicated, **as directed**.
 - f. Curved-Edge Cornerbead: Use at curved openings.
 4. Aluminum Trim:
 - a. Install aluminum trim according to manufacturer's written recommendations.
 - b. Apply and embed joint tape over flanges of aluminum trim accessories if recommended by trim manufacturer.
- E. Installing Joint Reinforcement



1. Gypsum Base for Veneer Plaster: Reinforce interior angles and flat joints with joint tape and embedding material to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.
 2. Abuse-Resistant Base: Reinforce joints between abuse-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
 3. Impact-Resistant Base: Reinforce joints between impact-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
 4. Moisture- and Mold-Resistant Base: Reinforce joints between moisture- and mold-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
 5. Cementitious Backer Units: Reinforce joints between cementitious backer units with joint tape and embedding material according to unit manufacturer's written recommendations.
- F. Gypsum Veneer Plastering
1. Bonding Agent: Apply bonding agent on dry monolithic concrete **OR** masonry **OR** abuse-resistant base panels **OR** cementitious backer units, **as directed**, according to gypsum veneer plaster manufacturer's written recommendations.
 2. Gypsum Veneer Plaster Application: Comply with ASTM C 843 and with veneer plaster manufacturer's written recommendations.
 - a. One-Component Gypsum Veneer Plaster: Trowel apply base coat over substrate to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm). Fill all voids and imperfections. Allow plaster to set, then scratch and immediately double back with gypsum veneer plaster to uniform total thickness of 3/16 inch (4.8 mm).
 - b. Two-Component Gypsum Veneer Plaster:
 - 1) Base Coat: Trowel apply base coat over substrate to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm). Fill all voids and imperfections.
 - 2) Finish Coat: Trowel apply finish-coat plaster over base-coat plaster to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
 - c. Where gypsum veneer plaster abuts only metal door frames, windows, and other units, groove finish coat to eliminate spalling.
 - d. Do not apply veneer plaster to gypsum base if paper facing has degraded from exposure to sunlight. Before applying veneer plaster, use remedial methods to restore bonding capability to degraded paper facing according to manufacturer's written recommendations and as approved by the Owner.
 3. Radiant-Heat, Two-Component Gypsum Veneer Plaster Ceilings: Comply with ASTM C 843 and with radiant-heat veneer plaster manufacturer's written recommendations.
 - a. Base Coat: Apply plaster base coat to sufficiently cover electric heating cables. Trowel plaster parallel in direction of cables to uniform thickness of 3/16 inch (4.8 mm). Completely cover cables.
 - b. Finish Coat: After base coat has developed sufficient bond, apply finish coat. Trowel plaster to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
 4. Concealed Surfaces: Do not omit gypsum veneer plaster behind cabinets, furniture, furnishings, and similar removable items. Omit veneer plaster in the following areas where it will be concealed from view in the completed Work unless otherwise indicated or required to maintain fire-resistance and STC ratings:
 - a. Above suspended ceilings.
 - b. Behind wood paneling.
 5. Gypsum Veneer Plaster Finish: Smooth-troweled finish, unless otherwise indicated **OR** Textured finish matching the Owner's sample, **as directed**.
- G. Protection
1. Protect installed gypsum veneer plaster from damage from weather, condensation, construction, and other causes during remainder of the construction period.
 2. Remove and replace gypsum veneer plaster and gypsum base panels that are wet, moisture damaged, or mold damaged.



-
- a. Indications that gypsum base panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - b. Indications that gypsum base panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 22 13 00a



SECTION 09 22 13 00b - PORTLAND CEMENT PLASTER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for portland cement plaster. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Interior portland cement plasterwork on metal lath, unit masonry and monolithic concrete.
 - b. Exterior portland cement plasterwork (stucco) on metal lath, unit masonry and monolithic concrete.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.
4. Samples: For each type of factory-prepared, colored or textured finish coat indicated; 12 by 12 inches (305 by 305 mm), and prepared on rigid backing.

D. Quality Assurance

1. Fire-Resistance Ratings: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Sound-Transmission Characteristics: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

F. Project Conditions

1. Comply with ASTM C 926 requirements.
2. Interior Plasterwork: Maintain room temperatures at greater than 40 deg F (4.4 deg C) for at least 48 hours before plaster application, and continuously during and after application.
 - a. Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
 - b. Ventilate building spaces as required to remove water in excess of that required for hydrating plaster in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.
3. Exterior Plasterwork:



- a. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
- b. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
- c. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.
4. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

1.2 PRODUCTS

A. Metal Lath

1. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - a. Recycled Content: Provide steel products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - b. Diamond-Mesh Lath: Flat **OR** Self-furring, **as directed**, 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - c. Flat Rib Lath: Rib depth of not more than 1/8 inch (3.1 mm), 2.75 lb/sq. yd. (1.5 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - d. 3/8-Inch (9.5-mm) Rib Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m) **OR** 4 lb/sq. yd. (2.2 kg/sq. m), **as directed**.
2. Wire-Fabric Lath:
 - a. Welded-Wire Lath: ASTM C 933; self-furring, 1.4 lb/sq. yd. (0.8 kg/sq. m) **OR** 1.95 lb/sq. yd. (1.1 kg/sq. m), **as directed**.
 - b. Woven-Wire Lath: ASTM C 1032; self-furring, with stiffener wire backing, 1.1 lb/sq. yd. (0.6 kg/sq. m) **OR** 1.4 lb/sq. yd. (0.8 kg/sq. m), **as directed**.
3. Paper Backing: FS UU-B-790, Type I, Grade D, Style 2 vapor-permeable paper **OR** Grade B, Style 1a vapor-retardant paper, **as directed**.
 - a. Provide paper-backed lath unless otherwise indicated **OR** at exterior locations **OR** in locations indicated on Drawings, **as directed**.

B. Accessories

1. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
2. Metal Accessories:
 - a. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
 - b. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - c. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - d. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
 - 1) Small nose cornerbead with expanded flanges; use unless otherwise indicated.
 - 2) Small nose cornerbead with perforated flanges; use on curved corners.
 - 3) Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
 - 4) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum, with expanded flanges; use at locations indicated on Drawings.
 - e. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.



- f. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - g. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
 - h. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6.34 to 16 mm) wide; with perforated flanges.
3. Plastic Accessories: Fabricated from high-impact PVC.
- a. Cornerbeads: With perforated flanges.
 - 1) Small nose cornerbead; use unless otherwise indicated.
 - 2) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
 - b. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
 - 1) Square-edge style; use unless otherwise indicated.
 - 2) Bull-nose style, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
 - c. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - d. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1/2-inch- (13-mm-) **OR** 1-inch- (25-mm-) **OR** 1-1/2-inch- (38-mm-), **as directed**, wide reveal; with perforated concealed flanges.
- C. Miscellaneous Materials
- 1. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
 - 2. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.
 - 3. Bonding Compound: ASTM C 932.
 - 4. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
 - 5. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
 - 6. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.
 - 7. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
 - 8. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants".
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Plaster Materials
- 1. Portland Cement: ASTM C 150, Type I **OR** Type II, **as directed**.
 - a. Color for Finish Coats: White **OR** Gray, **as directed**.
 - 2. Masonry Cement: ASTM C 91, Type N.
 - a. Color for Finish Coats: White **OR** Gray, **as directed**.
 - 3. Plastic Cement: ASTM C 1328.
 - 4. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match sample.



5. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
6. Sand Aggregate: ASTM C 897.
 - a. Color for Job-Mixed Finish Coats: White **OR** In color matching sample, **as directed**.
7. Perlite Aggregate: ASTM C 35.
8. Exposed Aggregates for Finish Coats: For marblecrete finish, clean, sound, crushed marble matching color and size gradation of sample.
9. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
 - a. Color: As selected from manufacturer's full range.
10. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.
 - a. Color: As selected from manufacturer's full range.

E. Plaster Mixes

1. General: Comply with ASTM C 926 for applications indicated.
 - a. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.
2. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
 - a. Portland Cement Mixes:
 - 1) Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 **OR** 3/4 to 1-1/2, **as directed**, parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - 2) Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 **OR** 3/4 to 1-1/2, **as directed**, parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
 - b. Masonry Cement Mixes:
 - 1) Scratch Coat: 1 part masonry cement and 2-1/2 to 4 parts aggregate.
 - 2) Brown Coat: 1 part masonry cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
 - c. Portland and Masonry Cement Mixes:
 - 1) Scratch Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - 2) Brown Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
 - d. Plastic Cement Mixes:
 - 1) Scratch Coat: 1 part plastic cement and 2-1/2 to 4 parts aggregate.
 - 2) Brown Coat: 1 part plastic cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
 - e. Portland and Plastic Cement Mixes:
 - 1) Scratch Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - 2) Brown Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
3. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:
 - a. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Portland and Masonry Cement Mix: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - c. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.



4. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:
 - a. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Masonry Cement Mix: Use 1 part masonry cement and 2-1/2 to 4 parts aggregate.
 - c. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.
5. Job-Mixed Finish-Coat Mixes:
 - a. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 **OR** 1-1/2 to 2, **as directed**, parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
 - b. Masonry Cement Mix: 1 part masonry cement and 1-1/2 to 3 parts aggregate.
 - c. Portland and Masonry Cement Mix: For cementitious materials, mix 1 part portland cement and 1 part masonry cement. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
 - d. Plastic Cement Mix: 1 part plastic cement and 1-1/2 to 3 parts aggregate.
6. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters or acrylic-based finish coatings, comply with manufacturer's written instructions.

1.3 EXECUTION

A. Examination

1. 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.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
2. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

C. Installation, General

1. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
2. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.
3. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

D. Installing Metal Lath

1. Expanded-Metal Lath: Install according to ASTM C 1063.
 - a. Partition Framing and Vertical Furring: Install flat diamond-mesh **OR** flat rib **OR** welded-wire **OR** woven-wire, **as directed**, lath.
 - b. Flat-Ceiling and Horizontal Framing: Install flat diamond-mesh **OR** flat rib **OR** 3/8-inch (9.5-mm) rib lath **OR** welded-wire **OR** woven-wire, **as directed**, lath.
 - c. Curved-Ceiling Framing: Install flat diamond-mesh **OR** welded-wire **OR** flat woven-wire, **as directed**, lath.
 - d. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh **OR** welded-wire **OR** woven-wire, **as directed**, lath.

E. Installing Accessories

1. Install according to ASTM C 1063 and at locations indicated on Drawings.
2. Reinforcement for External Corners:
 - a. Install lath-type, external-corner reinforcement at exterior locations.
 - b. Install cornerbead at interior and exterior, **as directed**, locations.



3. Control Joints: Install control joints at locations indicated on Drawings **OR** in specific locations approved for visual effect as follows, **as directed**:
 - a. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - 1) Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
 - 2) Horizontal and other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
 - b. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
 - c. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 - d. Where control joints occur in surface of construction directly behind plaster.
 - e. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

F. Plaster Application

1. General: Comply with ASTM C 926.
 - a. Do not deviate more than plus or minus 1/4 inch in 10 feet (6.4 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
 - b. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - c. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
2. Bonding Compound: Apply on unit masonry and concrete plaster bases.
3. Walls; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork, on masonry or on concrete; 3/4-inch (19-mm) thickness.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
4. Ceilings; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 1/2 inch (13 mm) thick **OR** 3/4 inch (19 mm) thick on concrete, **as directed**.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
5. Walls; Base-Coat Mix: Scratch coat for two-coat plasterwork, 3/8 inch (10 mm) thick on concrete masonry **OR** 1/4 inch (6 mm) thick on concrete, **as directed**.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
6. Ceilings; Base-Coat Mix: Scratch coat for two-coat plasterwork, 1/4 inch (6 mm) thick on concrete.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
7. Plaster Finish Coats: Apply to provide float **OR** dash **OR** scraped trowel-textured **OR** skip trowel-textured **OR** brocade (knock-down dash) **OR** trowel sweep **OR** combed **OR** sacked (California mission) **OR** English **OR** marblecrete, **as directed**, finish to match sample.



8. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.
 9. Concealed Exterior Plasterwork: Where plaster application will be used as a base for adhered finishes, omit finish coat.
 10. Concealed Interior Plasterwork:
 - a. Where plaster application will be concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
 - b. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
 - c. Where plaster application will be used as a base for adhesive application of tile and similar finishes, omit finish coat.
- G. Plaster Repairs
1. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.
- H. Protection
1. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

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SECTION 09 22 16 13 - NON-LOAD-BEARING STEEL FRAMING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for non-load bearing steel framing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes non-load-bearing steel framing members for the following applications:
 - a. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
 - b. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.

D. Quality Assurance

1. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
2. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.2 PRODUCTS

A. Non-Load-Bearing Steel Framing, General

1. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - a. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - b. Protective Coating: ASTM A 653/A 653M, G40 (Z120) **OR** ASTM A 653/A 653M, G60 (Z180) **OR** Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120), **as directed**, hot-dip galvanized, unless otherwise indicated.

B. Suspension System Components

1. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
2. Hanger Attachments to Concrete:
 - a. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.



- 1) Type: Cast-in-place anchor, designed for attachment to concrete forms **OR** Postinstalled, chemical anchor **OR** Postinstalled, expansion anchor, **as directed**.
- b. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
3. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
4. Flat Hangers: Steel sheet, in size indicated on Drawings **OR** 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated, **as directed**.
5. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
 - a. Depth: As indicated on Drawings **OR** 2-1/2 inches (64 mm) **OR** 2 inches (51 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
6. Furring Channels (Furring Members):
 - a. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
 - b. Steel Studs: ASTM C 645.
 - 1) Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - 2) Depth: As indicated on Drawings **OR** 1-5/8 inches (41.3 mm) **OR** 2-1/2 inches (63.5 mm) **OR** 3-5/8 inches (92.1 mm), **as directed**.
 - c. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
 - 1) Minimum Base Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - d. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.
 - 1) Configuration: Asymmetrical **OR** Hat shaped, **as directed**.
7. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

C. Steel Framing For Framed Assemblies

1. Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.027 inch (0.7 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - b. Depth: As indicated on Drawings **OR** 3-5/8 inches (92.1 mm) **OR** 6 inches (152.4 mm) **OR** 4 inches (101.6 mm) **OR** 2-1/2 inches (63.5 mm) **OR** 1-5/8 inches (41.3 mm), **as directed**.
2. Slip-Type Head Joints: Where indicated, provide one of the following:
 - a. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
 - b. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 - c. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
3. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
4. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.027 inch (0.7 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.



5. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
 - a. Depth: As indicated on Drawings **OR** 1-1/2 inches (38.1 mm), **as directed**.
 - b. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.
6. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - a. Minimum Base Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - b. Depth: As indicated on Drawings **OR** 7/8 inch (22.2 mm) **OR** 1-1/2 inches (38.1 mm), **as directed**.
7. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical **OR** Hat shaped, **as directed**.
8. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
 - a. Depth: As indicated on Drawings **OR** 3/4 inch (19.1 mm), **as directed**.
 - b. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch (0.79 mm).
 - c. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
9. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

D. Auxiliary Materials

1. General: Provide auxiliary materials that comply with referenced installation standards.
 - a. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
2. Isolation Strip at Exterior Walls: Provide one of the following:
 - a. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - b. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

1.3 EXECUTION

A. Preparation

1. 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.
 - a. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
2. Coordination with Sprayed Fire-Resistive Materials:
 - a. 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 (600 mm) o.c.
 - b. 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.

B. Installation, General

1. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.



- a. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 - b. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - c. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 - d. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
2. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
 3. Install bracing at terminations in assemblies.
 4. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

C. Installing Suspension Systems

1. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
2. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
3. Suspend hangers from building structure as follows:
 - a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - 1) Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - b. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - 1) Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - c. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - d. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - e. Do not attach hangers to steel roof deck.
 - f. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - g. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - h. Do not connect or suspend steel framing from ducts, pipes, or conduit.
4. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
5. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
6. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
7. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

D. Installing Framed Assemblies

1. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.



2. Install studs so flanges within framing system point in same direction.
 - a. Space studs as follows:
 - 1) Single-Layer Application: 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 400 mm **OR** 600 mm, **as directed**, o.c., unless otherwise indicated.
 - 2) Multilayer Application: 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 400 mm **OR** 600 mm, **as directed**, o.c., unless otherwise indicated.
 - 3) Tile backing panels: 16 inches (406 mm) **OR** 400 mm, **as directed**, o.c., unless otherwise indicated.
3. 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.
 - a. 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.
 - b. 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.
 - 1) Install two studs at each jamb, unless otherwise indicated.
 - 2) Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - 3) Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - c. 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.
 - d. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - 1) Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - e. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - f. Curved Partitions:
 - 1) Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - 2) Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.
4. Direct Furring:
 - a. Screw to wood framing.
 - b. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
5. Z-Furring Members:
 - a. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced 24 inches (610 mm) **OR** 600 mm, **as directed**, o.c.
 - b. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
 - c. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.
6. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16 13



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Task	Specification	Specification Description
09 22 36 13	09 22 13 00	Gypsum Plaster
09 22 36 13	09 22 13 00a	Gypsum Veneer Plaster
09 22 36 13	09 22 13 00b	Portland Cement Plaster



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SECTION 09 22 36 23 - LATH AND PLASTER RENOVATION

GENERAL

Description Of Work

1. This specification covers the furnishing and installation of materials for lath and plaster renovation. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

Quality Assurance

2. Regulatory Requirements:
 - a. Plaster Partitions: Listed and labeled for fire-protective ratings as indicated or scheduled.
 - b. Plaster Floor/Ceilings and Roof/Ceiling Assemblies: Listed and labeled for fire-protective ratings as indicated or scheduled.
 - c. Fire Rated Assemblies: Comply with UL 05, FM P8016, or GA 600 for required fire-rated assembly.

Submittals

3. Product Data: Submit in accordance with Detailed Scope of Work. Include each type of plaster material, metal lath, and lathing accessories to be installed.

Delivery, Storage, And Handling

4. General:
 - a. Plastering Materials: Deliver in original unopened containers and store off ground and under cover.
 - b. Metal Lath and Accessories: Protect from rusting during storage.
 - c. Rusted or Water Damaged Materials: Subject to rejection before or after installation.

Project Conditions

5. Environmental Requirements: Comply with Detailed Scope of Work.
 - a. Cold-Weather Protection: Do not apply plaster if ambient temperature is less than 4 degrees C (40 degrees F) or more than 26 degrees C (80 degrees F). Maintain this temperature range in all areas 7 days prior to application, during application, and for 7 days after plaster is set.
 - b. Hot-Weather Protection: Protect plaster against uneven or excessive evaporation during dry, hot weather and from strong blasts of dry air, either natural or artificial.
 - c. Ventilation: Ventilate building spaces as required to remove water in excess of that required for hydration of plaster. Begin ventilation immediately after plaster is applied and continue until it sets.
6. Existing Conditions: See Division 1 Section "Summary of Work". Do not interfere with use of occupied buildings or portions of buildings. Maintain free and safe passage to and from occupied areas.
7. Protection: Protect grounds, plantings, buildings, and any other facilities or property from damage caused by construction operations.

Scheduling And Sequencing

8. Scheduling and Completion: Comply with Detailed Scope of Work.
 - a. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.

PRODUCTS



Materials

9. Materials for Patching, Extending, and Matching:
 - a. Provide same products or types of construction as existing structure, as needed to patch, extend, or match existing work.
 - 1) Generally, Contract Documents will not define products or standards of workmanship present in existing construction. Determine products by inspection and any necessary testing, and workmanship by use of existing as sample of comparison.
 - 2) Patching, extending, and matching of existing work and systems shall result in complete, finished system.
 - b. Presence of product, finish, or type of construction, requires that patching, extending, or matching shall be performed as necessary to make work complete and consistent.
10. Partition Metals: ASTM C 645, galvanized steel:
 - a. Interior Steel Studs: Minimum 0.46 mm (25 gage), provide sizes and gages to match existing, or as indicated.
 - 1) Provide minimum of 0.84 mm (20 gage) studs both sides of hollow metal frames.
 - b. Steel Stud Runners: Match studs. Provide long leg runners for slip joint at structure above to allow for deflection.
 - c. Furring Channels: Hat-shaped furring channels, minimum 0.46 mm (25 gage).
 - d. Sheet Metal Reinforcement (Alternate to Wood Blocking): 1.52 mm (16 gage) minimum.
11. Suspended Ceiling Metals:
 - a. Main Runners (Primary Members): ASTM C 754 cold-rolled steel channels with rust-inhibitive finish.
 - 1) 50 mm (2 inches) deep, 88 kg per 100 m (590 pounds per 1,000 LF).
 - 2) 38 mm (1-1/2 inch) deep, 70 kg per 100 m (475 pounds per 1,000 LF).
 - 3) 19 mm (3/4 inch) deep, 45 kg per 100 m (300 pounds per 1,000 LF).
 - b. Cross Furring (Furring Channels): Hat-shaped galvanized steel furring channels, minimum 0.46 mm (25 gage).
 - c. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
 - 1) Hanger Wire: Minimum 4.1 mm (8 gage).
 - 2) Tie Wire: 6 mm (16 gage).
12. Lath:
 - a. Metal Lath: ASTM C 847, galvanized expanded metal.
 - 1) Weight: In compliance with ASTM C 841 for conditions and spacing of supports.
 - b. Gypsum Lath: ASTM C 37, plain. Provide Type X at fire-rated assemblies.
 - 1) Thickness: As indicated or specified and in compliance with ASTM C 841 for conditions and spacing of supports.
13. Fasteners:
 - a. Screws: ASTM C 1002, corrosion-resistant. Provide types as recommended by manufacturer for each application.
 - 1) To Metal Framing: Minimum 25 mm (1 inch), Type S.
 - 2) To Wood Framing: Minimum 32 mm (1-1/4 inch), Type W bugle head.
14. Accessories: ASTM C 841, galvanized steel.
 - a. Comer Beads: Small nose with expanded flanges, unless otherwise indicated.
 - b. Casing Beads: Square-edged style. with short or expanded flanges to suit kinds of plaster bases indicated.
 - c. Control Joints: Prefabricated folded pair of non-perforated screeds in M-shaped configuration, with expanded or perforated flanges.
 - 1) Provide removable protective tape on plaster face of control joints.
 - d. Cornerite: Galvanized expanded metal lath in accordance with ASTM C 841.
15. Gypsum Plaster Materials: ASTM C 28.
 - a. Base Coat Plasters: One of following:
 - 1) Gypsum ready-mixed plaster with mill-mixed perlite aggregate.
 - 2) Gypsum wood-fibered plaster, ASTM C 28, Type N.
 - b. Finish Coat Plasters: One of following:
 - 1) Gypsum ready-mixed finished plaster, manufacturers standard mill-mixed gauged interior finish.



- 2) Gypsum Gauging Plaster: ASTM C 28, Type G.
 - c. Quicklime: ASTM C 5.
 - d. Sand: ASTM C 35.
 - e. Finishing Hydrated Limes: ASTM C 206, Type S, special hydrated lime for finishing purposes.
 - f. Bonding Compound for Gypsum Plaster: ASTM C 631.
 - g. Water: Clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or substances that may be deleterious to plaster or metals in contact with plaster.
16. Sound-Isolation Materials:
- a. Sound Insulation: ASTM C 665, Type I (unfaced) mineral-fiber blankets, 12 to 16 kg per cu m (0.75 to 1 PCF), thickness as indicated or scheduled, or required by fire-rated assembly.
 - b. Acoustical Sealant:
 - 1) Concealed: ASTM C 919 nondrying, non-hardening, non-skinning, non-bleeding, and non-staining.
 - 2) Exposed: ASTM C 919 non-oxidizing and skinning, permanently elastic, and paintable.
 - c. Ductwork Penetrations Packing: Low-density fiberglass.
17. Gypsum Plaster Mixes: As recommended by manufacturer:
- a. Scratch Coat:
 - 1) Over Metal Lath: Gypsum wood-fibered plaster, neat or with job-mixed sand.
 - 2) Over Gypsum Lath: Gypsum neat plaster with job-mixed sand.
 - 3) Over Unit Masonry: Gypsum wood-fibered plaster, neat or with job-mixed sand.
 - b. Brown Coat:
 - 1) Over Metal Lath: Gypsum wood-fibered plaster, with job-mixed sand.
 - 2) Over Gypsum Lath: Gypsum neat plaster with job-mixed sand.
 - 3) Over Unit Masonry: Gypsum wood-fibered plaster with job-mixed sand.
 - c. Finish Coat: Proportion materials for finish coats to comply with ASTM C 842 for each type of finish coat and texture indicated.
 - 1) Gypsum Gauging Plaster 1 part plaster and 2 parts lime.
 - a) Over lightweight aggregate base coats, add 15 L (1/2 cubic foot) of perlite fines or 23 kg (50 pounds) of No. 1 white silica sand per 45 kg (100 pounds) of plaster.
 - 2) Gypsum Ready-mixed Finish Plaster Neat.
 - d. Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

EXECUTION

Examination

18. Units, Spaces, and Areas to be renovated: Comply with Detailed Scope of Work.
 - a. Verify that surfaces to receive rough carpentry are prepared to required grades and dimensions.

Preparation

19. Dust Protection: Comply with Detailed Scope of Work.
20. Building Occupation: Carry out demolition and renovation work to cause as little inconvenience to occupants as possible. See Detailed Scope of Work.
21. Protection: Comply with Detailed Scope of Work.
 - a. Protection: Provide drapes and drop cloths necessary to protect walls, floors, ductwork and piping, electrical work, etc. during plastering operations.
22. Selective Demolition: Comply with Detailed Scope of Work.
23. Surface Preparation: Clean projections, dust, loose particles, grease, bond breakers, and foreign matter from surfaces to receive plaster.



- a. Do not apply plaster directly to surfaces (1) of masonry or concrete that have been coated with bituminous compound or other waterproofing agents, or (2) that have been painted or previously plastered.
- b. Before plaster work is started, wet masonry and concrete surfaces thoroughly with fine fog spray of clean water to produce uniformly moist surface.
- c. Do not apply plaster to surfaces containing frost.

Laying-Out Work

24. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
 - a. Prior to commencing work, carefully compare and check Drawings (if any) for discrepancies in locations or elevations of work to be executed.
 - b. Refer discrepancies among Drawings (if any), Specifications, and existing conditions to the Owner for adjustment before work affected is performed.
 - 1) Failure to make such notification shall place responsibility on Contractor to carry out work in satisfactory, workmanlike manner.
25. Contractor: Responsible for location and elevation of construction contemplated by Construction Documents.

Performance

26. Patching: Patch and extend existing work using skilled mechanics who are capable of matching existing quality of workmanship.
 - a. Quality of Patched or Extended Work: Not less than specified for new work. If similar new work is not specified, equal to existing work.
27. Damaged Surfaces: Comply with Detailed Scope of Work.
28. Transitions from Existing to New Work: Comply with Detailed Scope of Work.
29. Isolation: Where lathing and metal support system abuts building structure horizontally and where partition/wall work abuts overhead structure, isolate work from structural movement sufficiently to prevent transfer of loads to work from building structure. Install slip or cushion-type joints to absorb deflections but maintain lateral support.
 - a. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.

Installation Of Suspended Steel Framing

30. General: Construct ceilings of lath and plaster on suspended steel framing system in accordance with manufacturer's recommendations and Reference Standards.
31. Hanger Installation: Attach hangers to structure above ceiling to comply with NAAMM ML/SFA 920.
32. Ceiling Suspension System Components: Install In sizes and at spacings indicated but not in smaller sizes or greater spacings than those required by ASTM C 841 and NAAMM ML/SFA 920.
 - a. Wire Hangers: Space and install wire hangers in accordance with ASTM C 841 and within 150 mm (6 inches) of channel ends, unless closer spacing indicated or required for fire-resistance rated assembly.
 - b. Main Runners (Primary Members): Space and install channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
 - c. Cross Furring (Furring Channels): Space and install furring channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
33. Framing Around Openings: Frame channels and lath on suspended soffits and ceilings and at furring to receive electric lights, etc. as indicated or as necessary to complete work. Furnish and install in furring, plaster rings or access panels furnished under other sections.

Installation Of Steel Stud Partitions

34. General: Install steel stud partition support systems in accordance with manufacturer's recommendations and Reference Standards.
35. Steel Stud Systems: Comply with ASTM C 754.



- a. To Receive Metal Lath: Space studs in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - b. To Receive Gypsum Lath: Space studs in accordance with ASTM C 841.
36. Extend partition support systems to finish ceilings and attach to ceiling suspension members, unless otherwise indicated.

