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Project Specifications

For

Meiners Oaks Elementary School
Public Library Conversion

400 S. Lomita Ave. Ojai, CA 93023

Prepared for

Ojai Unified School District
414 E Ojai Ave. Ojai, CA 93023

January 05, 2022

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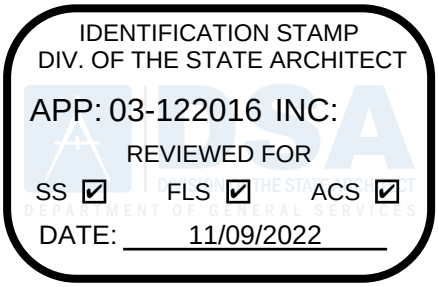

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SECTION 02 41 00 DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Furnishing all labor, materials, and equipment necessary for demolition, dismantling, cutting, and alterations as indicated, specified, and required for completion of the Contract, as applicable. Includes items such as the following:
      a. Protecting existing work to remain.
      b. Hazardous material identification and removal.
      c. Utility service and termination.
      d. Removing debris and equipment.
      e. Removal of items indicated on Drawings.
      f. Landscape and sprinkler demolition and reinstall.
      g. Disposal of material.

B. Related Sections:
   1. Section 01 50 00: Temporary Facilities and Controls.
   2. Section 01 57 13: Erosion control
   3. Section 31 00 00: Earthwork.
   4. Section 33 00 00: Utilities.

C. Regulatory Requirements:
   1. Conform to applicable jurisdictional authority regulations and codes for disposal of debris.
   2. Coordinate clearing work with utility companies.
   3. Maintain emergency access ways at all times.
   4. Contractor shall comply with all applicable laws and ordinances regarding hazardous materials, including contaminated soils, hazardous material transformers, and similar materials or components.

1.3 SUBMITTALS:

A. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shutoff, capping, and continuance of utility services.

B. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.

1.4 EXISTING CONDITIONS

A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

B. Conduct demolition to minimize interference with adjacent structures or items to remain.

Maintain protected egress and access at all times.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during Work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

B. Conduct demolition to minimize interference with adjacent structures or items to remain. Maintain protected egress and access at all times.

3.2 PROTECTION

A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.

B. In accordance with generally accepted construction practices, Contractor shall be solely and completely responsible for working conditions at the jobsite, including safety of all persons and property during performance of the Work. This requirement shall apply continuously and shall not be limited to normal working hours.

C. Safety precautions prevent damage to existing elements identified to remain or to be salvaged and prevent injury to the public and workmen engaged onsite. Demolish roofs, walls, and other building elements in such a manner that demolished materials fall within foundation lines of building. Do not allow demolition debris to accumulate onsite. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends:
   1. Protect existing items that are not indicated to be altered. Protect utilities designated to remain from damage.
   2. Protect trees, plant growth, and features designated to remain as final landscaping as shown on Drawings.
   3. Protect bench marks from damage or displacement.

D. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.

E. Fire Safety: Contractor shall conform to Chapter 33 of the California Fire Code (CFC), "Fire Safety During Construction and Demolition," at all times during the construction process. A copy of this chapter can be provided.

F. Any construction review of Contractor's performance conducted by the geotechnical Engineer is not intended to include review of the adequacy of Contractor's safety measures in, on, or near the construction site.

G. Surface Drainage: Provide for surface drainage during period of construction in a manner to avoid creating nuisance to adjacent areas. Contractor shall make a reasonable effort on a

daily basis to keep all excavations and the site free from water during entire progress of Work, regardless of cause, source, or nature of water.

H. Adjacent streets and sidewalks shall be kept free of mud, dirt, or similar nuisances resulting from earthwork operations.

I. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

3.3 EXAMINATION

A. Examine conditions of work in place before beginning Work; report defects.

B. Report existence of hazardous materials or unsafe structural conditions.

3.4 PREPARATION

A. Scheduling:
1. General: Coordinate and schedule demolition work as required by Owner and as necessary to facilitate construction progress.

B. Hazardous Materials:
1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact Owner. Do not proceed with demolition until directed by Owner.

C. Utility and Service Termination:
1. Locate and identify existing utility, service, and irrigation system components affected by Work of this Contract. Review existing record Drawings, conduct site investigations, contact Underground Service Alert and other qualified cable/pipe/line locator services, and implement all other means necessary to define the location of underground systems.
2. Prior to beginning any demolition, properly disconnect all water, gas, and electrical power supply at appropriate disconnect locations. Obtain all necessary releases and approvals from serving utility companies.
3. Prior to demolition or disconnect, obtain Owner's approval that such system does not impact facilities or systems beyond the extent of this Contract.
4. Mark location of disconnected systems. Identify and indicate stub-out locations on Project record documents.

D. Verify that existing plant life and features designated to remain are tagged or identified.
1. Architect will mark the features, trees, and shrubs to remain within the construction area. Contractor shall not commence clearing and grubbing operations until authorized by Owner and all protective measures are in place.

E. Coordinate the time and duration of all system disconnects with Owner.

3.5 DEMOLITION

A. General Requirements:
1. Clear areas required for access to site and execution of Work, including pavement,

structures, foundations, vegetation, trash, and debris.
2. Coordinate with Owner the time of day and route to remove demolished materials from premises.
3. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.
4. Remove all buried debris, rubble, trash, or other material not deemed suitable by the geotechnical Engineer.
5. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with specified fill material.

B. Fixture and Equipment Removal:
1. Remove existing fixtures and equipment as identified and shown on Drawings and required by Architect.
2. Verify all service connections to fixtures and equipment designated for removal have been properly disconnected.
3. Remove all conductors from conduit at all abandoned circuits.

3.6 UTILITY AND BUILDING SERVICES REMOVAL AND RE-INSTALLATION

A. Where crossing paths and potential points of interference with existing utility services are shown or can be reasonably inferred from surface conditions or evidence of subsurface systems, such as meter boxes, vaults, relief vents, cleanouts, and similar components:
1. Review all Contract Documents showing crossing paths and potential points of interference.
2. Pot-hole or determine by other means the accurate depth and location of such utilities.
3. Incorporate all costs required to complete work under this Contract, including additional trenching, re-routing of existing and new utilities, and all means necessary to construct work under this Contract.
4. No additional cost to Owner will be allowed for work necessary to accommodate utility conflicts where such crossing paths are shown on Contract Drawings or can be reasonably inferred from surface conditions or components.

B. Remove all conductors from conduit at all abandoned electrical circuits.

C. Seal off ends of all piping, drains, and other components as directed by Architect and serving utility.

D. Where necessary to maintain service to existing utility and building systems, relocate or redirect all conduit and conductors, piping, drains, and associated system components:
1. Re-circuit all electrical as required.
2. Re-circuit all landscape irrigation valving and control systems as required.
3. Temporarily terminate landscape system components in approved boxes or with approved caps, suitable for re-connection or extension.
4. Extend or otherwise modify all site drainage systems, including catch basins, drain inlets, and piping. Fine grade to maintain proper drainage flow pattern to drains.

E. Demolish structure in an orderly and careful manner:
1. Use of explosives prohibited.

3.7 SITE PAVEMENT REMOVAL

A. Remove sidewalk and curb where required for new construction as specified and as indicated on the Drawings:
1. Remove all paving by saw-cutting.
2. Remove concrete paving and curbing at locations shown on Drawings. Locate closest

adjacent expansion or weakened plane joint to define start of removal or saw-cutting.

B. Remove asphalt concrete paving areas where required for new construction as specified and as indicated on the Drawings:
   1. Remove all paving by saw-cutting.
   2. Remove paving assembly as required to expose subgrade.

3.8 LANDSCAPE AND IRRIGATION SYSTEMS DEMOLITION AND RENOVATION

A. Clearing, Grubbing, and Planting Demolition:
   1. Remove grass and grass roots to a minimum depth of two inches (2") below existing grade.
   2. Remove all shrubs, plants, and other vegetation within the area of the work unless designated to remain. Grub and remove all roots of all vegetation to a depth of 24 inches below existing grade.
   3. Remove only those trees that are specifically designated for removal, or as shown on the Drawings, within the construction area. Remove all stumps. Remove root ball and root systems larger than one inch (1") in diameter to a depth of two feet (2') below existing or finished grades, whichever is lower, and a minimum of five feet (5') beyond the edge of paving, structure, wall, or walkway.
   4. Hand cut existing tree roots over one inch (1") in diameter as necessary for trenching or other new construction. Apply multiple coats of emulsified asphalt sealant especially made for horticultural use on cut or damaged plant tissues to cut faces and adjacent surfaces. Cover exposed roots with wet burlap to prevent roots from dying out until backfilling is complete.
   5. Disking and mixing of vegetation, trash, debris, and other deleterious materials with surface soils prior to grading is not permitted.
   6. Remove all buried debris, organic material, rubble, trash, or other material not deemed suitable by the geotechnical Engineer.
   7. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with fill material in compliance with Section 31 00 00: Earthwork.
   8. Selected equipment of such sizes and capacities that the existing environment is disturbed as little as possible, and to afford ease of mobility within limited and relatively confined work areas. Make every effort to preserve the topography in its natural state.
   9. Keep drains, catch basins, surface drainage courses, and related drainage system components clear of debris and construction materials.
   10. Remove irrigation piping and appurtenances as necessary within area of work, unless noted otherwise to remain. Replace irrigation piping and appurtenances to irrigate new and/or existing landscaping. Contractor shall be responsible for temporary landscape irrigation until such time that irrigation system is restored and operational.