Metal Furring

37. General: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - a. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, bath accessories, furnishings, and similar work to comply with manufacturer's recommendations.
38. Metal Furring to Receive Gypsum Lath: Space furring channels in accordance with ASTM C 841.
39. Metal Furring Systems:
 - a. To Receive Metal Lath: Space furring in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - b. To Receive Gypsum Lath: Space furring in accordance with ASTM C 841.
40. Isolation: Where lathing and metal support system abuts building structure horizontally and where partition/wall work abuts overhead structure, isolate work from structural movement sufficiently to prevent transfer of loads to work from building structure. Install slip or cushion-type joints to absorb deflections but maintain lateral support.
 - a. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.

Installation Of Suspended Steel Framing

41. General: Construct ceilings of lath and plaster on suspended steel framing system in accordance with manufacturer's recommendations and Reference Standards.
42. Hanger Installation: Attach hangers to structure above ceiling to comply with NAAMM ML/SFA 920.
43. Ceiling Suspension System Components: Install in sizes and at spacings indicated but not in smaller sizes or greater spacings than those required by ASTM C 841 and NAAMM ML/SFA 920.
 - a. Wire Hangers: Space and install wire hangers in accordance with ASTM C 841 and within 150 mm (6 inches) of channel ends, unless closer spacing indicated or required for fire-resistance rated assembly.
 - b. Main Runners (Primary Members): Space and install channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
 - c. Cross Furring (Furring Channels): Space and install furring channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
44. Framing Around Openings: Frame channels and lath on suspended soffits and ceilings and at furring to receive electric lights, etc. as indicated or as necessary to complete work. Furnish and install in furring, plaster rings or access panels furnished under other sections.

Installation Of Steel Stud Partitions

45. General: Install steel stud partition support systems in accordance with manufacturer's recommendations and Reference Standards.
46. Steel Stud Systems: Comply with ASTM C 754.
 - a. To Receive Metal Lath: Space studs in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - b. To Receive Gypsum Lath: Space studs in accordance with ASTM C 841.
47. Extend partition support systems to finish ceilings and attach to ceiling suspension members, unless otherwise indicated.

Metal Furring

48. General: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - a. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, bath accessories, furnishings, and similar work to comply with manufacturer's recommendations.



49. Metal Furring to Receive Gypsum Lath: Space furring channels in accordance with ASTM C 841.
50. Metal Furring Systems:
 - a. To Receive Metal Lath: Space furring in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - b. To Receive Gypsum Lath: Space furring in accordance with ASTM C 841.

Lathing

51. Metal Lathing: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - a. At Metal Framing: Attach metal lath to furring channels with long dimension of sheet at right angles to furring channels with gage wire ties spaced not over 150 mm (6 inches) apart.
 - b. At Wood Framing: Nail metal lath to wood framing with long dimension of sheet at right angles to framing member.
 - c. Place ties where sides of sheets laps at supports and at side laps of sheets between supports. Lap metal lath not less than 13 mm (1/2 inch) at sides of sheets and 25 mm (1 inch) at ends of sheets.
 - d. Suspended and Furred Ceilings: Use 1.8 kg/sq m (3.4 pounds/SY) minimum weight diamond mesh lath.
 - e. Ceramic Tile Setting Beds: Use 1.8 kg/sq m (3.4 pounds/SY) minimum weight diamond mesh lath.
52. Gypsum Lath: Install in accordance with ASTM C 841.
 - a. Wood Framing and Furring: Install lath as follows:
 - 1) With screws to comply with lath manufacturer's directions.
 - 2) With nails.
 - 3) Provide floating angle construction.
 - b. Suspended and Furred Ceilings: Install lath to furring members with clips.
 - c. Vertical Metal Framing and Furring: Install lath as follows:
 - 1) With screws.
 - 2) With clips, supplemented by screws where required by lath manufacturer.
 - 3) Where sound-rated partitions are indicated, attach lath with resilient clips.

Installation Of Accessories

53. Accessories: Install as required to repair area of work to match existing. Install in accordance with ASTM C 841. Miter or cope accessories at comers; Install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and alignment during plastering.
54. Interior Corners: Apply cornerite.
55. Corner Beads: Install corner beads tightly secured to lath at exposed exterior corners.
56. Casing Beads: Install at terminations of plaster work, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or metal frames act as casing beads.
57. Control Joints: Install at locations indicated or, if not indicated, at spacings and locations required by Reference Standards. Coordinate specific locations with the Owner.
58. Access Panels: Provide access panels as required for maintenance of concealed plumbing work in coordination with Division 15 Section "Plumbing." Tiled Areas: Coordinate with Division 9 Section "Ceramic Tile."
59. Sound-Rated Plaster Work: Where sound-rated plaster work is indicated by STC ratings or other notation:
 - a. Acoustical Sealant: Seal work at perimeters, control joints, openings, and penetrations with continuous bead of acoustical sealant. Comply with ASTM C 919 and plastering manufacturer's recommendations for location of sealant beads.
 - b. Sound Insulation: Install insulation blankets within stud cavities of sound-rated partition assemblies where indicated.

Plastering

60. Plastering: Comply with ASTM C 842 in thickness to match existing.



- a. Preparation: Remove loose, fractured, or separated plaster to face of substrate. repairing lath at substrate to ensure repair area bounded by solid and sound existing plaster construction.
 - 1) Prepare monolithic surfaces for bonded base coats and use bonding compound to comply with Reference Standards for conditioning of monolithic surfaces.
 - b. Grout hollow metal frames, bases, and similar work with base-mat plaster material, and prior to lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 150 mm (6 inches) at each jamb anchor dip.
 - c. Plaster flush with metal frames and other built-in metal items or accessories that act as plaster ground, unless otherwise indicated. Where plaster is not terminated at metal by casing beads, cut base coat free from metal before plaster sets and groove finish coat at junctures with metal.
61. Preparation: Check metal grounds, comer beads, screeds, and other accessories carefully for alignment before starting plaster application. Check expansion and control joints and supporting metal structures to ensure that expansion and control joints can move unrestrained.
62. Plaster: Apply In accordance with ASTM C 842 in thickness to match existing:
- a. Use three-coat work over following plaster bases:
 - 1) Metal lath.
 - 2) Gypsum lath attached to ceiling supports by clips.
 - 3) Gypsum lath attached to ceiling supports spaced over 400 mm (16 inches) OC.
 - 4) Gypsum lath, 9.5 mm (3/8 inch) thick, with separate vapor retarder behind.
 - b. Use two-coat work over following bases.
 - 1) Gypsum lath except for installations requiring three-coat work.
 - 2) Unit masonry.
 - 3) Concrete, cast-in-place or precast when surface condition complies with ASTM C 842 for plaster bonded to solid base.
 - c. First Coat: Apply first coat of plaster with such force to secure good key.
 - d. Finish Coats: Apply troweled finish coats unless otherwise indicated.
63. Workmanship: Perform work true to line, straight, and plumb.
- a. Finished Surfaces: Free from waves, dents, bumps, cracks, pits. checks, streaks, catfaces, blisters, or other defects. Cutout and properly replace defective areas.
 - b. Execute work to avoid any irregularity occurring at point or place where one section is joined to another.
 - c. Arises and Angles: True and sharp.
64. Tolerances: Plaster surface plane within plus/minus 3 mm in 3 000 mm (1/8 inch in 10 feet).

Integrating Existing Work

65. Protection: Comply with Detailed Scope of Work.

Adjustments

66. Partition Removal: Comply with Detailed Scope of Work.

Dust Control

67. Dust: Comply with Detailed Scope of Work.

Patching And Cleaning

68. Cutting and Patching: Do necessary cutting, patching, and repairing and pointing up of plastering after other work is in place to restore defective areas. Repair or replace work to eliminate blisters, buckles, excessive crazing and check-cracking, dry outs, efflorescence, sweat-outs, and similar defects and where bond to substrate has failed.
- a. Sand smooth-troweled finishes lightly to remove trowel marks and arises.
69. Cleaning: As rapidly as plastering is completed in each space, clean up rubbish, utensils, and surplus material, sweep floor and leave in neat condition for work of others.
- a. When general plastering is concluded, remove plastering rubbish, equipment, and surplus materials from premises.
 - b. Clean surfaces splattered with plaster.



END OF SECTION 09 22 36 23



Task	Specification	Specification Description
09 22 36 23	09 22 13 00	Gypsum Plaster
09 22 36 23	09 22 13 00a	Gypsum Veneer Plaster
09 22 36 23	09 22 13 00b	Portland Cement Plaster
09 22 36 33	09 22 13 00	Gypsum Plaster
09 22 36 33	09 22 13 00a	Gypsum Veneer Plaster
09 22 36 33	09 22 13 00b	Portland Cement Plaster
09 22 36 33	09 22 36 23	Lath and Plaster Renovation



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SECTION 09 29 00 00 - GYPSUM BOARD**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for gypsum board. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Interior gypsum board.
 - b. Exterior gypsum board for ceilings and soffits.
 - c. Tile backing panels.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For the following products:
 - a. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
 - b. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.
3. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives used to laminate gypsum board panels to substrates, including printed statement of VOC content.

D. Quality Assurance

1. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
2. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

E. Storage And Handling

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

F. Project Conditions

1. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
2. Do not install interior products until installation areas are enclosed and conditioned.
3. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.



1.2 PRODUCTS

A. Panels, General

1. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
2. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Interior Gypsum Board

1. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
2. Regular Type:
 - a. Thickness: 1/2 inch (12.7 mm).
 - b. Long Edges: Tapered **OR** Tapered and featured (rounded or beveled) for prefilling, **as directed**.
3. Type X:
 - a. Thickness: 5/8 inch (15.9 mm).
 - b. Long Edges: Tapered **OR** Tapered and featured (rounded or beveled) for prefilling, **as directed**.
4. Type C:
 - a. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 - b. Long Edges: Tapered.
5. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - a. Thickness: 1/4 inch (6.4 mm).
 - b. Long Edges: Tapered.
6. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
 - a. Thickness: 1/2 inch (12.7 mm).
 - b. Long Edges: Tapered.
7. Foil-Backed Type:
 - a. Core: As indicated on Drawings **OR** 3/8 inch (9.5 mm), regular type **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X **OR** Type C as required by fire-resistance-rated assembly indicated on Drawings, **as directed**.
 - b. Long Edges: Tapered **OR** Tapered and featured (rounded or beveled) for prefilling, **as directed**.
8. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.
 - a. Core: As indicated on Drawings **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.
 - b. Long Edges: Tapered.
9. High-Impact Type: Manufactured with Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance).
 - a. Core: As indicated on Drawings **OR** 5/8 inch (15.9 mm) thick, **as directed**.
 - b. Plastic-Film Thickness: 0.010 inch (0.254 mm) **OR** 0.020 inch (0.508 mm) **OR** 0.030 inch (0.762 mm) **OR** 0.081 inch (2.057 mm), **as directed**.
10. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
 - a. Core: 5/8 inch (15.9 mm), Type X.
 - b. Long Edges: Tapered.

C. Exterior Gypsum Board For Ceilings And Soffits

1. Exterior Gypsum Soffit Board: ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.



- 1) Core: As indicated **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.
 2. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.
 - a. Core: As indicated **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.
- D. Tile Backing Panels
1. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.
 - a. Core: As indicated on Drawings **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X **OR** Type C as required by fire-resistance-rated assembly indicated on Drawings, **as directed**.
 2. Glass-Mat, Water-Resistant Backing Board:
 - a. Complying with ASTM C 1178/C 1178M.
 - b. Complying with ASTM C1177/C 1177M.
 - c. Core: As indicated on Drawings **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.
 3. Cementitious Backer Units: ANSI A118.9.
 - a. Thickness: As indicated on Drawings **OR** 1/2 inch (12.7 mm), **as directed**.
- E. Trim Accessories
1. Interior Trim: ASTM C 1047.
 - a. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet **OR** Galvanized or aluminum-coated steel sheet or rolled zinc **OR** Plastic **OR** Paper-faced galvanized steel sheet, **as directed**.
 - b. Shapes:
 - 1) Cornerbead.
 - 2) Bullnose bead.
 - 3) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - 4) L-Bead: L-shaped; exposed long flange receives joint compound.
 - 5) U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - 6) Expansion (control) joint.
 - 7) Curved-Edge Cornerbead: With notched or flexible flanges.
 2. Exterior Trim: ASTM C 1047.
 - a. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
 - b. Shapes:
 - 1) Cornerbead.
 - 2) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - 3) Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.
 3. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - b. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
- F. Joint Treatment Materials
1. General: Comply with ASTM C 475/C 475M.
 2. Joint Tape:
 - a. Interior Gypsum Wallboard: Paper.
 - b. Exterior Gypsum Soffit Board: Paper.
 - c. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - d. Tile Backing Panels: As recommended by panel manufacturer.
 3. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - a. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.



- b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping **OR** drying-type, all-purpose, **as directed**, compound.
 - 1) Use setting-type compound for installing paper-faced metal trim accessories.
 - c. Fill Coat: For second coat, use setting-type, sandable topping **OR** drying-type, all-purpose, **as directed**, compound.
 - d. Finish Coat: For third coat, use setting-type, sandable topping **OR** drying-type, all-purpose, **as directed**, compound.
 - e. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound **OR** drying-type, all-purpose compound **OR** high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish, **as directed**.
- 4. Joint Compound for Exterior Applications:
 - a. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
 - b. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
 - 5. Joint Compound for Tile Backing Panels:
 - a. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
 - b. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 - c. Cementitious Backer Units: As recommended by backer unit manufacturer.

G. Auxiliary Materials

- 1. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- 2. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 3. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - a. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - b. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- 4. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
- 5. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants".
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 6. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation".
- 7. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation".

H. Texture Finishes

- 1. Primer: As recommended by textured finish manufacturer.
- 2. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indexes of not more than 25 when tested according to ASTM E 84.
 - a. Texture: Fine **OR** Medium **OR** Coarse, **as directed**.
- 3. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.



- a. Texture: Light spatter **OR** Spatter knock-down, **as directed**.
4. Acoustical Finish: Water-based, chemical-setting or drying-type, job-mixed texture finish for spray application.
 - a. Application Thickness: 1/2 inch (12.7 mm).
 - b. Fire-Test-Response Characteristics: Indices when tested according to ASTM E 84 as follows:
 - 1) Flame Spread: Less than 25.
 - 2) Smoke Developed: Less than 450.
 - c. NRC: 0.55 according to ASTM C 423.

1.3 EXECUTION

A. Examination

1. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
2. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Applying And Finishing Panels, General

1. Comply with ASTM C 840.
2. 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.
3. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
4. 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.
5. Form control and expansion joints with space between edges of adjoining gypsum panels.
6. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - b. Fit gypsum panels around ducts, pipes, and conduits.
 - c. 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- (6.4- to 9.5-mm-) wide joints to install sealant.
7. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) 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.
8. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
9. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.
10. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.



11. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Applying Interior Gypsum Board

1. Install interior gypsum board in the following locations:
 - a. Regular Type: As indicated on Drawings **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
 - b. Type X: As indicated on Drawings **OR** Where required for fire-resistance-rated assembly **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
 - c. Type C: As indicated on Drawings **OR** Where required for specific fire-resistance-rated assembly indicated, **as directed**.
 - d. Flexible Type: As indicated on Drawings **OR** Apply in double layer at curved assemblies, **as directed**.
 - e. Ceiling Type: As indicated on Drawings **OR** Ceiling surfaces, **as directed**.
 - f. Foil-Backed Type: As indicated on Drawings **OR as directed**.
 - g. Abuse-Resistant Type: As indicated on Drawings **OR as directed**.
 - h. High-Impact Type: As indicated on Drawings **OR as directed**.
 - i. Moisture- and Mold-Resistant Type: As indicated on Drawings **OR as directed**.
2. Single-Layer Application:
 - a. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - b. On partitions/walls, apply gypsum panels vertically (parallel to framing) **OR** horizontally (perpendicular to framing), **as directed**, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - 1) Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 2) At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - c. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - d. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
3. Multilayer Application:
 - a. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - b. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - c. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - d. Fastening Methods: Fasten base layers and face layers separately to supports with screws **OR** Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners, **as directed**.
4. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
5. Curved Surfaces:



- a. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
 - b. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.
- D. Applying Exterior Gypsum Panels For Ceilings And Soffits
1. Apply panels perpendicular to supports, with end joints staggered and located over supports.
 - a. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
 - b. Fasten with corrosion-resistant screws.
- E. Applying Tile Backing Panels
1. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
 2. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at showers, tubs, and where indicated **OR** locations indicated to receive tile, **as directed**. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
 3. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated **OR** locations indicated to receive tile, **as directed**.
 4. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
 5. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- F. Installing Trim Accessories
1. 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.
 2. Control Joints: Install control joints at locations indicated on Drawings **OR** according to ASTM C 840 and in specific locations approved by the Owner for visual effect, **as directed**.
 3. Interior Trim: Install in the following locations:
 - a. Cornerbead: Use at outside corners, unless otherwise indicated.
 - b. Bullnose Bead: Use at outside corners **OR** where indicated, **as directed**.
 - c. LC-Bead: Use at exposed panel edges.
 - d. L-Bead: Use where indicated.
 - e. U-Bead: Use at exposed panel edges **OR** where indicated, **as directed**.
 - f. Curved-Edge Cornerbead: Use at curved openings.
 4. Exterior Trim: Install in the following locations:
 - a. Cornerbead: Use at outside corners.
 - b. LC-Bead: Use at exposed panel edges.
 5. Aluminum Trim: Install in locations indicated on Drawings.
- G. Finishing Gypsum Board
1. 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.
 2. Prefill open joints, rounded or beveled edges, and damaged surface areas.
 3. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
 4. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - a. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - b. Level 2: Panels that are substrate for tile **OR** Panels that are substrate for acoustical tile **OR** Where indicated on Drawings, **as directed**.



- c. Level 3: For surfaces receiving medium- or heavy-textured finishes before painting or heavy wallcoverings where lighting conditions are not critical **OR** Where indicated on Drawings, **as directed**.
- d. Level 4: For surfaces receiving light-textured finishes, wallcoverings, and flat paints **OR** At panel surfaces that will be exposed to view, unless otherwise indicated, **as directed**. This is generally the standard exposed finish. Gloss and semi-gloss enamel paints are not usually recommended over this level of finish. ASTM C 840 requires application of "drywall primer" on surfaces before final decoration
 - 1) Primer and its application to surfaces are specified in other Division 07.
- e. Level 5: For surfaces receiving gloss and semigloss enamels and other surfaces subject to severe lighting **OR** Where indicated on Drawings, **as directed**.
 - 1) Primer and its application to surfaces are specified in other Division 07.
- f. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- g. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- h. Cementitious Backer Units: Finish according to manufacturer's written instructions.

H. Applying Texture Finishes

- 1. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- 2. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.
- 3. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

I. Protection

- 1. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- 2. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00 00



SECTION 09 29 00 00a - GYPSUM BOARD RENOVATION**GENERAL**

Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum board renovation. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

Submittals

2. Quality Assurance/Control Submittals
 - a. Certificates: Manufacturer's written certification that gypsum products meet or exceed specified requirements.

Quality Assurance

3. Regulatory Requirements:
 - a. Gypsum Board Partitions: Listed and labeled for fire-protective ratings as indicated or scheduled.
 - b. Gypsum Board Floor/Ceilings and Roof/Ceiling Assemblies: Listed and labeled for fire protective ratings as indicated or scheduled.
 - c. Fire-Rated Assemblies: Comply with UL 05, FM P8016, or GA 600 for required fire-rated assembly.

Delivery, Storage, And Handling

4. Storage and Protection: Store wallboard off ground to protect it from weather and damage due to moisture damage.
 - a. Wallboard: Dry, free of warpage, and have bundling tape intact immediately prior to use.

Project Conditions

5. Environmental Requirements: Comply with Detailed Scope of Work.
 - a. During gypsum-panel application and finishing, maintain indoor temperatures within range of 13 degrees C (55 degrees F) to 21 degrees C (70 degrees F). Provide adequate ventilation to carry off excess moisture.
6. Existing Conditions: See Division 1 Section "Summary of Work". Do not interfere with use of occupied buildings or portions of buildings. Maintain free and safe passage to and from occupied areas.
7. Protection: Protect grounds, plantings, buildings and any other facilities or property from damage caused by construction operations.

Scheduling And Sequencing

8. Scheduling and Completion: Comply with Detailed Scope of Work.

PRODUCTS

Materials

9. Materials for Patching, Extending, and Matching:



- a. Provide same products or types of construction as in existing structure, as needed to patch, extend, or match existing work.
 - 1) Generally, Contract Documents will not define products present in existing construction. Determine products by Inspection and any necessary testing.
 - 2) Patching, extending, and matching of existing work and systems shall result in a complete, finished system.
- b. Presence of product, finish, or type of construction requires that patching, extending, or matching be performed as necessary to make work complete and consistent.

Metals

10. Partition Metals: ASTM C 645, galvanized steel:
 - a. Interior Steel Studs: Minimum 0.46 mm (25 gage), provide sizes and gages to match existing or as indicated.
 - 1) Provide minimum of 0.84 mm (20 gage) studs both sides of hollow metal frames.
 - b. Steel Stud Runners: Match studs. Provide long leg runners for slip joint at structure above to allow for deflection.
 - c. Furring Channels: Hat-shaped furring channels, minimum 0.46 mm (25 gage).
 - d. Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission by resilient attachment of gypsum board, 13 mm (1/2 inch) deep.
 - e. Sheet-Metal Reinforcement (Alternate to Wood Blocking): 1.52 mm (16 gage) minimum.
11. Suspended Coiling Metals:
 - a. Runner Channels: ASTM C 754 cold-rolled steel channels with rust-inhibitive finish.
 - 1) 50 mm (2 Inches) deep, 88 kg per 100 m (590 pounds per 1,000 LF).
 - 2) 38 mm (1-1/2 inch) deep, 70 kg per 100 m (475 pounds per 1,000 LF).
 - 3) 19 mm (3/4 Inch) deep, 45 kg per 100 m (300 pounds per 1,000 LF).
 - b. Furring Channels: Hat-shaped galvanized-steel furring channels, minimum 0.46 mm (25 gage).
 - c. Steel Studs: Galvanized steel as specified above, minimum 0.46 mm (25 gage).
 - d. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
 - 1) Hanger Wire: Minimum 4.1 mm (8 gage).
 - 2) Tie Wire: 6 mm (16 gage).

Gypsum Board And Related Materials

12. Gypsum Board: GA216 and ASTM C 36
 - a. Size: 12.7 mm and 15.9 mm (1/2 inch and 5/8 inch) thick to match existing, as indicated or scheduled. Provide boards 1 200 mm (48 inches) wide by length required to minimize cross joints.
 - b. Regular Tapered-edge gypsum panels.
 - 1) Provide Type X gypsum panels at fire-rated assemblies.
 - c. Water-Resistant: ASTM C 630, paintable, tapered-edge gypsum panels.
 - 1) Provide Type X water-resistant gypsum panels at fire-rated assemblies.
13. Cementitious Backer Units (CBU): ANSI A118.9, nailable/screwable backer board composed of stable portland cement, aggregates, and reinforcements with ability to remain unaffected by prolonged exposure to moisture, 12.7 mm (1/2 inch) thick.
14. Fasteners:
 - a. Screws: ASTM C 1002, drywall screws, corrosion resistant. Provide types as recommended by manufacturer for each application.
 - 1) Wallboard to Metal Framing: Minimum 25 mm (1 inch), Type S.
 - 2) Wall board to Wood Framing: Minimum 32 mm (1-1/4 inch) Type W bugle head.



- 3) Wall board to Wallboard: Type G.
- b. Nails: ASTM C 514.
15. Accessories: GA 216 and ASTM C 1047, galvanized steel.
 - a. Comer Bead: GA 216 Type CB-114 x 114.
 - b. Metal Trim (Casing Beads): GA 216 Type L, in depth to match gypsum-board thickness.
 - c. Control Joint: V-shaped control joint.
 - d. Adhesive: ASTM C 557 multi-purpose adhesive.
16. Finishing Materials: ASTM C 475.
 - a. Joint Tape: Provide type as recommended by panel manufacturer.
 - b. Joint Treatment: Joint compound, adhesive, water, and fasteners.
17. Sound-Isolation Materials:
 - a. Sound Insulation: ASTM C 665, Type I (unfaced) mineral fiber blankets, 3.7 to 4.9 kg per sq m (3/4 to 1 PCF), thickness as indicated, scheduled, or required by fire-rated assembly.
 - b. Acoustical Sealant:
 - 1) Concealed: ASTM C 919 nondrying, non-hardening, and non-skinning; non-bleeding; and non-staining.
 - 2) Exposed: ASTM C 919 non-oxidizing and skinning; permanently elastic; and paintable.
 - c. Ductwork Penetrations Packing: Low-density fiberglass.

EXECUTION

Examination

18. Units, Spaces, and Areas to be Renovated: Comply with Detailed Scope of Work.
 - a. Existing Conditions: Before beginning installation, examine substrates and framing to receive gypsum board for defects or conditions adversely affecting quality and execution of installation.

Preparation

19. Dust Protection: Comply with Detailed Scope of Work.
20. Building Occupation: Carry out demolition and renovation work to cause as little inconvenience to occupants as possible. See Detailed Scope of Work.
21. Protection: Comply with Detailed Scope of Work.
 - a. Protection: Provide drapes and drop cloths necessary to protect walls, floors, ductwork and piping, electrical work, etc. during drywall finishing operations.
22. Selective Demolition: Comply with Detailed Scope of Work.

Laying Out Work

23. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
 - a. Prior to commencing work, carefully compare and check Drawings (if any) for discrepancies in locations or elevations of work to be executed.
 - b. Refer discrepancies among Drawings (if any), Specifications, and existing conditions to the Owner or adjustment before work affected is performed.
 - 1) Failure to make such notification shall place responsibility on Contractor to carry out work in satisfactory, workmanlike manner.
 - c. Contractor: Responsible for location and elevation of construction indicated by Construction Documents.

Performance



24. Patching: Patch and extend existing work using skilled mechanics capable of matching existing quality of workmanship.
 - a. Quality of Patched or Extended Work: Not less than specified for new work. If similar new work is not specified, equal to existing work.
25. Damaged Surfaces: Comply with Detailed Scope of Work.
26. Transitions from Existing to New Work: Comply with Detailed Scope of Work.

Erection Of Drywall Stud Partitions

27. Reference Standard: Erect steel framing in accordance with ASTM C 754.
28. Layouts: Align partition studs accurately according to partition layout.
29. Anchoring: Anchor runner channels to concrete slabs with concrete stub nails or power-driven anchors at 600 mm (24 inches) OC. Anchor runner channels to coiling grid, where applicable, with stove bolts. Where studs extend above ceiling system, install headers where required to receive runners.
30. Studs: Position studs vertically in runners. Where studs are located adjacent to openings or partition intersections and comers. anchor studs to runners with manufacturer's metal lock fastener or with 13 mm (1/2 inch) Type S pan-head screws.
 - a. Space studs at 400 mm (16 Inches) and 600 mm (24 inches) OC as indicated or scheduled.
 - 1) Cementitious Backer Units (CBU): Space studs at maximum of 400 mm (16 inches) OC.
 - 2) Limiting Heights: Comply with ASTM C 754 for transverse load of 240 Pa (5 lb-force/SF) without exceeding either allowable stress or deflection of L/240. Comers and Intersections: Locate studs no more than 50 mm (2 inches) from abutting partitions, comers, etc.
 - b. Openings: Locate studs not more than 50 mm (2 inches) from opening frames. Anchor studs to frame anchor clips by bolt or screw attachment. Install headers over openings as recommended by the manufacturer.
 - 1) Solid-Core Wood Doors and Hollow Metal Doors: Provide two full-height studs at jambs fastened together back to back.
 - 2) Fire-Rated Openings: Comply with GA 219.
31. Bracing: Provide diagonal bracing at head of studs that terminate above the ceiling level. Bracing shall consist of metal studs bent to V-shape and extending at 45 degrees from partition head to structure above. Locate bracing 1 200 mm (48 inches) maximum OC.
32. Wood Blocking or Metal Reinforcement:
 - a. Wood Blocking: See Division 6 Section "Rough Carpentry."
 - b. Install metal reinforcement of size required for support of toilet and bath accessories, hardware, cabinets, shelving, counters, and other wall-mounted items.
 - c. Set true to line, level, or plumb well-secured in stud wall and flush with back of drywall or other wall finish.
 - d. Coordinate exact locations with other sections.

Miscellaneous Framing And Furring

33. General: Provide necessary framing and furring for special framing at recesses, offsets, specialty items, and at wall-mounted casework, shelving, and equipment.
34. Furring Channels: Install furring channels over back-up material. Position channels vertically at 600 mm (24 inches) OC. Use power-activated fasteners or stub nails at 600 mm (24 Inches) OC along alternating flanges. Shim channels level as required.
 - a. Cementitious Backer Units (CBU): Space furring at maximum of 400 mm (16 inches) OC.