3.9 DISPOSAL

A. Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.

B. Dispose of all demolished material, trash, debris, and other materials not used in the work in accordance with the regulations of jurisdictional authority.

C. It is required that all materials that are of a recyclable nature, be transported to a suitable legal recycling facility instead of a dump or refuse facility (unless they are one-in-the same).

D. Burning and Burying of Materials: **Not allowed**.

E. Haul Routes:

1. Obtain permits as required by jurisdictional agencies. Establish haul routes in advance; post flagmen for the safety of the public and workmen.
2. Keep streets free of mud, rubbish, etc. Assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.

F. Remove demolished materials and debris from site on a daily basis.

3.10 CLEANING

A. Upon completion of work of this Section, promptly remove from the working area all scraps and debris.

B. Clean excess material from the surface of all remaining paved surfaces and utility structures.

C. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION 02 41 00

SECTION 02 41 19 SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Demolition and removal of selected portions of building or structure.
   2. Accessories necessary for demolition and deconstruction.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose off-site unless indicated as salvaged or reinstallation.

B. Existing to Remain: Leave existing items that are not scheduled for salvage or reuse, as is; do not remove.

C. Deconstruct: To remove by disassembling or detaching an item from a surface, using methods and equipment to successfully prevent damage to the item and surfaces, and dispose of items unless indicated as salvaged or for reinstallation.

1.4 SUBMITTALS

A. Qualification Data: Submit copies of qualifications for refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building.

C. Proposed Protection Measures: Submit report, including Drawings, indicating proposed measures for protecting individuals and property, for environmental protection, dust control, and noise control. Indicate proposed locations, types, and construction of barriers.

D. Schedule of Selective Demolition Activities:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's onsite operations are uninterrupted.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

E. Inventory: Submit a list of items for removal and salvage and deliver to Owner prior to start of demolition.

F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Demolition standards: Comply with ASSE A10.6 and NFPA 241.
   2. Comply with EPA regulations prior to commencement of the work. Comply with hauling and disposal regulations of authorities having jurisdiction.
   3. Comply with applicable federal, state, and local codes for demolition work, dust and noise control, safety of structure, and debris removal.
   4. Obtain required permits from authorities having jurisdiction.

B. Refrigerant Recovery Technician Qualifications: Certified by an EPA approved certification program.

C. Pre-Demolition Conference:
   1. Conduct conference at the site:
      a. Inspect and discuss condition of construction to be selectively demolished.
      b. Review structural load limitations of existing structure.
      c. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
      d. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
      e. Review areas where existing construction is to remain and requires protection.

D. Arrange selective demolition schedule to avoid interference with Owner's and the school's operations.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor prior to proceeding. Existing warranties to be provided by Owner prior to the start of construction.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying existing system has been inspected and warranty remains in effect. Submit supporting documentation at closeout.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

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

PART 2 PRODUCTS

2.1 MATERIALS

A. Repair Materials:
   1. Use repair materials identical to existing materials:
      a. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
      b. Use materials whose installed performance equals or surpasses that of existing

materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide minimum of 72 hours' notice to Owner of demolition activities that will affect Owner's operations including but not limited to:
   1. Interruption of power.
   2. Interruption of utility services.
   3. Excessive noise.

B. Condition of Structure:
   1. Conditions existing at time of inspection will be maintained by Owner as far as practical. Owner assumes no responsibility for actual condition of items or structures to be demolished:
      a. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
      b. Before commencing selective demolition, Owner will remove the following items:
         1) <Insert items to be removed by Owner>.

C. Hazardous Materials:
   1. It is not anticipated that hazardous materials will be encountered in the Work:
      a. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract but before start of the Work.

D. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by at least 12 inches (300 mm).

E. Storage or sale of removed items or materials onsite is not permitted.

F. Traffic:
   1. Conduct operations and debris removal to ensure minimum interference with roads, streets, drives, fire lanes, walks, accessible paths, and adjacent occupied or used facilities:
      a. Do not close, block, or obstruct streets, drives, walks, or occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around obstructed traffic ways.