35. Resilient Furring Channels: Screw-attach In accordance with manufacturer's recommendations.
 - a. Spacing: 600 mm (24 inches) OC for framing at 16 inches OC and 400 mm (16 inches) OC for framing at 24 Inches OC.

Ceiling Grillage Erection

36. Reference Standard: Erect steel framing In accordance with ASTM C 754.
37. Hangers: Install wire hangers spaced not over 1 200 mm (48 inches) OC in direction of 38 mm (1-1/2 inch) main runner channels and within 150 mm (6 inches) of ends of main runners or interruptions of ceiling continuity. Hang from structure above.
38. Runners: Place main runners not over 1 200 mm (48 inches) OC. Provide, position, and level hangers with hangers saddle-tied along runners. Space furring channels at 600 mm (24 inches) OC at right angles to runner channels and secure with furring channel clips.
39. Reinforcement: At light troffers or other openings, reinforce grillage with 19 mm (3/4 inch) cold-rolled channels wired atop and parallel to main runner channels.
 - a. Provide lateral seismic bracing as required by code.
40. Special Shapes: Provide necessary framing and suspension for off sets, verticals, etc.

Insulation

41. Sound Insulation: Place sound Insulation blankets in partitions tight within spaces, around cut openings. behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
 - a. Ductwork Penetrations: Provide one-inch wide clearance around ductwork and pack with fiberglass ready for joint sealers.

Installation Of Gypsum Drywall

42. Reference Standards: Apply and finish gypsum board in accordance with GA 216 and ASTM C 840.
43. Partition Gypsum Board Layout: Apply gypsum wallboard panels vertically with abutting ends and edges occurring over stud flanges or furring.
 - a. Joints on Opposite Sides of Partitions: Stagger; joints shall not occur over same stud.
 - b. Two Layer Construction: Stagger Joints between layers.
44. Ceiling Gypsum Board: Apply gypsum board of maximum practical length with long dimensions at right angles to furring channels. End and edge joints shall occur over furring channels with end joints staggered. Properly support gypsum board around cutouts and openings.
45. Fasteners: Apply board to studs or furring with drywall screws spaced 300 mm (12 inches) OC in field of board and 200 mm (8 inches) OC staggered along abutting edges.
46. Water-Resistant: Apply gypsum wallboard manufacturer's recommended sealant to raw cut edges and screw heads.
47. Cementitious Backer Units (CBU): Install in accordance with ANSI A108.11 and manufacturer's recommendations.
48. Accessories:
 - a. Comer Bead: Apply as recommended by manufacturer at exposed outer corners.
 - b. Trim (Casing Beads): Apply as recommended by manufacturer, where gypsum board abuts other materials, and as indicated.
 - c. Control Joints: Comply with GA 216.
 - 1) Walls: Install at not more than 9 m (30 feet) OC.
 - 2) Ceilings: Install at not more than 15 m (50 feet) OC and where framing changes direction.
 - 3) Coordinate locations with the Owner.
49. Access Panels: Securely install access panels furnished under other sections. Set plumb and square to align with finish surface.



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50. Acoustical Sealant: Seal perimeter and penetrations on both sides of sound-rated partitions and partitions with sound-attenuation blankets with minimum of single 6 mm (1/4 inch) bead of sealant
 - a. Locations:
 - 1) Seal around gypsum-board perimeter in angle formed by gypsum-board panels and abutting dissimilar materials.
 - 2) Seal intersections of gypsum board with dissimilar materials.
 - 3) Seal pipe, conduit, ductwork, penetrations, etc.
 - 4) Seal around cutouts for lights, cabinets, pipes, ductwork, electrical boxes, etc.
 - 5) Seal gypsum board panel terminations in door and window frames.
 - 6) Seal control-joint locations before installing control Joints to panels.
 - b. Installation: Comply with ASTM C 919 and requirements of indicated sound-rated assembly. Provide number and positions of beads to comply with sound rating of assembly.
 51. Tolerances: Gypsum-board surface plane within plus or minus 3 mm in 3 000 mm (1/8 inch in 10 feet).
 52. Finishing: Finish in accordance with GA 214.
 - a. Concealed Locations (Not Exposed to View in Rooms): Level 1
 - b. Beneath Tile: Level 2.
 - c. Other Finished Areas: Level 4. Finish joints, trim, and fastener dimples. Sand smooth.
 - d. Cementitious Backer Units (CBU): Treat joints in accordance with ANSI A108.11 and manufacturer's recommendations.

END OF SECTION 09 29 00 00a



SECTION 09 29 00 00b - GYPSUM BOARD SHAFT-WALL ASSEMBLIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum board shaft-wall assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes gypsum board shaft-wall assemblies for the following:
 - a. Shaft-wall enclosures.
 - b. Chase enclosures.
 - c. Stair enclosures.
 - d. Horizontal enclosures.

C. Submittals

1. Product Data: For each gypsum board shaft-wall assembly indicated.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
 - b. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.

D. Quality Assurance

1. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119 by a testing and inspecting agency.
2. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
2. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
3. Stack panels flat on leveled supports off floor or slab to prevent sagging.

F. Project Conditions

1. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.
2. Do not install interior products until installation areas are enclosed and conditioned.
3. Do not install panels that are wet, moisture damaged, or mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.



PART 2 - PRODUCTS

- A. Gypsum Board Shaft-Wall Assemblies, General
1. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
 - a. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
 - b. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.
- B. Panel Products
1. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
 2. Gypsum Liner Panels: Comply with ASTM C 442/C 442M.
 - a. Type X: Manufacturer's proprietary liner panels with moisture-resistant paper faces.
 - 1) Core: 1 inch (25.4 mm) thick.
 - 2) Long Edges: Double bevel.
 - b. Moisture- and Mold-Resistant Type X: Manufacturer's proprietary liner panels with moisture- and mold-resistant core and surfaces; comply with ASTM D 3273.
 - 1) Core: 1 inch (25.4 mm) thick.
 - 2) Long Edges: Double bevel.
 3. Gypsum Base for Gypsum Veneer Plaster: As specified in Division 09 Section "Gypsum Veneer Plastering".
 4. Gypsum Board: As specified in Division 09 Section "Gypsum Board".
 5. Water-Resistant Gypsum Backing Board: As specified in Division 09 Section "Gypsum Board".
 6. Cementitious Backer Units: As specified in Division 09 Section "Tiling".
- C. Non-Load-Bearing Steel Framing
1. Framing Members: Comply with ASTM C 754 for conditions indicated.
 2. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - a. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - b. Protective Coating: ASTM A 653/A 653M, G40 (Z120) **OR** ASTM A 653/A 653M, G60 (Z180) **OR** Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120), **as directed**, hot-dip galvanized, unless otherwise indicated.
- D. Auxiliary Materials
1. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.
 2. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 09 Section(s) "Gypsum Veneer Plastering" OR "Gypsum Board", **as directed**, that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.
 3. Gypsum Base Joint-Reinforcing Materials: As specified in Division 09 Section "Gypsum Veneer Plastering".
 4. Gypsum Veneer Plaster: As specified in Division 09 Section "Gypsum Veneer Plastering".
 5. Gypsum Board Joint-Treatment Materials: As specified in Division 09 Section "Gypsum Board".
 6. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum face-layer panels and gypsum-base face-layer panels to backing-layer panels in multilayer construction.
 - a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



7. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - a. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
8. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - a. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
 - b. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
9. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
10. Acoustical Sealant: As specified in Division 07 Section "Thermal Insulation".
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Gypsum Board Shaft-Wall Assemblies

1. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing agency.
2. Fire-Resistance Rating: As indicated **OR** 1 hour **OR** 2 hours **OR** 3 hours **OR** 4 hours, **as directed**.
3. STC Rating: As indicated **OR** 51, minimum, **as directed**.
4. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
 - a. Depth: As indicated **OR** 2-1/2 inches (64 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**.
 - b. Minimum Base-Metal Thickness: As indicated **OR** 0.0179 inch (0.45 mm) **OR** 0.0220 inch (0.55 mm) **OR** 0.0329 inch (0.84 mm), **as directed**.
5. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches (51 mm) long and in depth matching studs.
 - a. Minimum Base-Metal Thickness: As indicated **OR** Matching steel studs **OR** 0.0179 inch (0.45 mm) **OR** 0.0220 inch (0.55 mm) **OR** 0.0329 inch (0.84 mm), **as directed**.
6. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
7. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches (76 mm), in depth matching studs, and not less than 0.0329 inch (0.84 mm) thick.
8. Room-Side Finish: As indicated **OR** Gypsum board **OR** Gypsum veneer plaster **OR** Cementitious backer units, **as directed**.
9. Shaft-Side Finish: As indicated **OR** As indicated by fire-resistance-rated assembly design designation, **as directed**.
10. Insulation: Sound attenuation blankets.

2.2 EXECUTION

A. Preparation



1. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft-wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft-wall assemblies to comply with requirements specified in Division 07 Section "Applied Fireproofing".
 - a. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runner 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 (610 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft-wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

B. Installation

1. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
 - a. ASTM C 754 for installing steel framing except comply with framing spacing indicated.
 - b. Division 09 Section(s) "Gypsum Veneer Plastering" OR "Gypsum Board", **as directed**, for applying and finishing panels.
 - c. Division 09 Section "Tiling" for cementitious backer units.
2. Do not bridge architectural or building expansion joints with shaft-wall assemblies; frame both sides of expansion joints with furring and other support.
3. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
 - a. At elevator hoistway entrance door frames, provide jamb struts on each side of door frame.
 - b. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch (0.79-mm) minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 gypsum base for veneer plaster **OR** gypsum board **OR** cementitious backer unit, **as directed**, face-layer panel.
4. Integrate stair hanger rods with gypsum board shaft-wall assemblies by locating cavity of assemblies where required to enclose rods.
5. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
6. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
7. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
8. Control Joints: Install control joints at locations indicated on Drawings **OR** according to ASTM C 840 and in specific locations approved by the Owner, **as directed**, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.
9. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.
10. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 4 inches (102 mm) of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch- (13- or 16-mm-) thick, gypsum board cants covering tops of projections. No recesses allowed (at steel beams especially).



- a. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches (610 mm) o.c. with screws fastened to shaft-wall framing.
 - b. Where steel framing is required to support gypsum board cants, install framing at 24 inches (610 mm) o.c. and extend studs from the projection to shaft-wall framing.
11. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3mm) from the plane formed by faces of adjacent framing.

C. Protection

1. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
2. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00 00b



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Task	Specification	Specification Description
09 29 00 00	01 22 16 00	No Specification Required



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SECTION 09 51 13 00 - ACOUSTICAL PANEL CEILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for acoustical panel ceilings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes acoustical panels and exposed suspension systems for ceilings.
2. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

C. Definitions

1. AC: Articulation Class.
2. CAC: Ceiling Attenuation Class.
3. LR: Light Reflectance coefficient.
4. NRC: Noise Reduction Coefficient.

D. Submittals

1. Product Data: For each type of product indicated.
2. Coordination Drawings: Drawn to scale and coordinating acoustical panel ceiling installation with hanger attachment to building structure and ceiling mounted items:
3. Samples: For each exposed finish.
4. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
5. Product test reports.
6. Research/evaluation reports.
7. Maintenance data.

E. Quality Assurance

1. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
2. Fire-Test-Response Characteristics
 - a. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1) Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - 2) Identify materials with appropriate markings of applicable testing and inspecting agency.
 - b. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A **OR B OR C**, **as directed**, materials as determined by testing identical products per ASTM E 84:
 - 1) Smoke-Developed Index: 450 or less.



3. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
 - c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
 - d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
 - e. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them 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.
2. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
3. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.2 PRODUCTS

A. Acoustical Panels, General

1. 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.
 - a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
2. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - a. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by the Owner from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
3. 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.
4. Antimicrobial Fungicide Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

B. Acoustical Panels For Acoustical Panel Ceiling

1. Classification: Provide fire-resistance-rated, **as directed**, panels complying with ASTM E 1264 for type, form, and pattern as follows:



- a. Type and Form: Type III, mineral base with painted finish; Form 1, nodular **OR** 2, water felted **OR** 4, cast or molded, **as directed**.
 - b. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 1, nodular; with glass-fiber cloth **OR** washable vinyl-film, **as directed**, overlay.
 - c. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face **OR** vinyl overlay on face and back **OR** vinyl overlay on face, back, and sealed edges **OR** fiberglass-fabric overlay on face, **as directed**.
 - d. Type and Form: Type XII, glass-fiber base with membrane-faced overlay; Form 1, plastic **OR** 2, cloth **OR** 3, other, **as directed**.
 - e. Type and Form: Type XX, other types; described as high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
 - f. Pattern: C (perforated, small holes) **OR** CD (perforated, small holes and fissured) **OR** CE (perforated, small holes and lightly textured) **OR** D (fissured) **OR** E (lightly textured) **OR** F (heavily textured) **OR** G (smooth) **OR** GH (smooth and printed) **OR** I (embossed) **OR** J (embossed-in-register) **OR** K (surface scored) **OR** Z (other patterns as described) **OR** As indicated by manufacturer's designation, **as directed**.
2. Color: White **OR** As selected from manufacturer's full range **OR** Match sample **OR** As indicated by manufacturer's designation **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 3. LR: Not less than 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90, **as directed**.
 4. NRC: Not less than 0.10 **OR** 0.35 **OR** 0.40 **OR** 0.50 **OR** 0.55 **OR** 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95 **OR** 1.00, **as directed**.
 5. CAC: Not less than 20 **OR** 25 **OR** 30 **OR** 35 **OR** 40, **as directed**.
 6. AC: Not less than 170 **OR** 180 **OR** 190 **OR** 200 **OR** 210, **as directed**.
 7. Edge/Joint Detail: Square **OR** Reveal sized to fit flange of exposed suspension system members **OR** Flush reveal sized to fit flange of exposed suspension system members **OR** Beveled, kerfed and rabbeted long edges and square, butt-on short edges, **as directed**.
 8. Thickness: 5/8 inch (15 mm) **OR** 3/4 inch (19 mm) **OR** 7/8 inch (22 mm) **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 9. Thickness (For glass-fiber-based panels): 1/8 inch (3 mm) **OR** 9/16 inch (15 mm) **OR** 5/8 inch (15 mm) **OR** 7/16 inch (22 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm) **OR** 3 inches (76 mm) **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 10. Modular Size: 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 600 by 600 mm **OR** 600 by 1200 mm **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 11. Antimicrobial Treatment: Broad spectrum fungicide and bactericide **OR** Fungicide, **as directed**, based.
- C. Metal Suspension Systems, General
1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 2. 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.
 3. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
 - a. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
 4. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per



ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

- 1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
 - 2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - 4) Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
- b. 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 hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
5. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
- a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
OR
Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
OR
Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 - b. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
6. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
7. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
8. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
9. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
10. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
11. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.
12. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
13. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including manufacturer's standard **OR** closed-cell PVC **OR** neoprene **OR** antimicrobial, **as directed**, gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.
- D. Metal Suspension System For Acoustical Panel Ceiling
1. Wide-Face, Capped, Double-Web, Fire-Rated, **as directed**, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
 - c. Face Design: Flat, flush.
 - d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
 - e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match



- color of acoustical unit **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
2. Narrow-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 ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
 - c. Face Design: Flat, flush **OR** Flanges formed with an integral center reveal, **as directed**.
 - d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
 - e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
 3. Narrow-Face, Steel-Capped, Double-Web, Fire-Rated Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished, cold-rolled, 9/16-inch- (15-mm-) wide metal caps on flanges.
 - a. Structural Classification: Intermediate-duty system.
 - b. Face Design: Flat, flush.
 - c. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
 4. Narrow-Face, Uncapped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, to produce structural members with 9/16-inch- (15-mm-) wide faces.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: With 1/8-inch- (3.2-mm-) wide, slotted, box-shaped flange **OR** With 1/4-inch- (6.35-mm-) wide, slotted, box-shaped flange **OR** Flanges formed in stepped design with a center protrusion projecting 19/64 inch (7.54 mm) below flange surfaces supporting panel faces and forming 3/16-inch- (4.76-mm-) wide reveals between edges of protrusion and those of panels, **as directed**.
 - c. Face Finish: Painted white **OR** in color as selected from manufacturer's full range **OR** to match color indicated by manufacturer's designation **OR** to match color of acoustical unit, **as directed**.
 - d. Reveal Finish: Painted to match flange color **OR** white **OR** black **OR** in color other than flange color as selected from manufacturer's full range of contrasting reveal colors, **as directed**.
 5. Wide-Face, Capped, Double-Web, Fire-Rated, **as directed**, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide, aluminum caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: Flat, flush.
 - c. Face Finish: Painted white **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Natural finish, **as directed**.
 6. Wide-Face, Single-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet electrolytically zinc coated, with prefinished flanges of width indicated.
 - a. Structural Classification: Heavy-duty system.
 - b. Face Finish: Painted white **OR** black, **as directed**.



7. Wide-Face, Capped, Double-Web, Stainless-Steel Suspension System: Main and cross runners roll formed from Type 304 or 316, stainless-steel sheet, with prefinished 15/16-inch- (24-mm-) wide, stainless-steel caps on flanges.
 - a. Structural Classification: Intermediate-duty system.
 - b. Face Design: Flat, flush.
 8. Narrow-Face, Single-Web, Extruded-Aluminum Suspension System: Main and cross runners formed from extruded aluminum to produce structural members with 9/16-inch- (15-mm-) wide faces.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: Screw-slot profile.
 - c. Face Finish: Painted white **OR** Satin anodized per AA-M12C22A31 and AAMA 611, **as directed**.
 - d. Reveal Finish: Match face finish **OR** Painted white **OR** Painted black, **as directed**.
 9. Extra-Wide-Face, Double-Web **OR** Single-Web, **as directed**, Metal Suspension System: Main and cross runners formed from extruded aluminum **OR** aluminum-capped steel **OR** steel-capped steel, **as directed**, to produce structural members with 1-1/2-inch- (50-mm-) **OR** 2-inch- (50-mm-), **as directed**, wide flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: Flat, flush.
 - c. Face Finish: Painted white **OR** Satin anodized per AA-M12C22A31 and AAMA 611, **as directed**.
 - d. Gasket System: Clean-room type.
- E. Metal Edge Moldings And Trim
1. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 - a. 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. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - c. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 2. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
 - a. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.
 - b. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
 - c. Conversion-Coated Finish: AA-M12C42 (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating).
 - d. Conversion-Coated and Factory-Primed Finish: AA-M12C42R1x (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating; organic coating as follows):
 - 1) Manufacturer's standard, factory-applied prime-coat finish ready for field painting.
 - e. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.



- f. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
- 1) Organic Coating: Thermosetting, primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

F. Acoustical Sealant

1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

1.3 EXECUTION

A. Preparation

1. 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. Installation

1. General: Install acoustical panel ceilings to comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - a. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
2. Suspend ceiling hangers from building's structural members and as follows:
 - a. 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.
 - b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - c. 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.
 - d. 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.
 - e. 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.
 - f. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - g. 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.



- h. 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.
 - i. Do not attach hangers to steel deck tabs.
 - j. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - k. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 - l. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
 4. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - b. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
 5. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
 6. 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.
 - a. Arrange directionally patterned acoustical panels as follows:
 - 1) As indicated on reflected ceiling plans.
OR
Install panels with pattern running in one direction parallel to long **OR** short, **as directed**, axis of space.
OR
Install panels in a basket-weave pattern.
 - b. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 - c. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - d. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
 - e. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - f. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
 - g. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
 - h. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

C. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.



2. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
 - a. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - 1) Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - 2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
3. Remove and replace acoustical panel ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

D. Cleaning

1. 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.

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SECTION 09 51 23 00 - ACOUSTICAL TILE CEILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for acoustical tile ceilings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes acoustical tiles for ceilings and the following:
 - a. Concealed suspension systems.
 - b. Direct attachment of tiles to substrates with adhesive.
 - c. Direct attachment of tiles to substrates with staples.
2. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

C. Definitions

1. AC: Articulation Class.
2. CAC: Ceiling Attenuation Class.
3. LR: Light-Reflectance coefficient.
4. NRC: Noise Reduction Coefficient.

D. Submittals

1. Product Data: For each type of product indicated.
2. Coordination Drawings: Drawn to scale and coordinating acoustical tile ceiling installation with hanger attachment to building structure and ceiling mounted items. Show size and location of initial access modules.
3. Samples: For each exposed finish.
4. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
5. Field quality-control test reports.
6. Product test reports.
7. Research/evaluation reports.
8. Maintenance data.

E. Quality Assurance

1. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
2. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:
 - a. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1) Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.



- 2) Identify materials with appropriate markings of applicable testing and inspecting agency.
- b. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class A **OR B OR C**, **as directed**, materials as determined by testing identical products per ASTM E 84:
 - 1) Smoke-Developed Index: 450 or less.
3. Seismic Standard: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
 - c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
 - d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
 - e. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them 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.
2. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.
3. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.2 PRODUCTS

A. Acoustical Tiles, General

1. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
2. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
 - a. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by the Owner from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
3. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles 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.
4. Antimicrobial Fungicide Treatment: Provide acoustical tiles with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide



added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

- B. Acoustical Tiles For Acoustical Tile Ceiling
1. Classification: Provide fire-resistance-rated, **as directed**, tiles complying with ASTM E 1264 for type, form, and pattern as follows:
 - a. Type III, mineral base with painted finish; Form 1, nodular **OR** 2, water felted **OR** 4, cast or molded, **as directed**.
 - b. Pattern: C (perforated, small holes) **OR** CD (perforated, small holes and fissured) **OR** CE (perforated, small holes and lightly textured) **OR** D (fissured) **OR** E (lightly textured) **OR** F (heavily textured) **OR** G (smooth) **OR** I (embossed) **OR** J (embossed-in-register) **OR** As indicated by manufacturer's designation, **as directed**.
 2. Color: White **OR** As selected from manufacturer's full range **OR** Match sample **OR** As indicated by manufacturer's designation **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 3. LR: Not less than 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80, **as directed**.
 4. NRC: Not less than 0.50 **OR** 0.55 **OR** 0.60 **OR** 0.65 **OR** 0.70, **as directed**.
 5. CAC: Not less than 20 **OR** 25 **OR** 30 **OR** 35 **OR** 40, **as directed**.
 6. AC: Not less than 170 **OR** 180 **OR** 190 **OR** 200 **OR** 210, **as directed**.
 7. Edge/Joint Detail: Square, kerfed and rabbeted, or tongue and grooved, or butt **OR** Beveled, kerfed and rabbeted, or tongue and grooved, or butt **OR** Beveled, kerfed and rabbeted long edges and square, butt on short edges, **as directed**.
 8. Thickness: 5/8 inch (15 mm) **OR** 3/4 inch (19 mm) **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 9. Modular Size: 12 by 12 inches (305 by 305 mm) **OR** 300 by 300 mm **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 10. Antimicrobial Treatment: Broad spectrum fungicide and bactericide **OR** Fungicide, **as directed**, based.
- C. Metal Suspension Systems, General
1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 2. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
 3. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
 4. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
 - 2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.
 - b. 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 hangers of type indicated, and with capability to sustain, without



failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

5. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - b. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
 6. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
 7. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
 8. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.
 9. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.
- D. Metal Suspension System For Acoustical Tile Ceiling
1. Direct-Hung, Double-Web, Fire-Rated, **as directed**, Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Access: Upward **OR** Downward, **as directed**, and end pivoted, **OR** side pivoted, **as directed**, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
 2. Indirect-Hung, Fire-Rated, **as directed**, Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Carrying Channels: Cold-rolled steel, 0.059850-inch- (1.52-mm-) minimum base (uncoated) metal thickness, not less than 3/16-inch- (4.7-mm-) wide flanges by 1-1/2-inch- (38-mm-) deep steel channels, 475 lb/1000 feet (0.707 kg/m), with rust-inhibitive paint finish **OR** hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, **as directed**.
 - c. Access: Where access is indicated, provide special cross runners or split splines to allow for removal of acoustical units in indicated access areas. Identify access tile with manufacturer's standard unobtrusive markers for each access unit.
- E. Metal Edge Moldings And Trim
1. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 - a. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 - b. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 2. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
 - a. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability



properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.

- b. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- c. Conversion-Coated Finish: AA-M12C42 (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating).
- d. Conversion-Coated and Factory-Primed Finish: AA-M12C42R1x (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating; organic coating as follows):
 - 1) Manufacturer's standard factory-applied prime-coat finish ready for field painting.
- e. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
- f. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - 1) Organic Coating: Thermosetting, enamel primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

F. Acoustical Sealant

1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

G. Miscellaneous Materials

1. Tile Adhesive: Type recommended by tile manufacturer, bearing UL label for Class 0-25 flame spread.
 - a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Staples: 5/16-inch- (8-mm-) long, divergent-point staples.

1.3 EXECUTION

A. Preparation

1. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
2. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

B. Installation, Suspended Acoustical Tile Ceilings

1. General: Install acoustical tile ceilings to comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - a. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
2. Suspend ceiling hangers from building's structural members and as follows:



- a. 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.
 - b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
OR
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.
 - c. 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.
 - d. 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.
OR
Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - e. 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.
 - f. 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.
 - g. Do not attach hangers to steel deck tabs.
 - h. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - i. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 - j. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
 4. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.
 - a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - b. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
 5. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
 6. Arrange directionally patterned acoustical tiles as follows:
 - a. As indicated on reflected ceiling plans.
OR
Install tiles with pattern running in one direction parallel to long **OR** short, **as directed**, axis of space.
OR



- Install tiles in a basket-weave pattern.
7. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
 - a. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
 - b. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
 - c. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.
- C. Installation, Directly Attached Acoustical Tile Ceilings
1. Adhesive Installation: Install acoustical tile by bonding to substrate, using amount of adhesive and procedure recommended in writing by tile manufacturer and as follows:
 - a. Remove loose dust from backs of tiles by brushing and prime them with a thin coat of adhesive.
 - b. Install splines in joints between tiles; maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively.
 - c. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.
 2. Stapled Installation: Fasten acoustical tile to substrate using a minimum of two staples per tile that are installed in flanges of tile and as follows:
 - a. Form double-lapped joint between tiles by securely pressing tile tongues into corresponding tile grooves.
 - b. Maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively. Shim tile or correct substrate as required to maintain tolerance.
 - c. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.
 3. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.
 4. Arrange directionally patterned acoustical tiles as follows:
 - a. As indicated on reflected ceiling plans.
OR
Install tiles with pattern running in one direction parallel to long axis of space.
OR
Install tiles with pattern running in one direction parallel to short axis of space.
OR
Install tiles in a basket-weave pattern.
- D. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
 2. Tests and Inspections: Testing and inspecting of completed installations of acoustical tile ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.
 - a. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no tiles have been installed.
 - 1) Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - 2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.



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3. Remove and replace acoustical tile ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

E. Cleaning

1. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23 00



Task	Specification	Specification Description
09 53 23 00	09 51 13 00	Acoustical Panel Ceilings



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SECTION 09 54 23 00 - ACOUSTICAL METAL PAN CEILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for acoustical metal pan ceilings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes clip-in, lay-in, snap-in, and torsion-spring acoustical metal pans and the following suspension system for ceilings:
 - a. Direct hung, exposed tee and slot-bolt grid.
 - b. Direct-hung and Indirect-hung, concealed grid designed to support metal pans.
2. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

C. Definitions

1. CAC: Ceiling Attenuation Class.
2. LR: Light Reflectance coefficient.
3. NRC: Noise Reduction Coefficient.

D. Performance Requirements

1. Structural Performance: Exterior snap-in metal pan ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling units; or permanent damage to fasteners and anchors.
 - a. Wind Load: Uniform pressure of 20 lbf/sq. ft. (960 Pa) **OR** of 30 lbf/sq. ft. (1436 Pa) **OR** as indicated on Drawings, **as directed**, acting inward or outward.
2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 100 deg F (55 deg C).

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Samples: For each exposed finish.
4. Performance Data: For installed products indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Coordination Drawings: Drawn to scale and coordinating and showing the following:
 - a. Ceiling suspension members.
 - b. Method of attaching hangers to building structure.
 - c. Ceiling-mounted items.
 - d. Ceiling perimeter and penetrations through the ceiling; and trim and moldings.
6. Product test reports.



7. Evaluation reports.
8. Field quality-control reports.
9. Maintenance data.

F. Quality Assurance

1. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
2. 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.
3. Seismic Standard: Provide acoustical metal pan ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings - Seismic Zones 0-2."
 - c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies - Seismic Zones 3 & 4."
 - d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
 - e. SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver acoustical metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them 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.
2. Handle acoustical metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.2 PRODUCTS

A. Acoustical Metal Ceiling Pans

1. Acoustical Metal Pan Standard: Provide manufacturer's standard acoustical metal pans of configuration indicated that comply with ASTM E 1264 classifications as designated by types, acoustical ratings, and light reflectances unless otherwise indicated.
 - a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
2. Sheet Metal Characteristics: For metal components 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, roughness, stains, or discolorations.
 - a. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209 (ASTM B 209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - b. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C 635.



- 1) Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - 2) Painted Finishes: Electrolytic zinc-coated steel complying with ASTM A 591/A 591M, 40Z (12G) coating, surface treatment as recommended by finish manufacturer for type of use and finish indicated.
 - 3) Chemical/Mechanical Finishes: Uncoated steel sheet complying with ASTM A 1008/A 1008M with luster or bright finish as required by finisher for applying electroplating or other metallic-finishing processes.
 - c. Stainless-Steel Sheet: Complying with ASTM A 240/A 240M, Type 304 **OR** Type 430, **as directed**.
3. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84.
- a. Bond fabric layer to panels in the factory with manufacturer's standard nonflammable adhesive.
4. Sound-Absorbent Pads: Provide width and length to completely fill concealed surface of pan, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:
- a. Plastic Sheet-Wrapped Mineral-Fiber Insulation: Pads consisting of nonrigid, PVC plastic sheet encapsulating unfaced mineral-fiber insulation complying with ASTM C 553, Type I, II, or III, and as follows:
 - 1) Mineral-Fiber Type and Thickness: Glass fiber; 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 3 inches (76 mm), **as directed**.
 - 2) Mineral-Fiber Density: 3/4 lb/cu. ft. (12 kg/cu. m) **OR** 1 lb/cu. ft. (16 kg/cu. m) **OR** 1-1/2 lb/cu. ft. (24 kg/cu. m), **as directed**.
 - 3) Plastic Sheet Thickness and Color: Not less than 0.003 inch (0.076 mm); clear **OR** flat black **OR** white, **as directed**.
 - b. Unwrapped, Glass-Fiber Insulation: Black coated, unfaced, complying with ASTM C 553, Type I, II, or III; not less than 1-lb/cu. ft. (16-kg/cu. m) density; treated to be nondusting; and as follows:
 - 1) Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - c. Spacer Grids: Provide manufacturer's standard aluminum **OR** galvanized-steel, **as directed**, grid units that provide an air cushion between metal pans and insulation pads and that act to improve sound absorption.
 - d. Sound Attenuation Panels: Provide manufacturer's standard aluminum **OR** galvanized-steel, **as directed**, unperforated metal backing unit that acts as a sound-attenuating pan to reduce the travel of sound through ceiling plenum into adjoining rooms.
 - 1) Sound-Absorbent Pads: Provide secondary sound-absorbent pads, same as specified for primary pads, for placement over sound attenuation pan to reduce plenum sound.
- B. Aluminum Pans For Acoustical Metal Pan Ceiling
1. Classification: Units complying with ASTM E 1264 for Type VII, perforated aluminum facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated aluminum facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated aluminum facing (pan) units, **as directed**.
 - a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in diagonal **OR** parallel, **as directed**, alignment to pan edge with uniform perforations of dimension, holes per square foot or inch, and percent open area as indicated by product designation **OR** selected from manufacturer's full range, **as directed**.
OR



Pattern: Pattern C (perforated, small holes) regularly spaced, with uniform perforations of dimension, holes per square foot or inch, and percent open area as specified by product designation **OR** selected from manufacturer's full range, **as directed**.

2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
 - a. Lay-in Pans: Formed to set in exposed suspension grid.
 - b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
 - c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.
 - d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
3. Pan Thickness: Not less than 0.020 inch (0.5 mm) **OR** 0.025 inch (0.6 mm) **OR** 0.032 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
OR
Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 24 by 60 inches (610 by 1525 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** 30 by 60 inches (760 by 1525 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Mill **OR** Lacquered mill **OR** Clear anodized **OR** Clear mirror-anodized **OR** Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** Bright-reflective metallic finish selected from manufacturer's full range, **as directed**.
8. LR: Not less than 0.70 **OR** 0.75, **as directed**.
9. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
10. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

C. Steel Pans For Acoustical Metal Pan Ceiling

1. Classification: Units complying with ASTM E 1264 for Type V, perforated steel facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated steel facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated steel facing (pan) units, **as directed**.
 - a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in diagonal **OR** parallel, **as directed**, alignment to pan edge with uniform perforations of dimension, holes per square foot or inch, and percent open area as indicated by product designation **OR** selected from manufacturer's full range, **as directed**.
OR
Pattern: Pattern C (perforated, small holes) regularly spaced, with uniform perforations of dimension, holes per square foot or inch, and percent open area as specified by product designation **OR** selected from manufacturer's full range, **as directed**.
2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
 - a. Lay-in Pans: Formed to set in exposed suspension grid.
 - b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
 - c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.



- d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
3. Pan Thickness: Not less than 0.010-inch (0.25-mm) **OR** 0.020-inch (0.5-mm) **OR** 0.024-inch (0.6-mm) **OR** 0.030-inch (0.75-mm) **OR** 0.036-inch (0.9-mm), **as directed**, nominal thickness.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
OR
Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 24 by 60 inches (610 by 1525 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** 30 by 60 inches (760 by 1525 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Bright-reflective metallic finish selected from manufacturer's full range, **as directed**.
8. LR: Not less than 0.70 **OR** 0.75, **as directed**.
9. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
10. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

D. Stainless-Steel Pans For Acoustical Metal Pan Ceiling

1. Classification: Units complying with ASTM E 1264 for Type VI, perforated stainless-steel facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated stainless-steel facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated stainless-steel facing (pan) units, **as directed**.
 - a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in parallel alignment to pan edge with uniform perforations of 0.109-inch (2.8-mm) diameter, 1800 holes/sq. ft. or inch, and 11.8 percent open area.
2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
 - a. Lay-in Pans: Formed to set in exposed suspension grid.
 - b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
 - c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.
 - d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
3. Pan Thickness: Not less than 0.019 inch (0.5 mm) **OR** 0.025 inch (0.65 mm) **OR** 0.030 inch (0.76 mm), **as directed**.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
OR
Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Brushed, directional polish **OR** Satin, directional polish **OR** Mirrorlike reflective, nondirectional polish, **as directed**.



8. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
9. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

E. Metal Suspension Systems

1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
3. Suspension Systems: Provide systems complete with carriers, runners, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, and other suspension components required to support ceiling units and other ceiling-supported construction.
4. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
 - 2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - 4) Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
 - b. 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 hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
5. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 - c. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 - d. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635, Table 1, Direct Hung will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
6. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
7. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
8. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
9. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
10. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical metal pans in place.
11. Hold-Down Clips: Manufacturer's standard hold-down clips spaced to secure acoustical metal pans in place to molding and trim at perimeter **OR** at each pan, **as directed**.



12. Exposed Metal Edge Moldings and Trim: Provide exposed members as indicated or as required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of and penetrations through ceiling, to conceal edges of pans and runners, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching acoustical metal pan ceiling units, unless otherwise indicated.
 - a. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.
- F. Direct-Hung, Standard-Grid, Metal Suspension System For Acoustical Metal Pan Ceiling
1. Suspension System: For clip-in **OR** lay-in **OR** torsion-spring, **as directed**, pans.
 2. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide sheet metal caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
 - c. Face Design: Flat, flush.
 - d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
 - e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of metal pan **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
 3. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized according to ASTM A 653/653M, G30 (Z90) coating designation, with prefinished, cold-rolled, 9/16-inch- (15-mm-) wide sheet metal caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
 - c. Face Design: Flat, flush **OR** Flanges formed with an integral center reveal, **as directed**.
 - d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
 - e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of metal pan **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
 4. Narrow-Face, Uncapped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized, to produce structural members with 9/16-inch- (15-mm-) wide faces.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: With 1/8-inch- (3.2-mm-) wide, slotted, box-shaped flange **OR** With 1/4-inch- (6.35-mm-) wide, slotted, box-shaped flange, **as directed**.
 - c. Face Finish: Painted white **OR** in color as selected from manufacturer's full range **OR** to match color indicated by manufacturer's designation **OR** to match color of metal pan, **as directed**.
 5. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide aluminum caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: Flat, flush.
 - c. Face Finish: Painted white **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Natural finish, **as directed**.
 6. Wide-Face, Capped, Double-Web, Stainless-Steel Suspension System: Main and cross runners roll formed from and capped with Type 304 or 316 stainless-steel sheet, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide stainless-steel caps on flanges.



- a. Structural Classification: Intermediate-duty system.
 - b. Face Design: Flat, flush.
7. Suspension System for Torsion-Spring Metal Pans: Provide runners with factory-cut slots fabricated to accept torsion-spring attachment.
- G. Metal Suspension System For Acoustical Snap-In Metal Pan Ceiling
1. Indirect-Hung, Snap-Tee **OR** Bar, **as directed**, System: Designed to support metal pans that snap into main runners, consisting of main runners connected to carrying channels that are attached by hangers to building structure, and complying with the following requirements:
 - a. Main Runners: Formed from the following metal:
 - 1) Aluminum Sheet: Alloy and temper recommended by aluminum producer and finisher for type of use indicated and manufacturer's standard finish, complying with ASTM B 209 (ASTM B 209M).
 - 2) Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, with not less than 80Z (24G) zinc coating.
 - 3) Hot-Dip Galvanized Steel: ASTM A 653/A 653M, not less than G60 (Z180) zinc coating.
 - 4) Stainless-Steel Sheet: ASTM A 666, Type 302 or 304, stretcher leveled, with cold-rolled mill finish.
 - 5) Metal Sheet: Metal as standard with ceiling system manufacturer with factory-applied protective finish complying with ASTM C 635.
 - b. Carrying Channels: Same member and metal as indicated for main runners.
OR
Carrying Channels: Cold-rolled steel, not less than 0.060-inch (1.5-mm) nominal thickness of base (uncoated) metal and 7/16-inch- (11-mm-) wide flanges, protected with rust-inhibitive paint **OR** hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, **as directed**, and as follows:
 - 1) Depth and Weight: 1-1/2 inches and 475 lb/1000 feet (38 mm and 215 kg/305 m) **OR** 2 inches and 590 lb/1000 feet (51 mm and 268 kg/305 m), **as directed**.
 - c. Exterior Bracing Channels and Angles: Cold-rolled steel, hot-dip galvanized to comply with ASTM A 653/A 653M, G60 (Z180) coating designation; size and profile as required to withstand wind load.
 2. Direct-Hung, Snap-Tee **OR** Bar, **as directed**, System: Designed to support metal pans that snap into main runners, consisting of main runners supported by hangers attached directly to building structure, and complying with the following requirements:
 - a. Hangers: Angles or channels, as standard with ceiling system manufacturer, formed from same metal as main runners.
 - b. Main Runners: Rolled aluminum sheet; alloy and temper recommended by aluminum producer and finisher for type of use indicated and manufacturer's standard finish, complying with ASTM B 209 (ASTM B 209M).
 3. Access Panels: For access at locations indicated, provide acoustical snap-in metal pan ceiling units, accessible by key or tool **OR** two access knobs; place one access knob at each end of panel near corners, **as directed**.
 - a. Access Key or Tool: Provide manufacturer' standard key or tool for opening access panels; one **OR** two, **as directed**.
- H. Acoustical Sealant
1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or



less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

- I. General Finish Requirements
 1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
 2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 3. 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.
- J. Aluminum Finishes
 1. Mill Finish: AA-M10C10 (Mechanical Finish: as fabricated, unspecified; Chemical Finish: chemically cleaned).
 2. Lacquered Mill Finish: AA-M10C10R1x (Mechanical Finish: as fabricated, unspecified; Chemical Finish: chemically cleaned; Organic Coating: as specified below).
 - a. Organic Coating: Manufacturer's standard clear organic coating.
 3. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
 4. Clear Mirror Anodic Finish: AA-M21C12A212, 0.005 mm or thicker.
 5. Color-Coated Finish: Manufacturer's standard powder-coat, **as directed**, baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
 6. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.
- K. Galvanized-Steel Sheet Finishes
 1. Color-Coated Finish: Manufacturer's standard powder-coat, **as directed**, baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
- L. Steel Sheet Finishes
 1. Electroplated Finish: Electroplating process complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, and minimum thickness to produce a coating uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unplated areas, and other visible defects.
 2. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.
- M. Stainless-Steel Finishes
 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.



1.3 EXECUTION

A. Preparation

1. Measure each ceiling area and establish layout of acoustical metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and Coordination Drawings.

B. Installation

1. Install acoustical metal pan ceilings to comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
2. Suspend ceiling hangers from building's structural members and as follows:
 - a. 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.
 - b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - c. 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.
 - d. 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.
OR
Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved.
 - e. 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.
 - f. 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.
 - g. Do not attach hangers to steel deck tabs.
 - h. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - i. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 - j. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
4. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pans.
 - a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - b. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
5. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.



6. Cut acoustical metal pan units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
 7. Install acoustical metal pans in coordination with suspension system and exposed moldings and trim.
 - a. For lay-in square-edge pans, install pans with edges fully hidden from view by flanges of suspension system runners and moldings.
 - b. For lay-in reveal-edge pans on suspension system runners, install pans with bottom of reveal in firm contact with top surface of runner flanges.
 - c. For lay-in reveal-edge pans on suspension system members with box-shaped flanges, install pans with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
 - d. For clip-in **OR** torsion-spring-hinged, **as directed**, pans, position pans according to manufacturer's written instructions.
 - e. For snap-in pans, fit adjoining units to form flush, tight joints.
 - f. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
 - g. Fit adjoining units to form flush, tight joints.
 - h. Install directionally patterned or textured metal pans in directions indicated.
 - i. Install sound-absorbent fabric layers in perforated metal pans.
 - j. Install sound-absorbent pads in perforated metal pans over metal spacer grids, **as directed**.
 8. Install sound attenuation panels in areas indicated by reflected ceiling plans or room finish schedules. Lay panels directly on ceiling system and close major openings to form complete coverage in required areas. Lay second sound-absorbent pads on sound attenuation panels.
 9. Install hold-down clips where indicated.
- C. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 2. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
 - a. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - 1) Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - 2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
 3. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
 4. Prepare test and inspection reports.
- D. Cleaning
1. Clean exposed surfaces of acoustical metal pan ceilings, including trim and edge moldings after removing strippable, temporary protective covering, if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, 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, including dented and bent units.



END OF SECTION 09 54 23 00



SECTION 09 54 23 00a - LINEAR METAL CEILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for linear metal ceilings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes strip linear metal pans and suspension systems for ceilings.

C. Definitions

1. LR: Light Reflectance coefficient.
2. NRC: Noise Reduction Coefficient.

D. Performance Requirements

1. Structural Performance: Exterior linear metal ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling units; or permanent damage to fasteners and anchors.
 - a. Wind Load: Uniform pressure of 20 lbf/sq. ft. (960 Pa) **OR** of 30 lbf/sq. ft. (1436 Pa) **OR** as indicated on Drawings, **as directed**, acting inward or outward.
2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), **as directed**, material surfaces.

E. Submittals

1. Product Data: For each type of product indicated.
2. Performance Data: For installed products indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Samples: For each exposed finish.
4. Coordination Drawings: Drawn to scale and coordinating and showing the following:
 - a. Linear pattern.
 - b. Joint pattern.
 - c. Ceiling suspension members.
 - d. Method of attaching hangers to building structure.
 - e. Ceiling-mounted items.
 - f. Ceiling perimeter and penetrations through ceiling; trim and moldings.
5. Product test reports.
6. Evaluation reports.
7. Maintenance data.

F. Quality Assurance

1. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory.
2. 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.



3. Seismic Standard: Comply with the following:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings - Seismic Zones 0-2."
 - c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies - Seismic Zones 3 & 4."
 - d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
 - e. SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

G. Delivery, Storage, And Handling

1. Deliver linear metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them 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.
2. Handle linear metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.2 PRODUCTS

A. Linear Metal Ceiling Pans

1. Acoustical Metal Pan Standard: Provide manufacturer's standard linear metal pans of configuration indicated that comply with ASTM E 1264.
 - a. Mounting Method for Measuring NRC: Type E-400.
2. Sheet Metal Characteristics: For metal components 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, roughness, stains, or discolorations.
 - a. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209 (ASTM B 209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - b. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C 635.
 - c. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled and ASTM A 591/A 591M, 40Z (12G) coating for painted finish **OR** ASTM A 1008/A 1008M for electroplating, **as directed**; with protective coating complying with ASTM C 635 and recommended by finisher for finish indicated.
 - d. Stainless-Steel Sheet: Complying with ASTM A 240/A 240M, Type 304 **OR** Type 430, **as directed**.
3. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated to snap on and be securely retained on carriers without separate fasteners, and finished to comply with requirements indicated.
4. Pan Splices: Construction same as pans, in lengths 8 to 12 inches (200 to 300 mm); with manufacturer's standard finish.
5. End Caps: Metal matching pans **OR** Plastic **OR** Manufacturer's standard material, **as directed**; fabricated to fit and conceal exposed ends of pans.
6. Filler Strips: Metal matching pans **OR** Plastic **OR** Manufacturer's standard material, **as directed**; fabricated to uninterruptedly close voids between pans.
7. Moldings and Trim: Provide manufacturer's standard moldings and trim for exposed members, and as indicated or required, for edges and penetrations of ceiling, around fixtures, at changes in ceiling height, and for other conditions; of same metal and finish as linear metal ceiling pans.



8. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84.
 - a. Bond fabric layer to pan in the factory with manufacturer's standard nonflammable adhesive.
 9. Sound-Absorbent Pads: Provide width and length to completely fill between carriers, joined at center of panel, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:
 - a. Plastic Sheet-Wrapped Mineral-Fiber Insulation: Pads consisting of nonrigid, PVC plastic sheet encapsulating unfaced mineral-fiber insulation complying with ASTM C 553, Type I, II, or III, and as follows:
 - 1) Mineral-Fiber Type and Thickness: Glass fiber; 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 3 inches (76 mm), **as directed**.
 - 2) Mineral-Fiber Density: 3/4 lb/cu. ft. (12 kg/cu. m) **OR** 1 lb/cu. ft. (16 kg/cu. m) **OR** 1-1/2 lb/cu. ft. (24 kg/cu. m), **as directed**.
 - 3) Plastic Sheet Thickness and Color: Not less than 0.003 inch (0.076 mm); clear **OR** flat black **OR** white, **as directed**.
 - b. Unwrapped, Glass-Fiber Insulation: Black-coated, unfaced, glass-fiber insulation complying with ASTM C 553, Type I, II, or III, not less than 1-lb/cu. ft. (16-kg/cu. m) density, treated to be nondusting, and as follows:
 - 1) Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
- B. Metal Suspension Systems
1. Metal Suspension Systems Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C 635 requirements.
 2. Suspension Systems: Provide systems complete with carriers, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.
 3. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
 - a. Cast-in-Place and Postinstalled Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
 - 2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC service condition (mild).
 - 3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.
 - 4) Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
 - b. 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 hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
 4. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:
 - a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 - c. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.



- d. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635, Table 1, Direct Hung will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
 5. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
 6. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed from 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
 7. Carriers: Factory finished with matte-black baked finish, **as directed**.
 - a. Main Carriers: Aluminum, not less than 0.240-inch (6.0-mm) rolled sheet, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, complying with ASTM B 209 (ASTM B 209M).
 - b. Main Carriers: Steel, not less than 0.0209-inch (0.53-mm) nominal thickness, cold-rolled sheet, with factory-applied protective coating, complying with ASTM C 635.
 - 1) Electrolytic Zinc-Coated Steel: ASTM A 591/A 591M, not less than 80Z (24G), **as directed**, zinc coating.
 - 2) Hot-Dip Galvanized Steel: ASTM A 653/A 653M, not less than G60 (Z180), **as directed**, zinc coating.
 - c. Adaptable Carriers: Manufacturer's standard carriers for direct attachment to existing suspended tees.
 - d. Flexible Radial Carriers: Manufacturer's standard radial carriers.
 - e. Expansion Carriers: Manufacturer's standard carriers allowing for irregularities or other unusual space conditions.
 8. Carrier Splices: Same metal, profile, and finish as indicated for carriers.
 9. Stabilizer Channels, Tees, and Bars: Manufacturer's standard components for stabilizing main carriers at regular intervals and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated; and factory finished with matte-black baked finish.
 10. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
 11. Exterior Bracing Channels and Angles: Cold-rolled steel, hot-dip galvanized to comply with ASTM A 653/A 653M, G60 (Z180) coating designation; size and profile as required to withstand wind load.
 12. Hold-Down Clips: Manufacturer's standard hold-down clips spaced as standard with manufacturer.
 13. Edge Moldings and Trim: Provide exposed members as indicated or required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of penetrations through ceiling, to conceal ends of pans and carriers, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching linear metal pans or extruded plastic unless otherwise indicated.
 - a. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.
- C. Aluminum Pans And Suspension System For Linear Metal Ceiling
1. Aluminum Pans and Suspension System:
 2. Classification: Units complying with ASTM E 1264 for Type XIII, aluminum strips with mineral- or glass-fiber-base backing; Form 1, perforated **OR** Type XIII, aluminum strips with mineral- or glass-fiber-base backing; Form 2, unperforated **OR** Type XX, other types described as perforated aluminum strips with sound-absorbent fabric backing, **as directed**.
 3. Pan Thickness: Not less than 0.018 inch (0.46 mm) **OR** 0.022 inch (0.56 mm) **OR** 0.024 inch (0.6 mm) **OR** 0.025 inch (0.65 mm) **OR** 0.027 inch (0.7 mm) **OR** 0.032 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
 4. Pan Edge Detail: Beveled **OR** Square **OR** Round **OR** Manufacturer's standard edge detail, **as directed**.



5. Linear Module Width and Pan Face Width: 2-inch (51-mm) module width and 1-1/4-inch (32-mm) face width **OR** 4-inch (102-mm) module width and 3-1/4-inch (83-mm) face width **OR** 6-inch (152-mm) module width and 5-1/4-inch (133-mm) face width **OR** 8-inch (203-mm) module width and 7-1/4-inch (184-mm) face width **OR** 100-mm module width and 80-mm face width **OR** 200-mm module width and 180-mm face width **OR** 300-mm module width and 280-mm face width **OR** As indicated on Drawings, **as directed**.
6. Pan Depth: 5/8 inch (16 mm) deep **OR** 3/4 inch (19 mm) deep **OR** Not less than 1 to 1-1/2 inches (25 to 38 mm) deep **OR** 15 mm deep **OR** As indicated, **as directed**.
7. Pan Face Finish: Mill **OR** Lacquered mill **OR** Clear anodized **OR** Clear mirror-anodized **OR** Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** High-performance organic coating in color selected from manufacturer's full range **OR** Bright-reflective finish selected from manufacturer's full range, **as directed**.
8. End Cap, Finish of Exposed Portions: Matte black **OR** To match pan **OR** Manufacturer's standard finish, **as directed**.
9. Filler Strip Design: Recessed **OR** Flush **OR** An integral extension of pan profile **OR** Expansion, for use with expansion carriers **OR** Slotted, for air diffusion, **as directed**.
10. Filler Strip, Finish of Exposed Portions: Matte black **OR** To match pan, **as directed**.
11. LR: Not less than 0.70 **OR** 0.75, **as directed**.
12. NRC: Not less than 0.65 **OR** 0.75 **OR** 0.95, **as directed**.
13. Suspension-System Main-Carrier Material: Aluminum **OR** Electrolytic zinc-coated steel **OR** Hot-dip galvanized steel **OR** Manufacturer's standard material and protective finish, **as directed**.

D. Steel Pans And Suspension System For Linear Metal Ceiling

1. Steel Pans and Suspension System:
2. Classification: Units complying with ASTM E 1264 for Type XIII, steel strips with mineral- or glass-fiber-base backing; Form 1, perforated **OR** Type XIII, steel strips with mineral- or glass-fiber-base backing; Form 2, unperforated **OR** Type XX, other types described as perforated steel strips with sound-absorbent fabric backing, **as directed**.
3. Pan Thickness: Not less than 0.015 inch (0.4 mm) **OR** 0.020 inch (0.5 mm) **OR** 0.024 inch (0.6 mm) **OR** 0.030 inch (0.75 mm), **as directed**.
4. Pan Edge Detail: Beveled **OR** Square **OR** Round **OR** Manufacturer's standard edge detail, **as directed**.
5. Linear Module Width and Pan Face Width: 2-inch (51-mm) module width and 1-1/4-inch (32-mm) face width **OR** 4-inch (102-mm) module width and 3-1/4-inch (83-mm) face width **OR** 6-inch (152-mm) module width and 5-1/4-inch (133-mm) face width **OR** 8-inch (203-mm) module width and 7-1/4-inch (184-mm) face width **OR** As indicated on Drawings, **as directed**.
6. Pan Depth: 5/8 inch (16 mm) deep **OR** 3/4 inch (19 mm) deep **OR** Not less than 1 to 1-1/2 inches (25 to 38 mm) deep **OR** 15 mm deep **OR** As indicated, **as directed**.
7. Pan Face Finish: Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** Electroplated finish selected from manufacturer's full range, **as directed**.
8. End Cap, Finish of Exposed Portions: Matte black **OR** To match pan **OR** Manufacturer's standard finish, **as directed**.
9. Filler Strip Design: Recessed **OR** Flush **OR** An integral extension of pan profile **OR** Expansion, for use with expansion carriers **OR** Slotted, for air diffusion, **as directed**.
10. Filler Strip, Finish of Exposed Portions: Matte black **OR** To match pan, **as directed**.
11. LR: Not less than 0.70 **OR** 0.75, **as directed**.
12. NRC: Not less than 0.65 **OR** 0.75 **OR** 0.95, **as directed**.
13. Suspension-System Main-Carrier Material: Aluminum **OR** Electrolytic zinc-coated steel **OR** Hot-dip galvanized steel **OR** Manufacturer's standard material and protective finish, **as directed**.

E. Stainless-Steel Pans And Suspension System For Linear Metal Ceiling

1. Stainless-Steel Pans and Suspension System:
2. Classification: Units complying with ASTM E 1264 for Type XIII, stainless-steel strips with mineral- or glass-fiber-base backing; Form 1, perforated **OR** Type XIII, stainless-steel strips with



mineral- or glass-fiber-base backing; Form 2, unperforated **OR** Type XX, other types described as perforated stainless-steel strips with sound-absorbent fabric backing, **as directed**.

3. Pan Thickness: Not less than 0.016 inch (0.396 mm) **OR** 0.019 inch (0.475 mm), **as directed**.
4. Pan Edge Detail: Manufacturer's standard edge detail, **as directed**.
5. Linear Module Width and Pan Face Width: 2-inch (51-mm) module width and 1-1/4-inch (32-mm) face width **OR** 4-inch (102-mm) module width and 3-1/4-inch (83-mm) face width **OR** 6-inch (152-mm) module width and 5-1/4-inch (133-mm) face width **OR** 8-inch (203-mm) module width and 7-1/4-inch (184-mm) face width **OR** As indicated on Drawings, **as directed**.
6. Pan Depth: 5/8 inch (16 mm) deep **OR** As indicated, **as directed**.
7. Pan Face Finish: Brushed, directional polish **OR** Satin, directional polish **OR** Mirrorlike reflective, nondirectional polish, **as directed**.
8. End Cap, Finish of Exposed Portions: Matte black **OR** To match pan **OR** Manufacturer's standard finish, **as directed**.
9. Filler Strip Design: Recessed **OR** Flush **OR** An integral extension of pan profile **OR** Expansion, for use with expansion carriers **OR** Slotted, for air diffusion, **as directed**.
10. Filler Strip, Finish of Exposed Portions: Matte black **OR** To match pan, **as directed**.
11. NRC: Not less than 0.65 **OR** 0.75 **OR** 0.95, **as directed**.
12. Suspension-System Main-Carrier Material: Aluminum **OR** Electrolytic zinc-coated steel **OR** Hot-dip galvanized steel **OR** Manufacturer's standard material and protective finish, **as directed**.

F. Accessories

1. Access Panels: For access at locations indicated, provide door hinge assembly, retainer clip, and retainer bar, assembled with ceiling panels and carrier sections into access doors of required size, permitting upward or downward opening.

G. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. 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.