G. Explosives: Explosives are **not permitted** at the site.

H. Flame Cutting: Do not use cutting torches for removal until flammable materials are removed. At concealed spaces, verify conditions prior to flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.

I. Environmental Controls: Use water sprinkling, temporary enclosures, or other acceptable methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable

conditions.

J. Utility Services:
1. Maintain existing utilities and protect against damage during demolition operations:
a. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, acceptable to Owner and governing authorities.

K. Protections:
1. Provide temporary barriers to protect Owner's personnel and public from injury from work:
a. Take protective measures to provide free and safe passage to occupied portions of building.
b. Provide protection to ensure safe passage of Owner’s personnel and the public around demolition areas and to and from occupied portions of adjacent areas, buildings, and structures.
c. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
d. Protect existing work that becomes exposed during demolition operations:
1) Protect existing improvements, appurtenances, and conditions to remain.
2) Protect adjacent floors with coverings.
3) Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.
e. Construct temporary, insulated, dustproof partitions to separate areas from noisy or extensive dirt or dust when operations are performed. Equip partitions with dustproof doors and security locks.
f. Provide temporary weather protection when exposing exterior conditions to prevent water leakage or damage to structure or interior areas of existing building.

L. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

3.2 EXAMINATION

A. Verify that affected utilities have been disconnected and capped before commencing selective demolition operations.

B. Review Project record documents of existing construction or existing condition and hazardous material information provided by Owner. Owner does not warrant existing conditions are same as those indicated in Project record documents.

C. Perform an engineering survey of condition of building to determine whether removing an element might result in structural deficiency or unplanned collapse of a portion of structure or adjacent structures during selective building demolition operations:
1. Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

F. Survey of Existing Conditions:
1. Record existing conditions with measured drawings or preconstruction photographs or video and templates:

a. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
b. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
c. For any electrical or low-voltage work to be performed in the Project (including fire alarm, PA, intercom, or data), test entire system for operation prior to initiation of Work. Notify Owner of any non-working components. Test entire system at the end of construction to ensure all systems operate properly.

3.3 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

B. Pest Control: Employ certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

C. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities. Comply with requirements for access and protection.

D. Temporary Facilities:
1. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain:
   a. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   b. Provide temporary weather protection during interval between selective demolition of existing construction on exterior surfaces and new construction to prevent water leakage and damage to structure and interior areas.
   c. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   d. Cover and protect furniture, furnishings, and equipment that have not been removed.
   e. Comply with requirements for temporary enclosures, dust control, heating, and cooling.

E. Furnishings and Equipment: Cover and protect furniture, equipment, and fixtures from spoilage or damage as necessary.

3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned:
1. Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished:
   a. Owner will arrange to shut off indicated services/systems when requested by Contractor.
   b. Arrange to shut off utilities with utility companies.
   c. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

d. Disconnect, demolish, and remove fire suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed:
   1) Piping to be removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2) Piping to be abandoned in place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
   3) Equipment to be removed: Disconnect and cap services and remove equipment.
   4) Equipment to be removed and reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   5) Equipment to be removed and salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
   6) Ducts to be removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   7) Ducts to be abandoned in place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.5 POLLUTION CONTROLS

A. Dust Control:
   1. Use water mist, temporary enclosures, and suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations including, but not limited to SCAQMD (Fugitive Dust) rules and regulations:
      a. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
      b. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

3.6 PROTECTION

A. Temporary Shoring:
   1. Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished:
      a. Strengthen or add new supports when required during progress of selective demolition.

B. Remove temporary barricades and protections where hazards no longer exist.

3.7 SELECTIVE DEMOLITION

A. Demolish and remove existing construction to the extent necessary for new work. Use methods required to complete the work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At

concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.
5. Maintain fire watch during and for at least 24 hours after flame cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin infested, and dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials to avoid imposing excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and adjacent occupied and used facilities.

C. Removed and Salvaged Items:
1. Remove items indicated for salvage. Clean and pack or crate items after cleaning. Identify contents of containers. Store items in secure area until delivery to Owner:
   a. Transport items to Owner's storage area designated by Owner. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse:
   a. Pack or crate items after cleaning and repairing. Identify contents of containers.
   b. Protect items from damage during transport and storage.
   c. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner, items may be removed to a suitable, protected storage location during selective demolition, cleaned, and reinstalled in original locations after selective demolition operations are complete.

F. Patching and Repair: Repair damage to adjacent construction caused by selective demolition operations promptly.

3.8 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs on Grade: Saw cut perimeter of area to be demolished, and then break up and remove.