H. Aluminum Finishes

1. Mill Finish: AA-M10C10.
2. Lacquered Mill Finish: AA-M10C10R1x with manufacturer's standard clear, organic coating.
3. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
4. Clear Mirror Anodic Finish: AA-M21C12A212, 0.005 mm or thicker.
5. Color-Coated Finish: Manufacturer's standard powder-coat baked paint finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
6. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
7. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

I. Galvanized-Steel Sheet Finishes



1. Color-Coated Finish: Manufacturer's standard powder-coat baked paint finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

J. Steel Sheet Finishes

1. Electroplated Finish: Electroplating process complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, and minimum thickness to produce a coating uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unplated areas, and other visible defects.
2. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

K. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1.3 EXECUTION

A. Installation

1. Comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic requirement indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
2. Suspend ceiling hangers from building's structural members and as follows:
 - a. 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.
 - b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - c. 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.
 - d. 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 to which hangers are attached and for type of hanger involved.
 - e. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - f. 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.
 - g. 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.
 - h. Do not attach hangers to steel deck tabs.
 - i. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - j. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.



- k. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers but without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
 4. Install edge moldings and trim of type indicated at perimeter of linear metal ceiling area and where necessary to conceal edges and ends of linear metal pans.
 - a. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - b. Do not use exposed fasteners, including pop rivets, on moldings and trim.
 5. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
 6. Cut linear metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
 7. Install linear metal pans in coordination with suspension system and exposed moldings and trim.
 - a. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
 - b. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
 - c. Install pans with butt joints using internal pan splices.
 - 1) Joint Configuration: Aligned **OR** Aligned, every other panel length **OR** Staggered a minimum of 12 inches (300 mm) **OR** Random **OR** As indicated, **as directed**.
 - d. Install directionally textured metal pans in directions indicated.
 - e. Where metal pan ends are visible, install end caps unless trim is indicated.
 - f. Install filler strips where indicated.
 - g. Install sound-absorbent fabric layers in perforated metal pans.
 - h. Install sound-absorbent pads at right angle to perforated metal pans so pads do not hang unsupported.
 8. Install hold-down clips where indicated.
- B. Cleaning
1. Clean exposed surfaces of linear metal ceilings, including trim and edge moldings after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, 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, including dented and bent units.

END OF SECTION 09 54 23 00a



SECTION 09 91 13 00 - EXTERIOR PAINTING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for exterior painting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - a. Concrete.
 - b. Clay masonry.
 - c. Concrete masonry units (CMU).
 - d. Steel.
 - e. Galvanized metal.
 - f. Aluminum (not anodized or otherwise coated).
 - g. Wood.
 - h. Plastic trim fabrications.
 - i. Exterior portland cement (stucco).
 - j. Exterior gypsum board.

C. Submittals

1. Product Data: For each type of product indicated. Provide data on all finishing products, including VOC content.
2. Samples: For each finish and for each color and texture required. Submit two painted samples, illustrating selected colors and textures for each color and system selected. Submit on tempered hardboard, 8 x 10 inch in size.
3. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 1.2, with the proposed product highlighted.

D. Quality Assurance

1. MPI Standards:
 - a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated. For renovation projects, comply with requirements of "MPI Maintenance Repainting Manual" for products and paint systems indicated.

E. Delivery, Storage, And Handling

1. 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 (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

F. Project Conditions

1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
2. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
3. Provide lighting level of 80 ft candles measured mid-height at substrate surface.



1.2 PRODUCTS

A. Paint, General

1. Conform to applicable code for flame and smoke rating requirements for products and finishes.
2. Conform to County of San Mateo Public Works Building Standards
 - a. Paint products shall not contain formaldehyde, aqueous ammonia, crystalline silica, or ethylene glycol. Total Volatile Organic Compounds (VOC) shall not exceed 2.9 pounds per gallon.
3. Material Compatibility:
 - a. 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.
 - b. 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.
4. Colors: As selected from manufacturer's full range.

B. Block Fillers

1. Interior/Exterior Latex Block Filler: MPI #4.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.

C. Primers/Sealers

1. Alkali-Resistant Primer: MPI #3.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Bonding Primer (Water Based): MPI #17.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Bonding Primer (Solvent Based): MPI #69.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint system indicated.

D. Metal Primers

1. Alkyd Anticorrosive Metal Primer: MPI #79.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
2. Quick-Drying Alkyd Metal Primer: MPI #76.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Cementitious Galvanized-Metal Primer: MPI #26.
 - a. VOC Content: E Range of E1.
4. Waterborne Galvanized-Metal Primer: MPI #134.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
5. Quick-Drying Primer for Aluminum: MPI #95.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

E. Wood Primers

1. Exterior Latex Wood Primer: MPI #6.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Exterior Alkyd Wood Primer: MPI #5.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
3. Exterior Oil Wood Primer: MPI #7.
 - a. VOC Content: E Range of E2.

F. Exterior Latex Paints

1. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).



- a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 3. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - G. Exterior Alkyd Paints
 1. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).
 - a. VOC Content: E Range of E1.
 2. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 3. Exterior Alkyd Enamel (Gloss): MPI #9 (Gloss Level 6).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 - H. Quick-Drying Enamels
 1. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 2. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - I. Textured And High-Build Coatings
 1. Latex Stucco and Masonry Textured Coating: MPI #42.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 2. High-Build Latex (Exterior): MPI #40.
 - a. VOC Content: E Range of E1 **OR** E3, **as directed**.
 - J. Aluminum Paint
 1. Aluminum Paint: MPI #1.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - K. Floor Coatings
 1. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 2. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 3. Interior/Exterior Latex Floor and Porch Paint (Low Gloss): MPI #60 (maximum Gloss Level 3).
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 3.
 4. Exterior/Interior Alkyd Floor Enamel (Gloss): MPI #27 (Gloss Level 6).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 - b. Additives: Manufacturer's standard additive to increase skid resistance of painted surface.
 - L. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
- 1.3 EXECUTION
- A. Examination
 1. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
 2. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Wood: 15 percent.
 - d. Plaster: 12 percent.
 - e. Gypsum Board: 12 percent.



3. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
4. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - a. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

B. Preparation And Application

1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
2. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - a. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
3. Apply paints 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.
4. 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.
5. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
6. Marks: Seal with shellac those which may bleed through surface finishes.
7. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

C. Exterior Painting Schedule

1. Paint systems herein are based on "MPI Architectural Painting Specification Manual" (hereafter, "MPI Manual"). For renovation projects, consult "MPI Maintenance Repainting Manual" and revise paint systems accordingly.
2. For a Premium Grade system, "MPI Manual" requires intermediate coat; if Custom Grade system is required or if so directed, delete intermediate coat, **unless directed otherwise** or as otherwise required by manufacturer's recommendations.
3. Concrete Substrates, Nontraffic Surfaces:
 - a. Latex System: MPI EXT 3.1A.
 - 1) Prime Coat: Exterior latex matching topcoat.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Aggregate/Latex System: MPI EXT 3.1 B.
 - 1) Prime Coat: Latex stucco and masonry textured coating.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Latex Over Alkali-Resistant Primer System: MPI EXT 3.1K.
 - 1) Prime Coat: Alkali-resistant primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. High-Build Latex System: MPI EXT 3.1L, applied to form dry film thickness of not less than 10 mils (0.25 mm).
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: High-build latex (exterior).
 - e. Latex Aggregate System: MPI EXT 3.1N.
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: Latex stucco and masonry textured coating.



4. Concrete Substrates, Traffic Surfaces:
 - a. Latex Floor Paint System: MPI EXT 3.2A.
 - 1) Prime Coat: Interior/exterior latex floor and porch paint (low gloss).
 - 2) Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
 - 3) Topcoat: Interior/exterior latex floor and porch paint (low gloss).
 - b. Alkyd Floor Enamel System: MPI EXT 3.2D.
 - 1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
 - 2) Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
 - 3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
 - c. Clear Sealer System: MPI EXT 3.2G.
 - 1) Prime Coat: Interior/exterior clear concrete floor sealer (solvent based).
 - 2) Intermediate Coat: Exterior/interior clear concrete floor sealer (solvent based).
 - 3) Topcoat: Interior/exterior clear concrete floor sealer (solvent based).
 - d. Water-Based Clear Sealer System: MPI EXT 3.2H.
 - 1) Prime Coat: Interior/exterior clear concrete floor sealer (water based).
 - 2) Intermediate Coat: Interior/exterior clear concrete floor sealer (water based).
 - 3) Topcoat: Interior/exterior clear concrete floor sealer (water based).
5. Clay-Masonry Substrates:
 - a. Latex System: MPI EXT 4.1A.
 - 1) Prime Coat: Exterior latex matching topcoat.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. High-Build Latex System: MPI EXT 4.1H, applied to form dry film thickness of not less than 10 mils (0.25 mm).
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: High-build latex (exterior).
 - c. Latex Aggregate System: MPI EXT 4.1B.
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: Latex stucco and masonry textured coating.
6. CMU Substrates:
 - a. Latex System: MPI EXT 4.2A.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkali-Resistant Primer System: MPI EXT 4.2L.
 - 1) Prime Coat: Alkali-resistant primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. High-Build Latex System: MPI EXT 4.2K, applied to form dry film thickness of not less than 10 mils (0.25 mm).
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: High-build latex (exterior).
 - d. Latex Aggregate System: MPI EXT 4.2B.
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: Latex stucco and masonry textured coating.
7. Steel Substrates:
 - a. Quick-Drying Enamel System: MPI EXT 5.1A.
 - 1) Prime Coat: Quick-drying alkyd metal primer.
 - 2) Intermediate Coat: Quick-drying enamel matching topcoat.
 - 3) Topcoat: Quick-drying enamel (semigloss) **OR** (high gloss), **as directed**.
 - b. Alkyd System: MPI EXT 5.1D.
 - 1) Prime Coat: Alkyd anticorrosive metal primer.



- 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
- 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
- c. Aluminum Paint System: MPI EXT 5.1K.
 - 1) Prime Coat: Alkyd anticorrosive metal primer.
 - 2) Intermediate Coat: Aluminum paint.
 - 3) Topcoat: Aluminum paint.
8. Galvanized-Metal Substrates: Galvanized-metal substrates should not be chromate passivated (commercially known as "bonderized") if primer is field applied. If galvanized metal is chromate passivated, consult manufacturers for appropriate surface preparation and primers.
 - a. Latex System: MPI EXT 5.3A.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Water-Based Primer System: MPI EXT 5.3H. "MPI Manual" recommends latex over water-based primer system for low-contact/traffic areas.
 - 1) Prime Coat: Waterborne galvanized-metal primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI EXT 5.3B.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
9. Aluminum Substrates:
 - a. Latex System: MPI EXT 5.4H.
 - 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd System: MPI EXT 5.4F.
 - 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
10. Glue-Laminated Beam and Column Substrates:
 - a. Latex System: MPI EXT 6.1L.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.1A.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI EXT 6.1B.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
11. Dressed Lumber Substrates: Including architectural woodwork **OR** doors, **as directed**.
 - a. Latex System: MPI EXT 6.3L.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**. Flat paint is not recommended for use on doors.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.3A.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**. Flat paint is not recommended for use on doors.



- c. Alkyd System: MPI EXT 6.3B.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**. Flat paint is not recommended for use on doors.
- 12. Wood Panel Substrates: Including plywood siding **OR** fascias **OR** soffits, **as directed**.
 - a. Latex System: MPI EXT 6.4K.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.4G.
 - 1) Prime Coat: Exterior alkyd wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI EXT 6.4B.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
- 13. Wood Shingle and Shake Substrates (Excluding Roofs):
 - a. Latex System: MPI EXT 6.6E.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.6A.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI EXT 6.6B.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
- 14. Dimension Lumber Substrates, Nontraffic Surfaces: Including board siding **OR** fencing **OR** undersides of decking, **as directed**.
 - a. Latex System: MPI EXT 6.2M.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.2A.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI EXT 6.2C.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
- 15. Dimension Lumber Substrates, Traffic Surfaces: Including lumber decking **OR** stairs, **as directed**.
 - a. Latex System: MPI EXT 6.5E.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Interior/exterior latex floor and porch (low gloss).
 - 3) Topcoat: Interior/exterior latex floor and porch (low gloss).
 - a) With additive to increase skid resistance of painted surface.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.5A.
 - 1) Prime Coat: Exterior alkyd wood primer.
 - 2) Intermediate Coat: Interior/exterior latex floor and porch (low gloss).
 - 3) Topcoat: Interior/exterior latex floor and porch (low gloss).



- a) With additive to increase skid resistance of painted surface.
 - c. Alkyd Floor Enamel System: MPI EXT 6.5B.
 - 1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
 - 2) Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
 - 3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
 - a) With additive to increase skid resistance of painted surface.
- 16. Plastic Trim Fabrication Substrates:
 - a. Latex System: MPI EXT 6.8A.
 - 1) Prime Coat: Bonding primer (water based) **OR** (solvent based), **as directed**.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd System: MPI EXT 6.8B.
 - 1) Prime Coat: Bonding primer (water based) **OR** (solvent based), **as directed**.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
- 17. Stucco Substrates:
 - a. Latex System: MPI EXT 9.1A.
 - 1) Prime Coat: Exterior latex matching topcoat.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkali-Resistant Primer System: MPI EXT 9.1J.
 - 1) Prime Coat: Alkali-resistant primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. High-Build Latex System: MPI EXT 9.1H, applied to form dry film thickness of not less than 10 mils (0.25 mm).
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: High-build latex (exterior).
- 18. Exterior Gypsum Board Substrates:
 - a. Latex System: MPI EXT 9.2A.
 - 1) Prime Coat: Exterior latex matching topcoat.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.

END OF SECTION 09 91 13 00

**SECTION 09 91 13 00a - WOOD STAINS AND TRANSPARENT FINISHES**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wood stains and transparent finishes. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and the application of wood finishes on the following substrates:
 - a. Exterior Substrates:
 - 1) Exposed glue-laminated beams and columns.
 - 2) Exposed dimension lumber (rough carpentry).
 - 3) Dressed lumber (finish carpentry).
 - 4) Exposed wood panel products.
 - 5) Wood decks and stairs.
 - 6) Wood shingles and shakes (excluding roofs).
 - b. Interior Substrates:
 - 1) Exposed glue-laminated beams and columns.
 - 2) Exposed dimension lumber (rough carpentry).
 - 3) Dressed lumber (finish carpentry).
 - 4) Exposed wood panel products.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For interior primers, stains, and transparent finishes, including printed statement of VOC content.
3. Samples: For each finish and for each color and texture required.
4. Product List: Printout of MPI's current "MPI Approved Products List" for each product category specified in Part 1.2, with the product proposed for use highlighted.

D. Quality Assurance

1. MPI Standards:
 - a. Products: Complying with MPI standards indicated and listed in its "MPI Approved Products List."
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and finish systems indicated.

E. Delivery, Storage, And Handling

1. 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 (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

F. Project Conditions

1. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
2. Do not apply exterior finishes in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.



1.2 PRODUCTS

A. Materials, General

1. Material Compatibility:
 - a. Provide materials for use within each finish 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.
 - b. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.
2. VOC Content of Field-Applied Interior Primers, Stains, and Transparent Finishes: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to primers, stains, and transparent finishes that are applied in a fabrication or finishing shop:
 - a. Flat Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Primers: VOC content of not more than 150 g/L.
 - c. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - d. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - e. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - f. Floor Coatings: VOC not more than 100 g/L.
 - g. Shellacs, Clear: VOC not more than 730 g/L.
 - h. Stains: VOC not more than 250 g/L.
3. Stain Colors: As selected from manufacturer's full range **OR** Match samples **OR** As indicated in a color schedule, **as directed**.

B. Wood Fillers

1. Wood Filler Paste: MPI #91.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

C. Primers And Sealers

1. Exterior Alkyd Wood Primer: MPI #5.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
2. Exterior Latex Wood Primer: MPI #6.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Exterior Oil Wood Primer: MPI #7.
 - a. VOC Content: E Range of E2.
4. Wood Preservative: MPI #37.
 - a. VOC Content: E Range of E1 **OR** E3, **as directed**.
5. Alkyd Sanding Sealer: MPI #102.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
6. Lacquer Sanding Sealer: MPI #84.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
7. Shellac: MPI #88.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.

D. Stains

1. Exterior Semitransparent Stain (Solvent Based): MPI #13.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
2. Exterior Solid-Color Stain (Solvent Based): MPI #14.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Exterior, Solid-Color Latex Stain: MPI #16.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Stain for Wood Decks: MPI #33.
 - a. VOC Content: E Range of E1 **OR** E3, **as directed**.
5. Interior Wood Stain (Semitransparent): MPI #90.



- a. VOC Content: E Range of E1 **OR** E2, **as directed**.

E. Varnishes

1. Exterior Marine Spar Varnish (Gloss): MPI #28, Gloss Level 7.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
2. Exterior Varnish (Gloss): MPI #29, Gloss Level 6.
 - a. VOC Content: E Range of E1.
3. Exterior Varnish (Semigloss): MPI #30, Gloss Level 5.
 - a. VOC Content: E Range of E1.
4. Interior Varnish (Flat): MPI #73, Gloss Level 1, alkyd type.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
5. Interior Varnish (Semigloss): MPI #74, Gloss Level 5, alkyd type.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
6. Interior Varnish (Gloss): MPI #75, Gloss Level 6, alkyd type.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

F. Polyurethane Finishes

1. Two-Component Aliphatic Polyurethane (Clear): MPI #78.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Interior, Oil-Modified, Clear Urethane (Satin): MPI #57, Gloss Level 4.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
3. Interior, Oil-Modified, Clear Urethane (Gloss): MPI #56, Gloss Level 6.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Moisture-Cured Clear Polyurethane (Flat): MPI #71, Gloss Level 1.
 - a. VOC Content: E Range of E2.
5. Moisture-Cured Clear Polyurethane (Gloss): MPI #31.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

G. Waterborne Acrylic Finishes

1. Waterborne Clear Acrylic (Satin): MPI #128, Gloss Level 4.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
2. Waterborne Clear Acrylic (Semigloss): MPI #129, Gloss Level 5.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
3. Waterborne Clear Acrylic (Gloss): MPI #130, Gloss Level 6.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.

H. Lacquers

1. Lacquer (Clear Flat): MPI #87, Gloss Level 1.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Lacquer (Clear Satin): MPI #85, Gloss Level 4.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Lacquer (Clear Gloss): MPI #86, Gloss Level 6.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

I. Oil Finish

1. Danish Oil: MPI #92.
 - a. VOC Content: E Range of E3.

1.3 EXECUTION

A. Preparation



1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
 2. Remove plates, machined surfaces, and similar items already in place that are not to be finished. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 - a. After completing finishing operations, reinstall items that were removed; use workers skilled in the trades involved. Remove surface-applied protection if any.
 3. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
 - a. Remove surface dirt, oil, or grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 - b. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
 - c. Countersink steel nails, if used, and fill with putty tinted to final color to eliminate rust leach stains.
 4. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
- B. Application
1. Apply finishes according to manufacturer's written instructions.
 - a. Use applicators and techniques suited for finish and substrate indicated.
 - b. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
 2. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.
- C. Field Quality Control
1. The following procedure may be requested at any time and as often as the Owner deems necessary during the period when finishes are being applied:
 - a. Engage the services of a qualified testing agency to sample finish materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with product requirements.
 - c. the Owner may direct Contractor to stop applying finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces if, on refinishing with complying materials, the two finishes are incompatible.
- D. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 2. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
 3. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by the Owner, and leave in an undamaged condition.
 4. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.
- E. Exterior Wood-Finish-System Schedule
1. Exposed Glue-Laminated Beam and Column Substrates:
 - a. Solid-Color, Solvent-Based Stain System: MPI EXT 6.1C.



- 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
- 2) Two Stain Coats: Exterior solid-color stain (solvent based).
- b. Varnish Over Semitransparent Stain System: MPI EXT 6.1D.
 - 1) Stain Coat: Exterior semitransparent stain (solvent based).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior marine spar varnish (gloss) **OR** varnish (gloss) **OR** varnish (semigloss), **as directed**.
- c. Varnish System: MPI EXT 6.1K.
 - 1) Four (for a Premium Grade system) **OR** Three, **as directed**, Finish Coats: Exterior marine spar varnish (gloss) **OR** varnish (gloss) **OR** varnish (semigloss), **as directed**.
- d. Clear, Two-Component Polyurethane Over Stain System: MPI EXT 6.1E.
 - 1) Stain Coat: Exterior semitransparent stain (solvent based).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Two-component aliphatic polyurethane (clear).
- e. Clear, Two-Component Polyurethane System: MPI EXT 6.1H.
 - 1) Three Finish Coats: Two-component aliphatic polyurethane (clear).
2. Exposed Rough Carpentry Substrates:
 - a. Solid-Color Latex Stain System: MPI EXT 6.2B.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
 - b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.2D.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - c. Two Stain Coats (for a Premium Grade system) One Stain Coat, **as directed**: Exterior solid-color stain (solvent based).
 - d. Semitransparent Stain System: MPI EXT 6.2L.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
 - e. Varnish Over Semitransparent Stain System: MPI EXT 6.2E.
 - 1) Stain Coat: Exterior semitransparent stain (solvent based).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior marine spar varnish (gloss) **OR** varnish (gloss) **OR** varnish (semigloss), **as directed**.
 - f. Varnish System: MPI EXT 6.2K.
 - 1) Four (for a Premium Grade system) **OR** Three, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
 - g. Clear, Two-Component Polyurethane System: MPI EXT 6.2H.
 - 1) Three Finish Coats: Two-component aliphatic polyurethane (clear).
3. Finish Carpentry Substrates:
 - a. Solid-Color Latex Stain System: MPI EXT 6.3K.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
 - b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.3C.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior solid-color stain (solvent based).
 - c. Semitransparent Stain System: MPI EXT 6.3D.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
 - d. Varnish Over Semitransparent Stain System: MPI EXT 6.3E.
 - 1) Stain Coat: Exterior semitransparent stain (solvent based).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
 - e. Varnish System: MPI EXT 6.3F.
 - 1) Four (for a Premium Grade system) **OR** Three, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
 - f. Clear, Two-Component Polyurethane System: MPI EXT 6.3G.
 - 1) Three Finish Coats: Two-component aliphatic polyurethane (clear).



- F. Exposed Wood Panel-Product Substrates:
- a. Solid-Color Latex Stain System: MPI EXT 6.4A.
 - 1) Prime Coat: Exterior alkyd **OR** latex **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
 - b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.4C.
 - 1) Prime Coat (for a Premium Grade system): Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats: Exterior solid-color stain (solvent based).
 - c. Semitransparent Stain System: MPI EXT 6.4D.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
 - d. Varnish Over Semitransparent Stain System: MPI EXT 6.4J.
 - 1) Stain Coat: Exterior semitransparent stain (solvent based).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
 - e. Varnish System: MPI EXT 6.4H.
 - 1) Four (for a Premium Grade system) **OR** Three, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
2. Wood Deck and Stair Substrates:
- a. MPI EXT 6.5D.
 - 1) Preservative Coat: Wood preservative.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Stain for wood decks.
 - b. MPI EXT 6.5F.
 - 1) Two Stain Coats: Stain for wood decks.
3. Wood Shingle and Shake Substrates (Excluding Roofs):
- a. Solid-Color Latex Stain System: MPI EXT 6.6D.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
 - b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.6C.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior solid-color stain (solvent based).
 - c. Semitransparent Stain System: MPI EXT 6.6F.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
- G. Interior Wood-Finish-System Schedule
1. Exposed Glue-Laminated Beam and Column Substrates:
 - a. Alkyd Varnish Over Stain System: MPI INT 6.1K.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Varnish Over Stain and Sealer System: MPI INT 6.1P.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Alkyd sanding sealer.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd Varnish Over Sealer System: MPI INT 6.1C.
 - 1) Seal Coat: Alkyd sanding sealer.
 - 2) Two Finish Coats: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Polyurethane Varnish Over Stain System: MPI INT 6.1J.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.



- e. Polyurethane Varnish System: MPI INT 6.1D.
 - 1) One Factory-Applied Finish Coat: Matching field-applied finish coats.
 - 2) Two Field-Applied Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
- f. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.1S.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
- g. Waterborne Clear Acrylic Over Stain System: MPI INT 6.1R.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- h. Waterborne Clear Acrylic System: MPI INT 6.F.
 - 1) Three Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- i. Solid-Color Latex Stain System: MPI INT 6.1T.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
- j. Solid-Color, Solvent-Based Stain System: MPI INT 6.1H.
 - 1) Two Stain Coats: Exterior solid-color stain (solvent based).
- k. Semitransparent Stain System: MPI INT 6.1G.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
- 2. Exposed Rough Carpentry Substrates:
 - a. Alkyd Varnish Over Stain and Sealer System: MPI INT 6.2K.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Alkyd sanding sealer.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Varnish Over Sealer System: MPI INT 6.2P.
 - 1) Seal Coat: Alkyd sanding sealer.
 - 2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Polyurethane Varnish Over Stain System: MPI INT 6.2J.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
 - d. Polyurethane Varnish System: MPI INT 6.2H.
 - 1) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
 - e. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.2N.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
 - f. Waterborne Clear Acrylic Over Stain System: MPI INT 6.2M.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- 3. Finish Carpentry Substrates:
 - a. Alkyd Varnish Over Stain and Sealer System: MPI INT 6.3D.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Varnish Over Sealer System: MPI INT 6.3J.
 - 1) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.



- 2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (semigloss) **OR** (gloss), **as directed**.
- c. Polyurethane Varnish Over Stain System: MPI INT 6.3E.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
- d. Polyurethane Varnish System: MPI INT 6.3K.
 - 1) One Factory-Applied Finish Coat: Matching field-applied finish coats.
 - 2) Two Field-Applied Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
- e. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.3Y.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
- f. Moisture-Cured Clear Polyurethane System: MPI INT 6.3X.
 - 1) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
- g. Clear, Two-Component Polyurethane System: MPI INT 6.3Z.
 - 1) Three (for a Premium Grade system) Two, **as directed**, Finish Coats: Two-component aliphatic polyurethane (clear).
- h. Waterborne Clear Acrylic Over Stain System: MPI INT 6.3W.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- i. Waterborne Clear Acrylic System: MPI INT 6.3Q.
 - 1) Three Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- j. Lacquer Over Stain and Sealer System: MPI INT 6.3F.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Lacquer sanding sealer.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).
- k. Lacquer Over Sealer System: MPI INT 6.3H.
 - 1) Seal Coat: Lacquer sanding sealer.
 - 2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).
- l. Semitransparent Stain System: MPI INT 6.3C.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
- m. Danish Oil System: MPI INT 6.3M.
 - 1) Two Finish Coats: Danish oil.
4. Exposed Wood Panel-Product Substrates:
 - a. Alkyd Varnish Over Sealer and Stain System: MPI INT 6.4D.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Varnish Over Sealer System: MPI INT 6.4G.
 - 1) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.
 - 2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Polyurethane Varnish Over Stain System: MPI INT 6.4E.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
 - d. Polyurethane Varnish System: MPI INT 6.4.J.



- 1) One Factory-Applied Finish Coat: Matching field-applied finish coats.
- 2) Two Field-Applied Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
- e. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.4V.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
- f. Waterborne Clear Acrylic Over Stain System: MPI INT 6.4U.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- g. Lacquer Over Stain and Sealer System: MPI INT 6.4F.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Lacquer sanding sealer.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).
- h. Lacquer Over Sealer System: MPI INT 6.4Y.
 - 1) Seal Coat: Lacquer sanding sealer.
 - 2) Three (for a Premium Grade system) Two, **as directed**, Finish Coats: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).
- i. Semitransparent Stain System: MPI INT 6.4C.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
- j. Danish Oil System: MPI INT 6.4K.
 - 1) Two Finish Coats: Danish oil.

END OF SECTION 09 91 13 00a



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SECTION 09 91 13 00b - HIGH-TEMPERATURE-RESISTANT COATINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for high-temperature-resistant coatings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and application of high-temperature-resistant coating systems on steel substrates subject to high temperatures.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each coating and for each color and texture required.
3. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For coatings, including printed statement of VOC content and chemical components.

D. Quality Assurance

1. Master Painters Institute (MPI) Standards:
 - a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List" **OR** "MPI Maintenance Repainting Manual," **as directed**.
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, for products and coating systems indicated.

E. Delivery, Storage, And Handling

1. 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 (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

F. Project Conditions

1. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 104 deg F (10 and 40 deg C).
2. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. High-Temperature-Resistant Coatings

1. VOC Content of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) :
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Anticorrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content of not more than 250 g/L.
 - d. Flat Interior Topcoat Paints: VOC content of not more than 50 g/L.
 - e. Nonflat Interior Topcoat Paints: VOC content of not more than 150 g/L.



- f. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - g. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - h. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
2. Chemical Components of Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
- a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.
 - 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
3. Colors: As selected from manufacturer's full range **OR** Match samples, **as directed**.
4. Primer: Undercoating recommended in writing for use in coating system by manufacturer of high-temperature-resistant coating under conditions indicated.
5. Heat-Resistant Enamel (Gloss): MPI #21.
- a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
6. Inorganic Zinc Primer: MPI #19.
- a. VOC Content: Minimum E Range of 0 **OR** E1 **OR** E2 **OR** E3, **as directed**.
7. Aluminum Heat-Resistant Enamel: MPI #2.
- a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
8. High-Heat-Resistant Coating: MPI #22.
- a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.

1.3 EXECUTION

A. Preparation



1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, applicable to substrates indicated.
 2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
 3. Clean steel substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
 - a. Remove incompatible primers as required to produce coating systems indicated.
- B. Application
1. Apply high-temperature-resistant coating systems according to manufacturer's written instructions.
 - a. Use applicators and techniques suited for coating and substrate indicated.
 - b. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - c. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- C. Field Quality Control
1. Contractor shall invoke the following procedure at any time and as often as necessary during the period when coatings are being applied:
 - a. Engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with specified requirements.
 - c. the Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.
- D. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
 3. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Owner, and leave in an undamaged condition.
 4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.
- E. High-Temperature-Resistant Coating Schedule
1. Heat-Resistant Enamel (Gloss) Coating System (System below corresponds with MPI EXT 5.2A and MPI INT 5.2A coating systems) {suitable for use on surfaces that reach a maximum temperature of 400 deg F (205 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.



- c. Finish Coat(s): Heat-resistant enamel (gloss), MPI #21, in number of coats recommended in writing by manufacturer for conditions indicated.
 2. Inorganic Zinc Primer Coating System (System below corresponds with MPI EXT 5.2C and MPI INT 5.2C coating systems) {suitable for use on surfaces that reach a maximum temperature of 750 deg F (400 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.
 - c. Finish Coat(s): Inorganic zinc primer, MPI #19, in number of coats recommended in writing by manufacturer for conditions indicated.
 3. Aluminum Heat-Resistant Enamel Coating System (System below corresponds with MPI EXT 5.2B and MPI INT 5.2B coating systems) {suitable for use on surfaces that reach a maximum temperature of 800 deg F (427 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.
 - c. Finish Coat(s): Aluminum heat-resistant enamel, MPI #2, in number of coats recommended in writing by manufacturer for conditions indicated.
 4. High-Heat-Resistant Coating System (System below corresponds with MPI EXT 5.2D and MPI INT 5.2D coating systems) {suitable for use on surfaces that reach a maximum temperature of 1100 deg F (593 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.
 - c. Finish Coat(s): High-heat-resistant coating, MPI #22, in number of coats recommended in writing by manufacturer for conditions indicated.

END OF SECTION 09 91 13 00b



Task	Specification	Specification Description
09 91 13 00	01 22 16 00	No Specification Required



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SECTION 09 91 23 00 - INTERIOR PAINTING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for interior painting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - a. Concrete.
 - b. Clay masonry.
 - c. Concrete masonry units (CMU).
 - d. Steel.
 - e. Galvanized metal.
 - f. Aluminum (not anodized or otherwise coated).
 - g. Wood.
 - h. Gypsum board.
 - i. Plaster.
 - j. Spray-textured ceilings.
 - k. Cotton or canvas insulation covering.

C. Submittals

1. Product Data: For each type of product indicated. Provide data on all finishing products, including VOC content.
2. Samples: For each finish and for each color and texture required. Submit two painted samples, illustrating selected colors and textures for each color and system selected. Submit on tempered hardboard, 8 x 10 inch in size.
3. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 1.2, with the proposed product highlighted.
4. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components.

D. Quality Assurance

1. MPI Standards:
 - a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

E. Delivery, Storage, And Handling

1. 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 (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

F. Project Conditions

1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).



2. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
3. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.2 PRODUCTS

A. Paint, General

1. Conform to applicable code for flame and smoke rating requirements for products and finishes.
2. Conform to County of San Mateo Public Works Building Standards
 - a. Paint products shall not contain formaldehyde, aqueous ammonia, crystalline silica, or ethylene glycol. Total Volatile Organic Compounds (VOC) shall not exceed 2.9 pounds per gallon.
3. Material Compatibility:
 - a. 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.
 - b. 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.
4. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - d. Floor Coatings: VOC not more than 100 g/L.
 - e. Shellacs, Clear: VOC not more than 730 g/L.
 - f. Shellacs, Pigmented: VOC not more than 550 g/L.
 - g. Flat Topcoat Paints: VOC content of not more than 50 g/L.
 - h. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 - i. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - j. Floor Coatings: VOC not more than 100 g/L.
 - k. Shellacs, Clear: VOC not more than 730 g/L.
 - l. Shellacs, Pigmented: VOC not more than 550 g/L.
 - m. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - n. Dry-Fog Coatings: VOC content of not more than 400 g/L.
 - o. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
5. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
6. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.



- 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.
 - 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
7. Colors: As selected from manufacturer's full range **OR** Match samples **OR** As indicated in a color schedule, **as directed**.
- B. Block Fillers
1. Interior/Exterior Latex Block Filler: MPI #4.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
- C. Primers/Sealers
1. Interior Latex Primer/Sealer: MPI #50.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 2. Interior Alkyd Primer/Sealer: MPI #45.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 3. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.
- D. Metal Primers
1. Alkyd Anticorrosive Metal Primer: MPI #79.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 2. Quick-Drying Alkyd Metal Primer: MPI #76.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 3. Rust-Inhibitive Primer (Water Based): MPI #107.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 4. Cementitious Galvanized-Metal Primer: MPI #26.
 - a. VOC Content: E Range of E1.
 5. Waterborne Galvanized-Metal Primer: MPI #134.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 6. Vinyl Wash Primer: MPI #80.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 7. Quick-Drying Primer for Aluminum: MPI #95.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- E. Wood Primers
1. Interior Latex-Based Wood Primer: MPI #39.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.



- b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.

F. Latex Paints

1. Interior Latex (Flat): MPI #53 (Gloss Level 1).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 0.5 **OR** EPR 1.5 **OR** EPR 2.5, **as directed**.
2. Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
3. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
4. Interior Latex (Satin): MPI #43 (Gloss Level 4).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1.5 **OR** EPR 2 **OR** EPR 2.5 **OR** EPR 3.5, **as directed**.
5. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 2 **OR** EPR 3 **OR** EPR 4, **as directed**.
6. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 2 **OR** EPR 3 **OR** EPR 4, **as directed**.
7. Institutional Low-Odor/VOC Latex (Flat): MPI #143 (Gloss Level 1).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 4 **OR** EPR 5.5, **as directed**.
8. Institutional Low-Odor/VOC Latex (Low Sheen): MPI #144 (Gloss Level 2).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 4.5.
9. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 4.5.
10. Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 3 **OR** EPR 5.5, **as directed**.
11. High-Performance Architectural Latex (Low Sheen): MPI #138 (Gloss Level 2).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 4 **OR** EPR 5 **OR** EPR 6, **as directed**.
12. High-Performance Architectural Latex (Eggshell): MPI #139 (Gloss Level 3).
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 5 **OR** EPR 6, **as directed**.
13. High-Performance Architectural Latex (Satin): MPI #140 (Gloss Level 4).
 - a. VOC Content: E Range of E1 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 4.5 **OR** EPR 6.5, **as directed**.
14. High-Performance Architectural Latex (Semigloss): MPI #141 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 5 **OR** EPR 6 **OR** EPR 7, **as directed**.
15. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
16. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
17. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

G. Alkyd Paints

1. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).



- a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 2. Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 3. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 4. Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
- H. Quick-Drying Enamels
1. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 2. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- I. Textured Coating
1. Latex Stucco and Masonry Textured Coating: MPI #42.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
- J. Dry Fog/Fall Coatings
1. Latex Dry Fog/Fall: MPI #118.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 2. Waterborne Dry Fall: MPI #133.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 3. Interior Alkyd Dry Fog/Fall: MPI #55.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- K. Aluminum Paint
1. Aluminum Paint: MPI #1.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- L. Floor Coatings
1. Interior Concrete Floor Stain: MPI #58.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 2.
 2. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 3. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 4. Interior/Exterior Latex Floor and Porch Paint (Low Gloss): MPI #60 (maximum Gloss Level 3).
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 3.
 5. Exterior/Interior Alkyd Floor Enamel (Gloss): MPI #27 (Gloss Level 6).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 - b. Additives: Manufacturer's standard additive to increase skid resistance of painted surface.
- M. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
- 1.3 EXECUTION
- A. Preparation



1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that 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.
 - a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - b. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
3. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - a. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
4. 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.
5. Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.
6. Concrete Masonry Substrates: Remove 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.
7. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
8. 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.
9. Aluminum Substrates: Remove surface oxidation.
10. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
11. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
12. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.
13. Wood Substrates:
 - a. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - b. Sand surfaces that will be exposed to view, and dust off.
 - c. Prime edges, ends, faces, undersides, and backsides of wood.
 - d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
14. Gypsum Board Substrates: Fill minor defects with filler compound. Spot prime defects after repair. Do not begin paint application until finishing compound is dry and sanded smooth.
15. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
16. Spray-Textured Ceiling Substrates: Do not begin paint application until surfaces are dry.
17. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.
18. Marks: Seal with shellac those which may bleed through surface finishes.
19. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

B. Application

1. Apply paints according to manufacturer's written instructions.
 - a. Use applicators and techniques suited for paint and substrate indicated.



- b. 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.
 - c. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 2. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
 3. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
 4. Apply paints 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.
 5. Painting Mechanical and Electrical Work:
 - a. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - b. Finish equipment, piping, conduit, and exposed duct work at all exterior areas in colors according to the color schedule.
 - c. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
 - d. Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
 - 1) Mechanical Work:
 - a) Uninsulated metal piping.
 - b) Uninsulated plastic piping.
 - c) Pipe hangers and supports.
 - d) Tanks that do not have factory-applied final finishes.
 - e) Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - f) Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - g) Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - 2) Electrical Work:
 - a) Switchgear.
 - b) Panelboards.
 - c) Electrical equipment that is indicated to have a factory-primed finish for field painting.
- C. Field Quality Control
1. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
 - a. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with product requirements.
 - c. Owner may direct Contractor to stop applying paints 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.
- D. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.



2. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. 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 the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

E. Interior Painting Schedule

1. Concrete Substrates, Nontraffic Surfaces:
 - a. Latex System: MPI INT 3.1E.
 - 1) Prime Coat: Interior latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Sealer System: MPI INT 3.1A.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Latex Over Latex Aggregate System: MPI INT 3.1B.
 - 1) Prime Coat: Latex stucco and masonry textured coating.
 - 2) Intermediate Coat (for MPI Premium Grade system): Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Alkyd System: MPI INT 3.1D.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - e. Institutional Low-Odor/VOC Latex System: MPI INT 3.1M.
 - 1) Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - f. High-Performance Architectural Latex System: MPI INT 3.1C.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
2. Concrete Substrates, Traffic Surfaces:
 - a. Latex Floor Enamel System: MPI INT 3.2A.
 - 1) Prime Coat: Interior/exterior latex floor and porch paint (low gloss).
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior/exterior latex floor and porch paint (low gloss).
 - 3) Topcoat: Interior/exterior latex floor and porch paint (low gloss).
 - b. Alkyd Floor Enamel System: MPI INT 3.2B.
 - 1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
 - 2) Intermediate Coat (for MPI Premium Grade system): Exterior/interior alkyd floor enamel (gloss).
 - 3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
 - c. Concrete Stain System: MPI INT 3.2E.
 - 1) First Coat (for MPI Premium Grade system): Interior concrete floor stain.



- 2) Topcoat: Interior concrete floor stain.
- d. Clear Sealer System: MPI INT 3.2F.
 - 1) First Coat: Interior/exterior clear concrete floor sealer (solvent based).
 - 2) Topcoat: Interior/exterior clear concrete floor sealer (solvent based).
- e. Water-Based Clear Sealer System: MPI INT 3.2G.
 - 1) First Coat: Interior/exterior clear concrete floor sealer (water based).
 - 2) Topcoat: Interior/exterior clear concrete floor sealer (water based).
3. Clay-Masonry Substrates:
 - a. Latex System: MPI INT 4.1A.
 - 1) Prime Coat: Interior latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd System: MPI INT 4.1D.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Latex Aggregate System: MPI INT 4.1B.
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: Latex stucco and masonry textured coating.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 4.1M.
 - 1) Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 4.1L.
 - 1) Prime Coat: High-performance architectural latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
4. CMU Substrates:
 - a. Latex System: MPI INT 4.2A.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd System: MPI INT 4.2C.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd Over Latex Sealer System: MPI INT 4.2N.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Sealer Coat: Interior latex primer/sealer.
 - 3) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 4) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 4.2E.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.



- 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- e. High-Performance Architectural Latex System: MPI INT 4.2D.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
5. Steel Substrates:
 - a. Quick-Drying Enamel System: MPI INT 5.1A.
 - 1) Prime Coat: Quick-drying alkyd metal primer.
 - 2) Intermediate Coat: Quick-drying enamel matching topcoat.
 - 3) Topcoat: Quick-drying enamel (semigloss) **OR** (high gloss), **as directed**.
 - b. Water-Based Dry-Fall System: MPI INT 5.1C.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Topcoat: Latex dry fog/fall **OR** Waterborne dry fall, **as directed**.
 - c. Alkyd Dry-Fall System: MPI INT 5.1D.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Topcoat: Interior alkyd dry fog/fall.
 - d. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - e. Alkyd System: MPI INT 5.1E.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - f. Aluminum Paint System: MPI INT 5.1M.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.
 - g. Institutional Low-Odor/VOC Latex System: MPI INT 5.1S.
 - 1) Prime Coat: Rust-inhibitive primer (water based).
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - h. High-Performance Architectural Latex System: MPI INT 5.1R.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
6. Galvanized-Metal Substrates:
 - a. Water-Based Dry-Fall System: MPI INT 5.3H.
 - 1) Prime Coat: Waterborne dry fall.
 - 2) Topcoat: Waterborne dry fall.
 - b. Alkyd Dry-Fall System: MPI INT 5.3F.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Topcoat: Interior alkyd dry fog/fall.
 - c. Latex System: MPI INT 5.3A.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.



- 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- d. Latex Over Waterborne Primer System: MPI INT 5.3J.
 - 1) Prime Coat: Waterborne galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- e. Alkyd System: MPI INT 5.3C.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat: Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
- f. Aluminum Paint System: MPI INT 5.3G.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.
- g. Institutional Low-Odor/VOC Latex System: MPI INT 5.3N.
 - 1) Prime Coat: Waterborne galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- h. High-Performance Architectural Latex System: MPI INT 5.3M.
 - 1) Prime Coat: Waterborne galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
7. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 - a. Latex System: MPI INT 5.4H.
 - 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Over Vinyl Wash Primer System: MPI INT 5.4A.
 - 1) Prime Coat: Vinyl wash primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd Over Quick-Drying Primer System: MPI INT 5.4J.
 - 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Aluminum Paint System: MPI INT 5.4D.
 - 1) Prime Coat: Vinyl wash primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.
 - e. Institutional Low-Odor/VOC Latex System: MPI INT 5.4G.
 - 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - f. High-Performance Architectural Latex System: MPI INT 5.4F.
 - 1) Prime Coat: Quick-drying primer for aluminum.



- 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
8. Glue-Laminated Beam and Column Substrates:
- a. Latex System: MPI INT 6.1M.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 6.1A.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI INT 6.1B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 6.1Q.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 6.1N.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
9. Dressed Lumber Substrates: Including architectural woodwork and doors.
- a. Latex System: MPI INT 6.3T.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 6.3U.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI INT 6.3B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 6.3V.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 6.3A.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.



- 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
10. Wood Panel Substrates: Including painted plywood, medium-density fiberboard, and hardboard.
 - a. Latex System: MPI INT 6.4R.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 6.4A.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI INT 6.4B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 6.4T.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat : Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 6.4S.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
11. Dimension Lumber Substrates, Nontraffic Surfaces: Including exposed joists and exposed beams.
 - a. Latex System: MPI INT 6.2D.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 6.2A.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat : Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI INT 6.2C.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 6.2L.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 6.2B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.



12. Wood Substrates, Traffic Surfaces:
- a. Latex Floor Paint System: MPI INT 6.5G.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
 - 3) Topcoat: Interior/exterior latex floor and porch paint (low gloss).
 - b. Alkyd Floor Enamel System: MPI INT 6.5A.
 - 1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
 - 2) Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
 - 3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
13. Gypsum Board Substrates:
- a. Latex System: MPI INT 9.2A.
 - 1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Over Latex Primer System: MPI INT 9.2C.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - d. High-Performance Architectural Latex System: MPI INT 9.2B.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
14. Plaster Substrates:
- a. Latex System: MPI INT 9.2A.
 - 1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 9.2K.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd Over Latex Primer System: MPI INT 9.2C.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.



- 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- e. High-Performance Architectural Latex System: MPI INT 9.2B.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
15. Spray-Textured Ceiling Substrates:
 - a. Latex (Flat) System: MPI INT 9.1A, spray applied.
 - 1) Prime Coat: Interior latex primer/sealer **OR** (flat), **as directed**.
 - 2) Topcoat: Interior latex (flat).
 - b. Latex System: MPI INT 9.1E, spray applied.
 - 1) Prime Coat: Interior latex matching topcoat.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
 - c. Latex Over Alkyd Primer System: MPI INT 9.1B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Alkyd (Flat) System: MPI INT 9.1C.
 - 1) Prime Coat: Interior alkyd (flat).
 - 2) Topcoat: Interior alkyd (flat).
 - e. Alkyd System: MPI INT 9.1D.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
16. Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.
 - a. Latex System: MPI INT 10.1A.
 - 1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Over Latex Primer System: MPI INT 10.1B.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Aluminum Paint System: MPI INT 10.1C.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 10.1D.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

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SECTION 09 91 23 00a - MULTICOLORED INTERIOR COATINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for multicolored interior coatings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and field application of multicolor interior coating systems applied on the following substrates:
 - a. Vertical concrete.
 - b. Cementitious composition board.
 - c. Clay masonry units.
 - d. Concrete masonry units (CMU).
 - e. Wood.
 - f. Fiberglass moldings and trim.
 - g. Plastic moldings and trim.
 - h. Plaster, Gypsum veneer plaster, and Gypsum board.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each finish-coat product and for each color and texture required.
3. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For coatings, including printed statement of VOC content and chemical components.

D. Quality Assurance

1. Fire-Test-Response Characteristics: Provide coatings with flame-spread and smoked-developed indexes of 25 or less and 450 or less, respectively, as determined by testing identical products per ASTM E 84 by testing and inspecting agency acceptable to authorities having jurisdiction.
2. Master Painters Institute (MPI) Standards: Comply with recommendations in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, applicable to products and coating systems indicated.
3. Mockups: Apply mockup of each coating system indicated to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - a. Architect will select one surface to represent surfaces and conditions for application of each coating system and type of substrate.
 - 1) Wall Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - 2) Other Items: Architect will designate items or areas required.
 - b. Apply mockup after permanent lighting and other environmental services have been activated.
 - c. Final approval of color and pattern selections will be based on mockup.
 - 1) If preliminary color and pattern selections are not approved, apply additional mockups of colors and patterns selected by Architect at no added cost to Owner.
 - d. Repair Mockup: After approval of color and pattern selections, apply representative repairs to 100 sq. in. (65 sq. cm) of mockup to establish quality standards for coating system repairs.
 - e. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.



- f. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Delivery, Storage, And Handling

1. 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 (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

1.2 PRODUCTS

A. Multicolor Coating Systems, General

1. Material Compatibility: Provide materials for use within each coating 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. VOC Content of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - d. Shellacs, Clear: VOC not more than 730 g/L.
 - e. Shellacs, Pigmented: VOC not more than 550 g/L.
 - f. Flat Topcoat Paints: VOC content of not more than 50 g/L.
 - g. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 - h. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - i. Shellacs, Clear: VOC not more than 730 g/L.
 - j. Shellacs, Pigmented: VOC not more than 550 g/L.
 - k. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
3. Chemical Components of Interior Paints and Coatings: Provide topcoat paints that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.



- 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
4. Colors and Patterns: Match samples **OR** As selected from manufacturer's full range **OR** As indicated in color schedule, **as directed**.
- B. Fillers And Primers
1. General: Undercoatings recommended in writing for use in coating systems by manufacturer of multicolor interior coating on substrates and under conditions indicated.
 2. Latex Block Filler: Waterborne, high-solids, emulsion-type, pigmented coating product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, with bridging and filling properties, and formulated for filling surfaces of CMU for subsequent applications of finish coatings.
 - a. VOC Content: Minimum E Range of E2 **OR** E3, **as directed**, according to requirements for MPI #4.
 3. Wood Filler Paste: Solvent-based, high-solids, clear paste product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, for use on open-grained or damaged woods and that fills hardwood pores with minimal surface residues and without showing cracking or shrinkage. When dry, sanding filler produces a smooth surface without clogging or gumming sandpaper.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**, according to requirements for MPI #91.
 4. Wood-Knot Sealer: White shellac or other sealer recommended in writing for this purpose by manufacturer of multicolor interior coating.
 5. Primer/Sealer for Multicolor Systems: Acrylic or acrylic/polyvinyl acetate (PVA) co-polymer emulsion-type, pigmented primer/sealer product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating.
 - a. VOC Content: Minimum E Range of E2 **OR** E3, **as directed**, according to requirements for MPI #125.
 6. Interior Alkyd Primer/Sealer: Solvent-based, pigmented primer/sealer.
 - a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**, according to requirements for MPI #45.
 7. Water-Based Bonding Primer: Water-based, emulsion-type, pigmented primer product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, and formulated to promote adhesion of subsequent coatings.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**, according to requirements for MPI #17.
 8. Solvent-Based Bonding Primer: Solvent-based, pigmented product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, and formulated to promote adhesion of subsequent coatings to substrate.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**, according to requirements for MPI #69.
- C. Multicolor Coatings
1. Multicolor Coatings: Complying with MPI #112 and listed in "MPI Approved Products List."
 - a. VOC Content: Minimum E Range of E1 **OR** E3, **as directed**.
 2. Clear Topcoat: Product of multicolor coating manufacturer complying with MPI #121 and listed in "MPI Approved Products List."
 - a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.



1.3 EXECUTION

A. Preparation

1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
3. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible primers, paints, and encapsulants.
4. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
5. Clay Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
6. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
7. Wood Substrates:
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of knot sealer before applying primer.
 - b. Sand surfaces that will be exposed to view and dust off.
 - c. Prime edges, ends, faces, undersides, and back sides of wood.
 - d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

B. Application

1. Apply coatings according to manufacturer's written instructions using applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Apply coating systems to produce uniformly textured, colored, and patterned finished-surface films without substrates, undercoats, marks, or stains showing through. Produce sharp, even glass lines and color breaks.

C. Cleaning And Protection

1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

D. Multicolor Interior Coating Schedule

1. Vertical Concrete Substrates: System below corresponds to MPI INT 3.1H
 - a. Prime Coat: Primer/sealer for multicolor systems.



- b. Multicolor Base Coat: Multicolor coating, MPI #112.
- c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
- d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
2. Cementitious Composition Board Substrates: System below corresponds to MPI INT 3.3F
 - a. Prime Coat: Primer/sealer for multicolor systems.
 - b. Multicolor Base Coat: Multicolor coating, MPI #112.
 - c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
3. Clay Masonry Units Substrates: System below corresponds to MPI INT 4.1H
 - a. Prime Coat: Primer/sealer for multicolor systems tinted to match multicolor basecoat.
 - b. Multicolor Base Coat: Multicolor coating, MPI #112.
 - c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
4. CMU Substrates: System below corresponds to MPI INT 4.2H
 - a. Block Filler: Latex block filler.
 - b. Prime Coat: Primer/sealer for multicolor systems.
 - c. Multicolor Base Coat: Multicolor coating, MPI #112.
 - d. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - e. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
5. Wood Substrates: System below corresponds to MPI INT 6.2E, MPI INT 6.3N, and MPI INT 6.4L
 - a. Fill Coat: Wood filler paste (Fill coat is optional component and is for use on open-grained woods where a smooth, glasslike finish is desired).
 - b. Prime Coat: Interior alkyd primer/sealer tinted to match multicolor base coat (for dressed lumber (finished carpentry)).
 - c. Multicolor Base Coat: Multicolor coating, MPI #112.
 - d. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - e. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
6. Fiberglass Molding and Trim Substrates: System below corresponds to MPI INT 6.7G
 - a. Prime Coat: Water-based **OR** Solvent-based, **as directed**, bonding primer.
 - b. Multicolor Base Coat: Multicolor coating, MPI #112.
 - c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
7. Plastic Molding and Trim Substrates: System below corresponds to MPI INT 6.8D
 - a. Prime Coat: Solvent-based bonding primer.
 - b. Multicolor Base Coat: Multicolor coating, MPI #112.
 - c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
8. Plaster **OR** Gypsum Veneer Plaster **OR** Gypsum Board, **as directed**, Substrates: System below corresponds to MPI INT 9.2G
 - a. Prime Coat: Primer/sealer for multicolor systems.
 - b. Multicolor Base Coat: Multicolor coating, MPI #112.
 - c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.

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Task	Specification	Specification Description
09 91 23 00	09 91 13 00	Exterior Painting
09 91 33 00	09 91 13 00a	Wood Stains and Transparent Finishes
09 91 33 00	09 91 13 00b	High-Temperature-Resistant Coatings



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SECTION 09 91 43 00 - CONCRETE REHABILITATION**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for concrete rehabilitation. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Removal of deteriorated concrete and reinforcement and subsequent replacement and patching.
 - b. Floor joint repair.
 - c. Epoxy crack injection.
 - d. Corrosion-inhibiting treatment.
 - e. Polymer overlays.
 - f. Polymer sealers.
 - g. Steel structural reinforcement.
 - h. Composite structural reinforcement.

C. Submittals

1. Product Data: For each type of product indicated. Include material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.
2. Formwork and Shoring Drawings: Prepared by or under the supervision of a qualified professional engineer detailing formwork and temporary shoring and supports. Include schedule and sequence for erection and removal relative to removal of deteriorated concrete and reinforcement and subsequent repair and reinforcement.
3. Samples: Cured Samples of overlay and patching materials.
4. Rehabilitation Program: For each phase of rehabilitation process, including protection of surrounding materials and Project site during operations. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work.
 - a. If alternative materials and methods to those indicated are proposed for any phase of rehabilitation work, submit substitution request and provide a written description of proposed materials and methods, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this Project.

D. Delivery, Storage, And Handling

1. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.
2. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.
3. Store cementitious materials off the ground, under cover, and in a dry location.
4. Store aggregates, covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

E. Project Conditions

1. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.



- a. Use only Class A epoxies when substrate temperatures are below or are expected to go below 40 deg F (5 deg C) within 8 hours.
 - b. Use only Class A or B epoxies when substrate temperatures are below or are expected to go below 60 deg F (16 deg C) within 8 hours.
 - c. Use only Class C epoxies when substrate temperatures are above and are expected to stay above 60 deg F (16 deg C) for 8 hours.
2. Cold-Weather Requirements for Cementitious Materials:
- a. Do not apply unless air temperature is above 40 deg F (5 deg C) and will remain so for at least 48 hours after completion of Work.
OR
Comply with the following procedures:
 - 1) When air temperature is below 40 deg F (5 deg C), heat patching material ingredients and existing concrete to produce temperatures between 40 and 90 deg F (5 and 32 deg C).
 - 2) When mean daily air temperature is between 25 and 40 deg F (minus 4 and plus 5 deg C), cover completed Work with weather-resistant insulating blankets for 48 hours after repair or provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after repair.
 - 3) When mean daily air temperature is below 25 deg F (minus 4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after repair.
3. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F (32 deg C) and above.
4. Environmental Limitations for High-Molecular-Weight Methacrylate Sealers: Do not apply when concrete surface temperature is below 55 deg F (13 deg C) or above 75 deg F (24 deg C) **OR** 90 deg F (32 deg C), **as directed**. Apply only to dry substrates **OR** substrates that have been dry for at least 72 hours.

1.2 PRODUCTS

A. Bonding Agents

1. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.
2. Epoxy Bonding Agent: ASTM C 881/C 881M, Type II **OR** V, **as directed**.
a. Thin Film Open Time: Not less than two **OR** six **OR** 24, **as directed**, hours.
3. Latex Bonding Agent: ASTM C 1059, Type I **OR** II **OR** II at exterior locations and where indicated, Type I at other locations, **as directed**.
4. Mortar Scrub-Coat: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 1 part fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 (1.18-mm) sieve.

B. Patching Mortar

1. Patching Mortar, General:
 - a. Overhead Patching Mortar: For overhead repairs, use patching mortar recommended by manufacturer for overhead use and as specified in this Article.
 - b. Coarse Aggregate for Adding to Patching Mortar: Washed aggregate complying with ASTM C 33, Size No. 8, Class 5S. Add only as permitted by patching mortar manufacturer.
2. Job-Mixed Patching Mortar: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 2-1/2 parts fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 (1.18-mm) sieve.



3. Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928.
4. Polymer-Modified, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains a non-redispersible latex additive as either a dry powder or a separate liquid that is added during mixing.
5. Polymer-Modified, Silica-Fume-Enhanced, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains silica fume complying with ASTM C 1240 and a non-redispersible latex additive as either a dry powder or a separate liquid that is added during mixing.

C. Concrete

1. Concrete Materials and Admixtures: Comply with Division 03 Section "Cast-in-place Concrete".
2. Steel and Fiber Reinforcement and Reinforcement Accessories: Comply with Division 03 Section "Cast-in-place Concrete".
3. Form-Facing Materials: Comply with Division 03 Section "Cast-in-place Concrete".
4. Shotcrete: Comply with Division 03 Section "Shotcrete".
5. Preplaced Aggregate: Washed aggregate complying with ASTM C 33, Class 5S, with 95 to 100 percent passing a 1-1/2-inch (37.5-mm) sieve, 40 to 80 percent passing a 1-inch (25-mm) sieve, 20 to 45 percent passing a 3/4-inch (19-mm) sieve, 0 to 10 percent passing a 1/2-inch (12.5-mm) sieve, and 0 to 2 percent passing a 3/8-inch (9.5-mm) sieve **OR** 100 percent passing a 1-1/2-inch (37.5-mm) sieve, 95 to 100 percent passing a 1-inch (25-mm) sieve, 40 to 80 percent passing a 3/4-inch (19-mm) sieve, 0 to 15 percent passing a 1/2-inch (12.5-mm) sieve, and 0 to 2 percent passing a 3/8-inch (9.5-mm) sieve, **as directed**.
6. Fine Aggregate for Grout Used with Preplaced Aggregate: Fine aggregate complying with ASTM C 33, but with 100 percent passing a No. 8 (2.36-mm) sieve, 95 to 100 percent passing a No. 16 (1.18-mm) sieve, 55 to 80 percent passing a No. 30 (0.6-mm) sieve, 30 to 55 percent passing a No. 50 (0.3-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, 0 to 10 percent passing a No. 200 (0.075-mm) sieve, and having a fineness modulus of 1.30 to 2.10.
7. Grout Fluidifier for Grout Used with Preplaced Aggregate: ASTM C 937.
8. Portland Cement for Grout Used with Preplaced Aggregate: ASTM C 150.
9. Pozzolans for Grout Used with Preplaced Aggregate: ASTM C 618.

D. Miscellaneous Materials

1. Epoxy Joint Filler: 2-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of at least 80 per ASTM D 2240.
2. Polyurea Joint Filler: 2-component, semirigid, 100 percent solids, polyurea resin with a Type A Shore durometer hardness of at least 80 per ASTM D 2240.
3. Epoxy Crack Injection Adhesive: ASTM C 881/C 881M, Type I **OR** IV, **as directed**, Grade 1, except for gel time **OR** solvent free, **as directed**.
4. Capping Adhesive: Product manufactured for use with crack injection adhesive by same manufacturer.
5. Corrosion-Inhibiting Treatment Materials: Water-based solution of alkaline corrosion-inhibiting chemicals that penetrates concrete by diffusion and forms a protective film on steel reinforcement.
6. Polymer Overlay: Epoxy adhesive complying with ASTM C 881/C 881M, Type III.
7. Aggregate for Use with Polymer Overlay: Oven-dried, washed silica sand complying with ACI 503.3.
8. Polymer Sealer: Low-viscosity epoxy or high-molecular-weight methacrylate penetrating sealer recommended by manufacturer for application to exterior concrete traffic surfaces.
9. Methylmethacrylate Sealer/Brighteners: Clear low-viscosity sealer recommended by manufacturer for sealing exterior exposed-aggregate concrete, and formulated to bring out color of aggregates and give concrete a wet look.
10. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - a. After fabricating, prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."



- b. For minimum protection to steel after preparation, apply one coat of lead- and chromate-free, modified-alkyd primer complying with MPI#76 and one coat of alkyd-gloss enamel complying with MPI#96.
 - c. After preparation, apply two-coat high-performance coating system consisting of organic zinc-rich primer, complying with SSPC-Paint 20 or SSPC-Paint 29 and topcoat of high-build, urethane or epoxy coating recommended by manufacturer for application over specified zinc-rich primer. Comply with coating manufacturer's written directions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
11. Bolts, Nuts, and Washers: Carbon steel; ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), for bolts; ASTM A 563 (ASTM A 563M), Grade A, for nuts; and ASTM F 436 (ASTM F 436M) for washers; hot-dip or mechanically zinc coated.
 12. Postinstalled Anchors: Chemical or expansion anchors, made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group A1 or A4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors, with capability to sustain, without failure, a load equal to four times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 13. Composite Structural Reinforcement: Manufacturer's system consisting of carbon **OR** glass, **as directed**,-fiber reinforcement in the form of preimpregnated sheets or tow sheet with field-applied saturant, and epoxy primers, fillers, adhesives, saturants, and topcoats, designed for use as external structural reinforcement for concrete.

E. Mixes

1. Mix products, in clean containers, according to manufacturer's written instructions.
 - a. Add clean silica sand and coarse aggregates to products only as recommended by manufacturer.
 - b. Do not add water, thinners, or additives unless recommended by manufacturer.
 - c. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
 - d. Do not mix more materials than can be used within recommended open time. Discard materials that have begun to set.
2. Mortar Scrub-Coat: Mix with enough water to provide consistency of thick cream.
3. Dry-Pack Mortar: Mix with just enough liquid to form damp cohesive mixture that can be squeezed by hand into a ball but is not plastic.
4. Concrete: Comply with Division 03 Section "Cast-in-place Concrete".
5. Shotcrete: Comply with Division 03 Section "Shotcrete".
6. Grout for Use with Preplaced Aggregate: Proportion according to ASTM C 938. Add grout fluidifier to mixing water followed by cementitious materials and then fine aggregate.

1.3 EXECUTION

A. Examination

1. Notify the Owner seven days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.
2. Locate areas of deteriorated or delaminated concrete using hammer or chain drag sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries. At columns and walls make boundaries level and plumb, unless otherwise indicated.
3. Locate at least three reinforcing bars using a pachometer, and drill test holes to determine depth of cover. Calibrate pachometer, using depth of cover measurements, and verify depth of cover in removal areas using pachometer.

**B. Preparation**

1. Protect people, motor vehicles, equipment, surrounding construction, Project site, plants, and surrounding buildings from injury resulting from concrete rehabilitation work.
 - a. Erect and maintain temporary protective covers over pedestrian walkways and at points of entrance and exit for people and vehicles, unless such areas are made inaccessible during the course of concrete rehabilitation work. Construct covers of tightly fitted, 3/4-inch (19-mm) exterior-grade plywood supported at 16 inches (405 mm) o.c. and covered with asphalt roll roofing.
 - b. Protect adjacent equipment and surfaces by covering them with heavy polyethylene film and waterproof masking tape or a liquid strippable masking agent. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
 - c. Neutralize and collect alkaline and acid wastes according to requirements of authorities having jurisdiction, and dispose of by legal means off the Owner's property.
 - d. Dispose of runoff from wet operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
 - e. Collect runoff from wet operations and dispose of by legal means off the Owner's property.
2. Shoring: Install temporary supports before beginning concrete removal.
3. Concrete Removal:
 - a. Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 inch (13 mm). Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.
 - b. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.
 - c. Remove additional concrete, if necessary, to provide a depth of removal of at least 1/2 inch (13 mm) over entire removal area.
 - d. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least a 3/4-inch (19-mm) clearance around bar.
 - e. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.
 - f. Provide fractured aggregate surfaces with a profile of at least 1/8 inch (3 mm) that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level, unless otherwise directed.
 - g. Thoroughly clean removal areas of loose concrete, dust, and debris.
4. Reinforcing Bar Preparation: Remove loose and flaking rust from reinforcing bars by high-pressure water cleaning **OR** abrasive blast cleaning **OR** needle scaling **OR** wire brushing, **as directed**, until only tightly bonded light rust remains.
 - a. Where section loss of reinforcing bar is more than 25 percent, or 20 percent in 2 or more adjacent bars, cut bars and remove and replace. Remove additional concrete as necessary to provide at least 3/4-inch (19-mm) clearance at existing and replacement bars. Splice replacement bars to existing bars according to ACI 318 (ACI 318M), by lapping, welding, or using mechanical couplings.
5. Preparation of Floor Joints for Repair: Saw-cut joints full width to edges and depth of spalls, but not less than 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**, deep. Clean out debris and loose concrete; vacuum or blow clear with compressed air.
6. Surface Preparation for Corrosion-Inhibiting Treatment: Clean concrete by low-pressure water cleaning **OR** detergent scrubbing **OR** sand blasting, **as directed**, to remove dirt, oils, films, and other materials detrimental to treatment application. Allow surface to dry before applying corrosion-inhibiting treatment.
7. Surface Preparation for Overlays: Remove delaminated material and deteriorated concrete surface material. Roughen surface of concrete by sand blasting **OR** shot blasting **OR** scarifying **OR** needle scaling **OR** high-pressure water jetting **OR** scabbling **OR** flame blasting **OR** milling, **as directed**, to produce a surface profile matching CSP 3 **OR** 4 **OR** 5 **OR** 6 **OR** 7 **OR** 8 **OR** 9, **as directed**, per ICRI 03732. Sweep and vacuum roughened surface to remove debris followed by low-pressure water cleaning.



8. Surface Preparation for Sealers: Clean concrete by shot blasting **OR** low-pressure water cleaning **OR** detergent scrubbing, **as directed**, to remove dirt, oils, films, and other materials detrimental to sealer application.
9. Surface Preparation for Sealers: Acid etch surface of concrete to produce a surface profile matching CSP 1 per ICRI 03732. Prepare surface for acid etching by detergent scrubbing to remove oils and films that may prevent acid penetration.
 - a. Remove excess acid solution, reaction products, and debris by squeegeeing or vacuuming.
 - b. Scrub surface with an alkaline detergent, rinse, and squeegee or vacuum.
 - c. Check acidity of surface with pH test paper and continue rinsing until pH is acceptable.
 - d. When pH is acceptable and surface is clean, vacuum dry.
10. Surface Preparation for Composite Structural Reinforcement: Remove delaminated material and deteriorated concrete surface material. Clean concrete where reinforcement and epoxy patching mortar is to be applied by low-pressure water cleaning **OR** detergent scrubbing, **as directed**, to remove dirt, oils, films, and other materials detrimental to epoxy application. Roughen surface of concrete by sand blasting.

C. Application

1. General: Comply with manufacturer's written instructions and recommendations for application of products, including surface preparation.
2. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to reinforcing bars and concrete by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or concrete.
3. Epoxy Bonding Agent: Apply to reinforcing bars and concrete by brush, roller, or spray according to manufacturer's written instructions, leaving no pinholes or other uncoated areas. Apply to reinforcing bars in at least two coats, allowing first coat to dry before applying second coat. Apply patching mortar or concrete while epoxy is still tacky. If epoxy dries, recoat before placing patching mortar or concrete.
4. Latex Bonding Agent, Type II: Mix with portland cement and scrub into concrete surface according to manufacturer's written instructions. Apply patching mortar or concrete while bonding agent is still wet. If bonding agent dries, recoat before placing patching mortar or concrete.
5. Latex Bonding Agent, Type I: Apply to concrete by brush roller or spray. Allow to dry before placing patching mortar or concrete.
6. Mortar Scrub-Coat: Dampen repair area and surrounding concrete 6 inches (150 mm) beyond repair area. Remove standing water and apply scrub-coat with a brush, scrubbing it into surface and thoroughly coating repair area. If scrub-coat dries, recoat before applying patching mortar or concrete.
7. Patching Mortar: Unless otherwise recommended by manufacturer, apply as follows:
 - a. Wet substrate thoroughly and then remove standing water. Scrub a slurry of neat patching mortar mixed with latex bonding agent into substrate, filling pores and voids.
 - b. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
 - c. For vertical patching, place material in lifts of not more than 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, nor less than 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**. Do not feather edge.
 - d. For overhead patching, place material in lifts of not more than 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, nor less than 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**. Do not feather edge.
 - e. After each lift is placed, consolidate material and screed surface.
 - f. Where multiple lifts are used, score surface of lifts to provide a rough surface for application of subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.



- g. Allow surfaces of lifts that are to remain exposed to become firm and then finish to a smooth **OR** rough, **as directed**, surface with a wood or sponge float **OR** broom or burlap drag, **as directed**.
- h. Wet-cure cementitious patching materials, including polymer-modified, cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.
- 8. Dry-Pack Mortar: Use for deep cavities and where indicated. Unless otherwise recommended by manufacturer, apply as follows:
 - a. Provide forms where necessary to confine patch to required shape.
 - b. Wet substrate and forms thoroughly and then remove standing water.
 - c. Place dry-pack mortar into cavity by hand, and compact into place with a hardwood drive stick and mallet or hammer. Do not place more material at a time than can be properly compacted. Continue placing and compacting until patch is approximately level with surrounding surface.
 - d. After cavity is filled and patch is compacted, trowel surface to match profile and finish of surrounding concrete. A thin coat of patching mortar may be troweled into the surface of patch to help obtain required finish.
 - e. Wet-cure patch for not less than seven days by water-fog spray or water-saturated absorptive cover.
- 9. Concrete: Place according to Division 03 Section "Cast-in-place Concrete" and as follows:
 - a. Apply epoxy-modified, cementitious bonding and anticorrosion agent **OR** epoxy bonding agent, **as directed**, to reinforcement and concrete substrate.
 - b. Apply latex bonding agent **OR** Type I, latex bonding agent **OR** mortar scrub-coat, **as directed**, to concrete substrate.
 - c. Use vibrators to consolidate concrete as it is placed.
 - d. At unformed surfaces, screed concrete to produce a surface that when finished with patching mortar will match required profile and surrounding concrete.
 - e. Where indicated place concrete by form and pump method.
 - 1) Design and construct forms to resist pumping pressure in addition to weight of wet concrete. Seal joints and seams in forms and junctions of forms with existing concrete.
 - 2) Pump concrete into place, releasing air from forms as concrete is introduced. When formed space is full, close air vents and pressurize to 14 psi (96 kPa).
 - f. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
 - g. Fill placement cavities with dry-pack mortar and repair voids with patching mortar. Finish to match surrounding concrete.
- 10. Shotcrete: Place according to Division 03 Section "Shotcrete" and as follows:
 - a. Apply epoxy-modified, cementitious bonding and anticorrosion agent **OR** epoxy bonding agent, **as directed**, to reinforcement and concrete substrate.
 - b. Apply latex bonding agent **OR** Type I, latex bonding agent **OR** mortar scrub-coat, **as directed**, to concrete substrate.
 - c. Screed and finish shotcrete to produce a surface matching required profile and surrounding concrete.
- 11. Grouted Preplaced Aggregate Concrete: Use for column and wall repairs **OR** where indicated, **as directed**. Place as follows:
 - a. Design and construct forms to resist pumping pressure in addition to weight of wet grout. Seal joints and seams in forms and junctions of forms with existing concrete.
 - b. Apply epoxy-modified, cementitious bonding and anticorrosion agent **OR** epoxy bonding agent, **as directed**, to reinforcement and concrete substrate.
 - c. Place aggregate in forms, consolidating aggregate as it is placed. Pack aggregate into upper areas of forms to achieve intimate contact with concrete surfaces.
 - d. Fill forms with water to thoroughly dampen aggregate and substrates. Drain water from forms before placing grout.



- e. Pump grout into place at bottom of preplaced aggregate, forcing grout upward. Release air from forms at top as grout is introduced. When formed space is full and grout flows from air vents, close vents and pressurize to 14 psi (96 kPa).
 - f. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
 - g. Repair voids with patching mortar and finish to match surrounding concrete.
12. Joint Filler: Install in nonmoving floor joints where indicated.
- a. Install filler to a depth of at least 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**. Use fine silica sand no more than 1/4 inch (6 mm) deep to close base of joint. Do not use sealant backer rods or compressible fillers below joint filler.
 - b. Install filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.
13. Epoxy Crack Injection: Comply with manufacturer's written instructions and the following:
- a. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond, and clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
 - b. Place injection ports as recommended by epoxy manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with capping adhesive.
 - c. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least 1/4 inch (6 mm) thick by 1 inch (25 mm) wider than crack.
 - d. Inject cracks wider than 0.003 inch (0.075 mm) to a depth of 8 inches (200 mm) or to a width of less than 0.003 inch (0.075 mm), whichever is less.
 - e. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.
 - f. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.
14. Corrosion-Inhibiting Treatment: Apply by brush, roller, or airless spray in two coats at manufacturer's recommended application rate. Remove film of excess treatment by high-pressure washing before patching treated concrete or applying a sealer or overlay.
15. Polymer Overlay: Apply according to ACI 503.3.
- a. Apply to traffic-bearing surfaces, including parking areas and walks.
16. Polymer Sealer: Apply by brush, roller, or airless spray at manufacturer's recommended application rate.
- a. Apply to traffic-bearing surfaces, including parking areas and walks.
17. Methylmethacrylate Sealer/Brighteners: Apply by brush, roller, or airless spray at manufacturer's recommended application rate.
- a. Apply to exterior concrete surfaces that are exposed to view, excluding traffic-bearing surfaces.
18. Composite Structural Reinforcement Using Preimpregnated Fiber Sheet: Unless otherwise recommended by manufacturer, apply as follows:
- a. Patch surface defects with epoxy mortar and allow to set before beginning reinforcement application.
 - b. Apply epoxy adhesive to a thickness of 1/16 inch (1.6 mm) to prepared concrete surfaces in areas where composite structural reinforcement will be applied.
 - c. Clean preimpregnated fiber sheet with acetone or other suitable solvent, and apply epoxy adhesive to a thickness of 1/16 inch (1.6 mm).
 - d. Apply adhesive-coated fiber sheet to adhesive-coated concrete within open time of epoxy adhesive, and roll with a hard rubber roller until fiber sheet is fully embedded in adhesive, air pockets are removed, and adhesive is forced out from beneath fiber sheet at edges.
 - e. Apply additional layers as indicated using same procedure.
19. Composite Structural Reinforcement Using Fiber Tow Sheet and Saturant: Unless otherwise recommended by manufacturer, apply as follows:
- a. Apply epoxy primer using brush or short nap roller to prepared concrete surfaces in areas where composite structural reinforcement will be applied.



- b. After primer has set, patch surface defects with epoxy filler and allow to set before beginning reinforcement application.
 - c. Apply epoxy saturant to fiber tow sheet or primed and patched surface with 3/8-inch- (10-mm-) nap roller. Apply fiber tow sheet to primed and patched surface while saturant is still wet, using pressure roller to remove air pockets. Remove paper backing from fiber tow sheet and apply additional epoxy as needed to fully saturate tow sheet.
 - d. Apply additional layers as indicated, fully saturating each with epoxy.
 - e. After saturant has cured, apply protective topcoat by brush, roller or spray.
- D. Field Quality Control
- 1. Testing Agency: Engage a qualified testing agency to sample materials and perform tests as follows:
 - a. Patching Mortar, Packaged Mixes: **<Insert number>** randomly selected samples tested according to ASTM C 928.
 - b. Patching Mortar, Field Mixed: **<Insert number>** randomly selected samples tested for compressive strength according to ASTM C 109/C 109M.
 - c. Concrete: As specified in Division 03 Section "Cast-in-place Concrete".
 - d. Shotcrete: As specified in Division 03 Section "Shotcrete".
 - e. Grouted Preplaced Aggregate: Tested for compressive strength of grout according to ASTM C 942.
 - 1) Testing Frequency: One sample for each 25 cu. yd. (19 cu. m) of grout or fraction thereof, but not less than one sample for each day's work.
 - f. Joint Filler: Core drilled samples to verify proper installation.
 - 1) Testing Frequency: One sample for each 100 feet (30 m) of joint filled.
 - 2) Where samples are taken, fill holes with joint filler.
 - g. Epoxy Crack Injection: Core drilled samples to verify proper installation.
 - 1) Testing Frequency: 3 samples from mockup and 1 sample for each 100 feet (30 m) of crack injected.
 - 2) Where samples are taken, fill holes with epoxy mortar.

END OF SECTION 09 91 43 00



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SECTION 09 93 23 53 - FLOOR TREATMENT REFINISHING WOOD FLOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for refinishing wood floors. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

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

C. Quality Assurance

1. Build mockup of typical flooring area as shown on Drawings including base and shoe moldings.
 - a. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area as shown on Drawings.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - c. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.2 PRODUCTS

- A. Cleaning Compound: A liquid chemical cleaner containing non-ionic and anionic type detergents, non-reactive to wood flooring. Compound shall have no free metal alkalies, no artificial coloring and no fatty acids. Compound shall be UL listed as "slip-resistant."
- B. Varnish Remover: Non-flammable paint and varnish remover.
- C. Stain: Penetrating type non-fading wood stain.
- D. Wood Filler: Paste type wood filler, pigmented if necessary to match sample, complying with Fed. Spec. TT-F-336.
- E. Floor Sealer: Penetrating type, pliable, wood-hardening finish/sealer.
- F. Floor Varnish: Alkyd resin varnish, specially compounded for floor finish, Fed. Spec. TT-V-109.
- G. Urethane Finish: Specially compounded for wood floor finish, moisture curing type, for multiple-coat application.
- H. Floor Wax: Liquid, solvent-type, slip-resistant, CID A-A-1550, Type II.

1.3 EXECUTION

A. Preparation:

1. Cleaning: Scrub thoroughly with cleaning compound and warm water. Rinse with clean water, mop dry, and buff with polishing machine.
2. Varnish Removal: Apply paint and varnish remover as required.



3. Sanding: Traverse floors two times with an electric-powered sanding machine. A rotary disc sander may be used for the final cut, but first cut shall be made with a drum-type machine. The first cut may be made crosswise of the grain or at a 45-degree angle. Make second cut in direction of grain. Use No. 1/2 sandpaper for first traverse and No. 0 for second traverse. Use an electric edger or hand sander for sanding areas near walls, in corners, and small closets.

B. Installation:

1. Apply Wood Paste Filler, followed by wiping cross-grain to work into pores and cracks.
2. Apply Stain if needed to match selected finish.
3. Apply Sealer (2 coats) complying with Fed. Spec. TT-S-176. Use Class I for white oak and red oak floors and Class II for beech, birch, and hard maple floors.
4. Apply Floor Varnish, (3 coats) buffing after each coat. First coat may be thinned as a sealer.
5. Apply Urethane Finish. Apply as many coats as needed to build a dry film thickness of 1.0 mil.
6. When Floors are Dry, apply two coats of wax complying with Fed. Spec. P-W-155; concentration 12 percent. Spread the wax at the rate of 1,500 square feet per gallon and polish the floors with a weighted floor brush or an electric polisher.
7. Protection: Upon completion of work, cover all traffic areas immediately with nonstaining kraft paper or polyethylene, taped along edges, and maintain floor protection until acceptance.

END OF SECTION 09 93 23 53



Task	Specification	Specification Description
09 93 23 53	09 91 13 00a	Wood Stains and Transparent Finishes



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SECTION 09 96 00 00 - HIGH-PERFORMANCE COATINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for high performance coatings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and application of high-performance coating systems on the following substrates:
 - a. Exterior Substrates:
 - 1) Concrete, vertical and horizontal surfaces.
 - 2) Clay masonry.
 - 3) Concrete masonry units (CMU).
 - 4) Steel.
 - 5) Galvanized metal.
 - 6) Aluminum (not anodized or otherwise coated).
 - 7) Wood.
 - b. Interior Substrates:
 - 1) Concrete, vertical and horizontal surfaces.
 - 2) Clay masonry.
 - 3) Concrete masonry units (CMU).
 - 4) Steel.
 - 5) Galvanized metal.
 - 6) Aluminum (not anodized or otherwise coated).
 - 7) Wood.
 - 8) Gypsum board.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each type of finish-coat product indicated.
3. Product List: For each product indicated. Cross-reference products to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.2: For coatings, including printed statement of VOC content and chemical components.

D. Quality Assurance

1. Master Painters Institute (MPI) Standards:
 - a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, for products and coating systems indicated.
2. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - a. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3.
 - 1) Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - 2) Other Items: Architect will designate items or areas required.



- b. Final approval of color selections will be based on mockups.
 - 1) If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
- c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- d. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Delivery, Storage, And Handling

- 1. 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 (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

F. Project Conditions

- 1. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- 2. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. High-Performance Coatings, General

- 1. Material Compatibility:
 - a. Provide materials for use within each coating 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.
 - b. Provide products of same manufacturer for each coat in a coating system.
- 2. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Anticorrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content of not more than 250 g/L.
 - d. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - e. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - f. Floor Coatings: VOC not more than 100 g/L.
 - g. Shellacs, Clear: VOC not more than 730 g/L.
 - h. Shellacs, Pigmented: VOC not more than 550 g/L.
 - i. Stains: VOC content of not more than 250 g/L.
 - j. Flat Interior Topcoat Paints: VOC content of not more than 50 g/L.
 - k. Nonflat Interior Topcoat Paints: VOC content of not more than 150 g/L.
 - l. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - m. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - n. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - o. Floor Coatings: VOC not more than 100 g/L.
 - p. Shellacs, Clear: VOC not more than 730 g/L.
 - q. Shellacs, Pigmented: VOC not more than 550 g/L.
 - r. Stains: VOC not more than 250 g/L.
 - s. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - t. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.



- u. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
 - 3. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.
 - 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
 - 4. Colors: As selected from manufacturer's full range **OR** Match samples **OR** As indicated in color schedule, **as directed**.
- B. Block Fillers
- 1. Interior/Exterior Latex Block Filler: MPI#4.
 - a. VOC Content: Minimum E Range of E2 **OR** E3, **as directed**.
 - 2. Epoxy Block Filler: MPI #116.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
- C. Interior Primers/Sealers
- 1. Interior Latex Primer/Sealer: MPI #50.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E2 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 2 **OR** 3, **as directed**.
 - 2. Interior Alkyd Primer/Sealer: MPI #45.
 - a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.
 - 3. Interior Latex-Based Wood Primer: MPI #39.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.



- b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR 2 OR 3, as directed.**
 - 4. Wood-Knot Sealer: White shellac or other sealer recommended in writing by manufacturer for this purpose.
- D. Metal Primers
 - 1. Inorganic Zinc Primer: MPI #19.
 - a. VOC Content: Minimum E Range of 0 **OR E1 OR E2 OR E3, as directed.**
 - 2. Epoxy Zinc Primer: MPI #20.
 - a. VOC Content: Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - 3. Rust-Inhibitive Primer (Water Based): MPI #107.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR 2 OR 3, as directed.**
 - 4. Cold-Curing Epoxy Primer: MPI #101.
 - a. VOC Content: Minimum E Range of E1 **OR E3, as directed.**
 - 5. Alkyd Anticorrosive Metal Primer: MPI #79.
 - a. VOC Content: Minimum E Range of E1 **OR E2, as directed.**
 - 6. Quick-Dry Alkyd Metal Primer: MPI #76.
 - a. VOC Content: Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - 7. Cementitious Galvanized-Metal Primer: MPI #26.
 - a. VOC Content: Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - 8. Waterborne Galvanized-Metal Primer: MPI #134.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR 2 OR 3, as directed.**
 - 9. Quick-Drying Primer for Aluminum: MPI #95.
 - a. VOC Content: Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - 10. Vinyl Wash Primer: MPI #80.
 - a. VOC Content: Minimum E Range of E2 **OR E3, as directed.**
- E. Water-Based, Light-Industrial Coatings
 - 1. Gloss, Water-Based, Light-Industrial Coating: MPI #110-G6.
 - a. Environmental Characteristics:
 - 1) VOC Content: Minimum E Range of E2.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 2.
 - 2. Semigloss, Water-Based, Light-Industrial Coating: MPI #110-G5.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E2 **OR E3, as directed.**
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 2 **OR 3, as directed.**
 - 3. Eggshell, Water-Based, Light-Industrial Coating: MPI #110-G3.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E2 **OR E3, as directed.**
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 2 **OR 3, as directed.**



F. Epoxy Coatings

1. Epoxy, Cold-Cured, Gloss: MPI #77.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Water-Based Epoxy (Interior and Exterior): MPI #115.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. High-Build Epoxy Marine Coating, Low Gloss: MPI #108.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Epoxy Deck Coating: MPI #82.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
5. Water-Based Epoxy Floor Paint: MPI #93.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR** 2 **OR** 3, **as directed**.

G. Polyurethane Coatings

1. Polyurethane, Two-Component, Pigmented, Gloss: MPI #72.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Two-Component, Aliphatic Polyurethane, Clear: MPI #78.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Polyurethane, Moisture Cured, Clear, Gloss: MPI #31.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Polyurethane, Moisture Cured, Clear, Flat: MPI #71.
 - a. VOC Content: Minimum E Range of E2.

H. Interior High-Performance Architectural Latex Coatings

1. High-Performance Architectural Latex, Velvet Finish: MPI #138, Gloss Level 2.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 4 **OR** 5 **OR** 6, **as directed**.
2. High-Performance Architectural Latex, Eggshell Finish: MPI #139, Gloss Level 3.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E2 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 5 **OR** 6, **as directed**.
3. High-Performance Architectural Latex, Satin Finish: MPI #140, Gloss Level 4.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 4.5 **OR** 6.5, **as directed**.
4. High-Performance Architectural Latex, Semigloss Finish: MPI #141, Gloss Level 5.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 5 **OR** 6 **OR** 7, **as directed**.

I. Wood Stains



1. Exterior Semitransparent Stain (Solvent Based): MPI #13.
 - a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.
2. Interior Wood Stain, Semitransparent (Solvent Based): MPI #90.
 - a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.

1.3 EXECUTION

A. Preparation

1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
3. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
 - a. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
4. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - a. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi (10 350 to 27 580 kPa) at 6 to 12 inches (150 to 300 mm) **OR** 4000 to 10,000 psi (27 580 to 68 950 kPa), **as directed**.
OR
Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
5. Clay Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - a. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi (690 to 4140 kPa) **OR** 1500 to 4000 psi (10 350 to 27 580 kPa), **as directed**, at 6 to 12 inches (150 to 300 mm).
6. CMU Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
7. Steel Substrates (for field applied primers): Remove rust and loose mill scale.
 - a. Clean using methods recommended in writing by coating manufacturer.

Blast clean according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning **OR** SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning," **as directed**.
8. 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 coatings.
9. Aluminum Substrates: Remove surface oxidation.
10. Wood Substrates:
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of knot sealer before applying primer.
 - b. Sand surfaces that will be exposed to view and dust off.
 - c. Prime edges, ends, faces, undersides, and back sides of wood.
 - d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

**B. Application**

1. Apply high-performance coatings according to manufacturer's written instructions.
 - a. Use applicators and techniques suited for coating and substrate indicated.
 - b. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - c. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
2. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
3. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
4. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

C. Field Quality Control

1. The following procedure may be requested at any time and as often as the Owner deems necessary during the period when coatings are being applied:
 - a. Engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with specified requirements.
 - c. the Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

D. Cleaning And Protection

1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

E. Exterior High-Performance Coating Schedule

1. Coating systems in this Article are based on "MPI Architectural Painting Specification Manual." For renovation projects, consult "MPI Maintenance Repainting Manual" and revise coating systems accordingly.
2. Concrete Substrates, Vertical Surfaces:
 - a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 3.1C):
 - 1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. Epoxy Coating System (System below corresponds to MPI EXT 3.1D):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.



- 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
- 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
- c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 3.1E):
 - 1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
3. Concrete Substrates, Horizontal Surfaces (System below corresponds to MPI EXT 3.2C):
 - a. Epoxy Slip-Resistant Deck Coating System:
 - 1) Topcoat: Epoxy deck coating, MPI #82.
4. Clay-Masonry Substrates (System below corresponds to MPI EXT 4.1C):
 - a. Water-Based, Light-Industrial Coating System:
 - 1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. Epoxy Coating System (System below corresponds to MPI EXT 4.1D) (MPI recommends this system for smooth brick.):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat : Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 4.1E) (MPI recommends this system for smooth brick.):
 - 1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
 - d. Polyurethane, Pigmented, Over Epoxy Coating System (System below corresponds to MPI EXT 4.1J):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
5. CMU Substrates:
 - a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 4.2C):
 - 1) Prime Coat: Interior/exterior latex block filler, MPI #4.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. Epoxy Coating System (System below corresponds to MPI EXT 4.2E):
 - 1) Block Filler: Epoxy block filler, MPI #116.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 4.2F):
 - 1) Block Filler: Epoxy block filler, MPI #116.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.



- d. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 4.2G):
 - 1) Block Filler: Epoxy block filler, MPI #116.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
- 6. Steel Substrates:
 - a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 5.1B, MPI EXT 5.1C, MPI EXT 5.1M and MPI EXT 5.1N, depending on primer selected):
 - 1) Prime Coat: Inorganic zinc primer, MPI #19 **OR** Alkyd anticorrosive metal primer, MPI #79 **OR** Rust-inhibitive primer, (water based), MPI #107 **OR** Cold-curing epoxy primer, MPI #101, **as directed**, primer.
 - 2) Intermediate Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat (intermediate coat is required for coating systems except MPI Custom Grade system using inorganic zinc primer).
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1F):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 5.1E):
 - 1) Prime Coat: Rust-inhibitive primer, (water based), MPI #107.
 - 2) Intermediate Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
 - d. Polyurethane, Pigmented, Over Epoxy Coating System (System below corresponds to MPI EXT 5.1H):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat (for Premium Grade system): Polyurethane, two-component, pigmented, gloss, MPI #72.
 - e. Polyurethane, Pigmented, Over Epoxy Coating System (System below corresponds to MPI EXT 5.1P)
 - 1) Prime Coat: Epoxy zinc primer, MPI#20.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - f. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1G):
 - 1) Prime Coat: Epoxy zinc primer, MPI#20.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat (for Premium Grade system): Polyurethane, two-component, pigmented, gloss, MPI #72.
 - g. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1J):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - h. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1L):
 - 1) Prime Coat: Inorganic zinc primer, MPI #19.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.



- 4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
7. Galvanized-Metal Substrates:
 - a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 5.3G and MPI EXT 5.3J, depending on primer selected):
 - 1) Prime Coat: Cementitious galvanized-metal primer, MPI #26 **OR** Waterborne galvanized-metal primer, MPI #134, **as directed**.
 - 2) Intermediate Coat (for Premium Grade system): Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. Epoxy Coating System (System below corresponds to MPI EXT 5.3C) (MPI recommends this system for high-contact and -traffic areas.):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat (for Premium Grade system): Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - c. Polyurethane, Pigmented Coating System (System below corresponds to MPI EXT 5.3D) (MPI recommends these systems for high-contact and -traffic areas.):
 - 1) Prime Coat: Vinyl wash primer, MPI #80.
 - 2) Intermediate Coat: Not required **OR** Cold-curing epoxy primer, MPI #101, **as directed**.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - d. Polyurethane, Pigmented Coating System (System below corresponds to MPI EXT 5.3L):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: Not required **OR** Polyurethane, two-component, pigmented, gloss, MPI #72, **as directed**.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
8. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 - a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 5.4G):
 - 1) Prime Coat: Quick-drying primer for aluminum, MPI #95.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. Epoxy Coating System (System below corresponds to MPI EXT 5.4E):
 - 1) Prime Coat: Vinyl wash primer, MPI #80.
 - 2) Intermediate Coat (for Premium Grade system): Epoxy, cold-cured, gloss, MPI #77.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - c. Polyurethane, Pigmented Coating System (System below corresponds to MPI EXT 5.4B) (MPI recommends these systems for high-contact and -traffic areas.):
 - 1) Prime Coat: Vinyl wash primer, MPI #80.
 - 2) Intermediate Coat: Cold-curing epoxy primer, MPI #101.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat (for Premium Grade system): Polyurethane, two-component, pigmented, gloss, MPI #72.
9. Wood Substrates:
 - a. Pigmented Polyurethane Coating System (System below corresponds to MPI EXT 6.1J, MPI EXT 6.2J, and MPI EXT 6.3H):
 - 1) Prime Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 2) Intermediate Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.



- b. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI EXT 6.1E for use on glue-laminated beams and columns):
 - 1) Stain Coat: Exterior semitransparent stain (solvent based), MPI #13.
 - 2) Intermediate Coat: Two-component, aliphatic polyurethane, clear, MPI #78.
 - 3) First Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.
 - 4) Second Topcoat (for Premium Grade systems): Two-component, aliphatic polyurethane, clear, MPI #78.
- F. Interior High-Performance Coating Schedule
1. Coating systems in this Article are based on "MPI Architectural Painting Specification Manual." For renovation projects, consult "MPI Maintenance Repainting Manual" and revise coating systems accordingly.
 2. Concrete Substrates, Vertical Surfaces (System below corresponds to MPI INT 3.1C):
 - a. High-Performance Architectural Latex Coating System:
 - 1) Prime Coat: Interior latex primer/sealer, MPI #50.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 3.1L):
 - 1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. Epoxy Coating System (System below corresponds to MPI INT 3.1F.) (MPI recommends this system for smooth concrete.):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 3.1G) (MPI recommends this system for smooth concrete.):
 - 1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
 3. Concrete Substrates, Horizontal Surfaces.
 - a. Epoxy Coating System (System below corresponds to MPI INT 3.2C):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - b. Water-Based Epoxy Floor Paint Coating System (System below corresponds to MPI INT 3.2L).
 - 1) Prime Coat: Water-based epoxy floor paint, MPI #93.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy floor paint, MPI #93, **as directed**.
 - 3) Topcoat: Water-based epoxy floor paint, MPI #93.
 - c. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 3.2D):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Not required **OR** Polyurethane, two-component, pigmented, gloss, MPI #72, **as directed**.



- 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
- d. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI INT 3.2K):
 - 1) Prime Coat: Two-component, aliphatic polyurethane, clear, MPI #78.
 - 2) Intermediate Coat: Not required **OR** Two-component, aliphatic polyurethane, clear, MPI #78, **as directed**.
 - 3) Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.
4. Clay-Masonry Substrates:
 - a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 4.1L):
 - 1) Prime Coat: High-performance architectural latex matching topcoat.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 4.1C):
 - 1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. Epoxy Coating System (System below corresponds to MPI INT 4.1F) (MPI recommends this system for smooth brick.):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 4.1G) (MPI recommends this system for smooth brick.):
 - 1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
 - e. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI INT 4.1K):
 - 1) Prime Coat: Two-component, aliphatic polyurethane, clear, MPI #78.
 - 2) Intermediate Coat: Not required **OR** Two-component, aliphatic polyurethane, clear, MPI #78, **as directed**.
 - 3) Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.
5. CMU Substrates:
 - a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 4.2D):
 - 1) Prime Coat: Interior/exterior latex block filler, MPI #4.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 4.2K):
 - 1) Prime Coat: Interior/exterior latex block filler, MPI #4.



- 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. Epoxy Coating System (System below corresponds to MPI INT 4.2F and MPI INT 4.2G, depending on primer selected) (MPI recommends these systems for dry environments.):
 - 1) Prime Coat: Interior/exterior latex block filler, MPI #4 **OR** Epoxy block filler, MPI #116, **as directed**.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 4.2J) (MPI recommends this system for wet environments.):
 - 1) Prime Coat: Interior/exterior latex block filler, MPI #4.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
6. Steel Substrates:
- a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 5.1R):
 - 1) Prime Coat: Alkyd anticorrosive metal primer, MPI #79 **OR** Quick-dry alkyd metal primer, MPI #76, **as directed**.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 5.1B and MPI INT 5.1N, depending on primer selected.):
 - 1) Prime Coat: Rust-inhibitive primer (water based), MPI #107 **OR** Cold-curing epoxy primer, MPI #101, **as directed**.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. High-Build Epoxy Coating System - Premium Grade (System below corresponds to MPI INT 5.1P):
 - 1) Prime Coat: Epoxy zinc primer, MPI#20.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - d. High-Build Epoxy Coating System – Custom Grade (System below corresponds to MPI INT 5.1P):
 - 1) Prime Coat: Epoxy zinc primer, MPI#20.
 - 2) Topcoat: High-build epoxy marine coating, low gloss, MPI #108.
 - e. Epoxy Coating System (System below corresponds to MPI INT 5.1L):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - f. Water-Based Epoxy Coating System (System below corresponds to MPI INT 5.1K):
 - 1) Prime Coat: Rust-inhibitive primer (water based), MPI #107.
 - 2) Intermediate Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
 - g. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.1F):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.



- 2) Intermediate Coat: Not required **OR** Polyurethane, two-component, pigmented, gloss, MPI #72, **as directed**.
- 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
- h. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.1H):
 - 1) Prime Coat: Inorganic zinc primer, MPI #19.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
- i. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.1J):
 - 1) Prime Coat: Epoxy zinc primer, MPI#20.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
- j. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI INT 5.1G):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
7. Galvanized-Metal Substrates:
 - a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 5.3M):
 - 1) Prime Coat: Waterborne galvanized-metal primer, MPI #134.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 5.3B and MPI INT 5.3K, depending on primer selected.):
 - 1) Prime Coat: Cementitious galvanized-metal primer, MPI #26 **OR** Waterborne galvanized-metal primer, MPI #134, **as directed**.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. Epoxy Coating System (System below corresponds to MPI INT 5.3D):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
8. Aluminum (Not Anodized or Otherwise Coated) Substrates (System below corresponds to MPI INT 5.4F):
 - a. High-Performance Architectural Latex Coating System:
 - 1) Prime Coat: Quick-drying primer for aluminum, MPI #95.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex, matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 5.4E):
 - 1) Prime Coat: Quick-drying primer for aluminum, MPI #95.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. Epoxy Coating System (System below corresponds to MPI INT 5.4B):



- 1) Prime Coat: Vinyl wash primer, MPI #80.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
- d. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.4C):
- 1) Prime Coat: Vinyl wash primer, MPI #80.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
9. Wood Substrates:
- a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 6.1N, MPI INT 6.3A, and MPI INT 6.4S):
- 1) Prime Coat: Interior latex-based wood primer, MPI #39.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
- b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 6.3P and MPI INT 6.4N):
- 1) Prime Coat: Interior alkyd primer/sealer, MPI #45.
 - 2) Intermediate Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
- c. Epoxy Coating System (System below corresponds to MPI INT 6.1L and MPI INT 6.3L):
- 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
- d. Pigmented Polyurethane Coating System (System below corresponds to MPI INT 6.1E):
- 1) Prime Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 2) Intermediate Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
- e. Polyurethane, Clear, Moisture-Cured Coating System (System below corresponds to MPI INT 6.1S, MPI INT 6.2N, MPI INT 6.3Y, and MPI INT 6.4V):
- 1) Stain Coat: Interior wood stain, semitransparent (solvent based), MPI #90.
 - 2) Intermediate Coat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
 - 3) First Topcoat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
 - 4) Second Topcoat: Not required **OR** Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
- f. Polyurethane, Clear, Moisture-Cured Coating System (System below corresponds to MPI INT 6.3X):
- 1) Intermediate Coat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
 - 2) First Topcoat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
 - 3) Second Topcoat: Not required **OR** Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
- g. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI INT 6.3Z):
- 1) Stain Coat: Exterior semitransparent stain (solvent based), MPI #13.
 - 2) Intermediate Coat: Not required **OR** Two-component, aliphatic polyurethane, clear, MPI #78, **as directed**.
 - 3) Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.
10. Gypsum Board Substrates:



- a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 9.2B):
 - 1) Prime Coat: Interior latex primer/sealer, MPI #50.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
- b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 9.2L):
 - 1) Prime Coat: Interior latex primer/sealer, MPI #50.
 - 2) Intermediate Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
- c. Epoxy Coating System (System below corresponds to MPI INT 9.2E):
 - 1) Prime Coat: Interior latex primer/sealer, MPI #50.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
- d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 9.2F):
 - 1) Prime Coat: Interior latex primer/sealer, MPI #50.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.

END OF SECTION 09 96 00 00



Task	Specification	Specification Description
09 96 53 00	09 91 13 00	Exterior Painting



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SECTION 09 96 56 00 - FIBERGLASS REINFORCED EPOXY COATING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fiberglass reinforced epoxy coating. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each coating system specified.

C. Material Storage

1. Store materials in a temperature controlled environment (50°F - 90°F) and out of direct sunlight.
2. Keep resins, hardeners, and solvents separated from each other and away from sources of ignition. One year shelf life is expected for products stored between 50°F - 90°F.

1.2 PRODUCTS

A. Materials

1. Multi-Layer, High Build Wall and Ceiling Surfacing System
 - a. Primer
 - 1) Water-based epoxy base coating.
 - b. Base Coat
 - 1) High performance epoxy coating.
 - c. Fiberglass Mesh Reinforcement
 - 1) Bound fiberglass cloth, 5.6 oz.
 - d. Saturant
 - 1) High performance epoxy coating.
 - e. Level Coat
 - 1) High performance epoxy coating.
 - f. Chemical Resistant Finish Coat
 - 1) 100% solids polyurethane.

1.3 EXECUTION

A. Primer

1. Mixing and Application: Water Based Epoxy Wall Coating should only be used on unpainted, porous surfaces. If the surface is painted with latex or an epoxy coating, clean and abrade the surface then apply the primer.
2. Premix resin and hardener separately, using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to whip air into the materials.
3. Add 2 parts resin to 1 part hardener, mix with low speed drill and Jiffy mixer for three minutes and until uniform. Apply material using a 1/4" short nap roller at a spread rate of 300-350 sq. ft. per gallon to yield 5 mils WFT.
4. Allow to cure for a minimum of 3 hours depending upon air movement. Lightly "pole sand" smooth rough edges of the flake before applying base coat.

B. Base Coat

1. Mixing and Application



- a. Premix resin and hardener separately, using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to introduce air into the material.
 - b. Add 3 parts resin to 1 part hardener by volume. Mix with low speed drill and Jiffy mixer for three minutes and until uniform. To insure proper system cure and performance, strictly follow mix ratio recommendations.
 - c. Base coat may be applied via spray, roller or brush. Apply using a 1/4" nap roller at a spread rate of 200-250 sq. ft. per gallon to yield 6-8 mils WFT evenly with no runs. Coverage will vary depending upon porosity of the substrate and surface texture.
- C. Fiberglass Reinforcement
1. Apply 5.6 oz. bound fiberglass cloth for walls and 4 oz. for ceilings directly into wet resin. Do not allow material to cure or recoating will be necessary.
 2. Hang fiberglass cloth directly to the wall similar to hanging wallpaper so seams are uniform and even. Overlap each strip using a double cut method. Remove the trimmed material behind the front strip.
 3. After hand affixing to wall, use a broad knife to remove air pockets, wrinkles or any irregularities.
- D. Saturant Coat
1. Mixing and Application
 - a. Premix resin and hardener separately, using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to introduce air into the material.
 - b. Add 3 parts 3548PA (resin) to 1 part 3548B (hardener) by volume. Mix with low speed drill and Jiffy mixer for three minutes and until uniform. To insure proper system cure and performance, strictly follow mix ratio recommendations.
 - c. Saturant coat may be applied via spray, roller or brush. Apply at a spread rate of 250-400 sq. ft. per gallon to yield 4-6 mils WFT evenly with no runs. Allow to cure overnight (minimum 10 hours) before lightly sanding seams, bumps and other imperfections with 60-80 grit sandpaper caused by the saturant coat.
- E. Level Coat
1. Mixing and Application
 - a. Apply leveling coat as described in previous step.
 - b. Allow to cure overnight.
 - c. An additional level coat may be applied.
 - d. Sand any imperfections prior to applying finish coat.
- F. Finish Coat
1. Mixing and Application
 - a. Premix resin using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to introduce air into the material.
 - b. Add 1 part resin to 1 part hardener by volume. Mix with low speed drill and Jiffy mixer for three minutes and until uniform. To insure proper system cure and performance, strictly follow mix ratio recommendations.
 - c. Finish coat may be applied via spray, roller or brush. Apply using a 1/4" nap non-shedding, urethane enamel roller at a spread rate of 250-400 sq. ft. per gallon to yield 4-6 WFT mils evenly with no runs. If second coat is required, the surface must be abraded with 80-120 grit paper or screen and tack wiped prior to second application.
 - d. Allow to cure 48 hours for water exposure and 7 days for chemical exposure. In cool and/or high humidity conditions, a surface film may form which can be washed with soap and water.

END OF SECTION 09 96 56 00



Task	Specification	Specification Description
09 96 56 00	09 96 00 00	High-Performance Coatings



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SECTION 09 96 66 00 - CEMENTITIOUS COATINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cementitious coatings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes surface preparation and application of cementitious coating systems on the following substrates:
 - a. Exterior and Interior concrete.
 - b. Exterior and Interior concrete masonry units.
 - c. Exterior and Interior brick.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content and chemical components.
3. Samples: In each color and gloss of finish coat indicated.
 - a. Submit Samples on rigid backing **OR** actual substrate, **as directed**, not less than 4 by 8 inches (100 by 200 mm), with mortar joint in center, **as directed**.
 - b. Step coats on Samples to show each coat required for system.
 - c. Label each coat of each Sample.
4. Material Certificates: For each cementitious coating, from manufacturer.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency or by a qualified testing agency, for each product formulation.

D. Quality Assurance

1. Source Limitations: Obtain cementitious coating materials from single source from single manufacturer.
2. Mockups: Apply benchmark samples of coating 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.
 - a. Architect will select one actual substrate of each type to represent surfaces and conditions for application of coating.
 - 1) Wall Surfaces: Prepare samples of at least 100 sq. ft. (9.3 sq. m).
 - b. Apply benchmark samples after permanent lighting and other environmental services have been activated.
 - c. Final approval of color selections will be based on benchmark samples.
 - 1) If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

E. Delivery, Storage, And Handling

1. Deliver materials to Project site in manufacturer's original, new, unopened packages and containers bearing manufacturer's name and label, and the following information:
 - a. Product name or title of material.
 - b. Manufacturer's stock number and date of manufacture.
 - c. Contents by volume, for pigment and vehicle constituents.
 - d. Application instructions.



- e. Color name and number.
- f. Handling instructions and precautions.
2. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.
 - a. Protect cementitious coating materials from freezing. Keep materials dry and storage area neat and orderly. Remove waste daily. Take necessary measures to ensure that workers and work areas are protected from health hazards resulting from handling, mixing, and applying the coating.

F. Project Conditions

1. Apply coatings only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
2. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. Cementitious Coatings

1. Polymer-Modified Cementitious Coating: Containing portland cement, polymer, and hydrated lime or aggregates.
2. Performance Requirements: Comply with the following:
 - a. Compressive Strength: Not less than 3500 psi (24.1 MPa) at 28 days according to ASTM C 109/C 109M.
 - b. Tensile Strength: Not less than 350 psi (2.41 MPa) at 28 days according to ASTM C 109/C 109M.
 - c. Flexural Strength: as directed by the Owner.
 - d. Adhesion: as directed by the Owner.
 - e. Permeance: as directed by the Owner.
 - f. Accelerated Weathering: as directed by the Owner.
 - g. UV Resistance: as directed by the Owner.
 - h. Salt-Spray Resistance: as directed by the Owner.
3. Other Materials: Provide crack fillers, block fillers, and related materials that are compatible with cementitious finish-coat materials and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
4. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:
 - a. Flat Paints and Coatings: VOC content of not more than 50 g/L.
 - b. Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
5. Chemical Components of Interior Paints and Coatings: Provide topcoat paints that comply with the following chemical restrictions:
 - a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.



- 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.
 - 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
6. Colors: As selected from manufacturer's full range **OR** As indicated in a color schedule, **as directed**.

1.3 EXECUTION

A. Examination

1. Examine substrates and conditions, with Applicator present, for compliance with requirements and other conditions affecting performance of the Work.
2. Verify suitability of substrates, including surface conditions and compatibility.
3. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - a. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

B. Preparation

1. Comply with manufacturer's written instructions for mixing and preparing materials and as applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - a. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
3. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, incompatible coatings, and loose substrate materials.
4. Cementitious and Masonry Surfaces: 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.
5. Crack Repair: Fill cracks according to manufacturer's written instructions before coating surfaces.
 - a. Cracks Larger Than 1/32 Inch (0.8 mm): Cut out static cracks, voids, or honeycombing larger than 1/32 inch (0.8 mm) and patch with materials recommended in writing by coating manufacturer. Identify dynamic cracks and treat according to manufacturer's written instructions before beginning application.

C. Application

1. Apply coatings according to manufacturer's written instructions. Use applicators and techniques suited for coating and substrate indicated.



- a. Dampen substrate of surfaces to receive cementitious coatings one hour before beginning application to prevent surface drag. Immediately before applying coatings, redampen substrate. Substrates shall be saturated surface dry at time of application.
 - b. Brushes: Use tampico or masonry brushes best suited for material being applied.
 - c. Spray Equipment: Use spray equipment recommended in writing by manufacturer for material and texture required.
2. Apply each material at not less than manufacturer's recommended spreading rate. Provide total cured material thickness indicated or as recommended in writing by manufacturer.
 3. Brush Application: Brush-out and work brush coats into surfaces in an even film, filling all pores and voids at rate recommended in writing by manufacturer to achieve cured material thickness indicated. Finish coat with smooth, horizontal strokes.
 4. Spray Application: Apply each coat according to manufacturer's written instructions to provide the equivalent hiding of brush-applied coats. Follow spray application with a general light brooming of coated surface to impart a slight texture.
- D. Field Quality Control
1. Testing of Coating Materials: Contractor shall invoke the following procedure at any time and as often as necessary during the period when coating operations are being conducted:
 - a. Engage the services of a qualified testing agency to sample coating materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with the following product requirements.
 - 1) Quantitative material analysis.
 - 2) Compressive strength.
 - 3) Tensile strength.
 - 4) Flexural strength.
 - 5) Permeance.
 - 6) Accelerated weathering.
 - c. the Owner may direct Contractor to stop coating application if test results show materials being used do not comply with requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.
- E. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
 3. Protect work of other trades against damage from coating application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by the Owner, and leave in an undamaged condition.
 4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.
- F. Coating Schedule
1. General: Apply additional coats when undercoats or other conditions show through final coat until cured film is of uniform coating finish, color, and appearance.
 2. Above-Grade Concrete and Masonry: Two finish coats with total cured thickness not less than 40 mils (1.0 mm).
 - a. First Coat: Apply polymer-modified cementitious coating material at the rate of 2 lb/sq. yd. (1 kg/sq. m) to achieve a total cured thickness of 25 mils (0.6 mm).
 - b. Second Coat: Apply polymer-modified cementitious coating material at the rate of 1 lb/sq. yd. (0.5 kg/sq. m) to achieve a total cured thickness of 15 mils (0.4 mm).



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3. Surfaces Previously Coated with Polymer-Modified Cementitious Coating: One finish coat with a total cured thickness of not less than 15 mils (0.4 mm).
 - a. Apply polymer-modified cementitious coating material at the rate of 1 lb/sq. yd. (0.5 kg/sq. m) to achieve a total cured thickness of 15 mils (0.4 mm).

END OF SECTION 09 96 66 00



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Task	Specification	Specification Description
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09 97 13 24	09 96 00 00	High-Performance Coatings
09 97 26 13	09 96 00 00	High-Performance Coatings
09 97 35 00	09 91 23 00	Interior Painting
09 97 63 00	09 96 00 00	High-Performance Coatings



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01 52 13 00	01 52 13 00, 01 22 16 00
01 52 19 00	01 22 16 00, 01 52 13 00
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09 22 36 13	09 22 13 00, 09 22 13 00a, 09 22 13 00b
09 22 36 23	09 22 36 23, 09 22 13 00, 09 22 13 00a, 09 22 13 00b
09 22 36 33	09 22 13 00, 09 22 13 00a, 09 22 13 00b, 09 22 36 23
09 29 00 00	09 29 00 00, 09 29 00 00a, 09 29 00 00b, 01 22 16 00
09 51 13 00	09 51 13 00
09 51 23 00	09 51 23 00
09 53 23 00	09 51 13 00
09 54 23 00	09 54 23 00, 09 54 23 00a
09 91 13 00	09 91 13 00, 09 91 13 00a, 09 91 13 00b, 01 22 16 00
09 91 23 00	09 91 23 00, 09 91 23 00a, 09 91 13 00
09 91 33 00	09 91 13 00a, 09 91 13 00b
09 91 43 00	09 91 43 00
09 93 23 53	09 93 23 53, 09 91 13 00a
09 96 00 00	09 96 00 00
09 96 53 00	09 91 13 00
09 96 56 00	09 96 56 00, 09 96 00 00
09 96 66 00	09 96 66 00
09 97 13 23	09 96 00 00

Task Specification(s)

09 97 13 24	09 96 00 00
09 97 26 13	09 96 00 00
09 97 35 00	09 91 23 00
09 97 63 00	09 96 00 00

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