E. Interior Slab on Grade: Use best practice removal methods to prevent cracking or structurally disturbing adjacent slabs or partitions. Use power saw where possible.

F. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI *Recommended Work Practices for the Removal of Resilient Floor Coverings*. Do not use methods requiring solvent-based adhesive strippers**.**

G. Below Grade Voids: Completely fill below grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over six inches (150 mm) in diameter, roots, or other organic matter.

H. Partitions: Completely remove indicated interior partitions and interior finishes indicated. Leave adjacent work scheduled to remain sound and ready for patching or for new finishes.

I. Doors and Frames:
1. Remove doors, frames, and hardware where indicated. Remove from site:
    a. Clean, store, and protect for reinstallation or return hardware to Owner as directed.

J. Cut existing masonry walls for new doors, windows, or openings indicated. Leave openings ready to receive new work or patching.

K. Windows: Remove existing windows where indicated. Remove associated anchors, shims, blocking, operating devices, sealant, and trim. Cut back interior finishes required for plumb surface for patching. Leave openings ready for installation of new materials and finishes.

L. Mechanical, Electrical, and Structural Elements:
1. If unanticipated mechanical, electrical, or structural elements conflicting with intended function or design are encountered, investigate and measure both nature and extent of the conflict:
    a. Submit written report to Architect in accurate detail. Pending receipt of directive, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.
    b. HVAC Equipment: Remove air conditioning equipment without releasing refrigerants.

3.9 REMOVAL OF STRUCTURAL ELEMENTS

A. Foundation: Demolish foundation walls to a minimum depth of 12 inches (300mm) below existing ground surface. Demolish and remove below grade wood or metal construction. Break up below grade concrete slabs.

B. Pneumatic Operated Hammers:
1. When possible, reduce use of pneumatic operated hammers. When necessary to use pneumatic tools, locate compressors as remote from occupied areas as possible:
    a. To break large pieces of concrete, isolate concrete from floor slabs and building structure to prevent structure borne vibration.

C. Saw Cutting:
1. Locate compressors as remote as possible from occupied areas of facility:
    a. Use diamond tipped saw blades and related equipment.
    b. Saw cut portions of walls and slabs. Angle saw blade at floors and corners to cut as closely as possible to desired location.
    c. Control runoff water used with saw to prevent damage to existing materials.

3.10 ROOF REMOVAL

A. Roof Assembly:
   1. Remove existing roofing to the extent that can be covered in one (1) day by new roofing. Maintain building interior in watertight and weathertight condition:
      a. Remove existing roof membrane, flashings, copings, and roof accessories.
      b. Remove existing roofing system down to substrate.

B. At new column extensions, cut through roofing as required for welding of new extension. Provide temporary watertight enclosure over stubs and temporarily flash to existing roof to make completely watertight.

C. At existing parapets, remove portions of roofing, flashing, stone, and masonry necessary to weld new steel and set form work. Provide temporary watertight enclosures over areas of open roof and temporarily flash to make watertight.

D. As column forms are placed, temporarily flash columns to existing roofing and cover with watertight tarpaulins before and after pouring. After column forms have been removed, temporarily flash new concrete structure into existing roofing immediately to maintain watertight roof.

E. When removing roofing to place supports for shoring of form work to transfer loads to existing columns or approved structure or to support scaffolding, work platforms, or similar loads, temporarily flash supports to make roof watertight.

F. Remove excess residue. Thoroughly clean and remove asphalt, dust, and loose materials and leave ready for new work.

3.11 PATCHING AND REPAIRS

A. Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching: Comply with Section 01 73 29: Cutting and Patching.

C. Repairs:
   1. When necessary to repair to existing surfaces, patch to produce surfaces suitable for new materials:
      a. Fill holes and depressions in existing masonry walls to remain with masonry patching material applied according to manufacturer's written recommendations.

D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

E. Floors and Walls:
   1. Where walls or partitions are demolished, 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 existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance:
      a. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
      b. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
      c. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.12 DISPOSAL OF DEMOLISHED MATERIALS

A. Legally remove demolition waste materials from site and dispose in an EPA approved construction and demolition waste landfill acceptable to authorities having jurisdiction; recycle or reuse components:
   1. Do not allow demolished materials to accumulate onsite.
   2. Remove and transport debris to prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or devices that convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.13 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 02 82 00 ASBESTOS REMEDIATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Asbestos material abatement and disposal.
2. Accessories necessary for complete removal.

B. Related Sections:
1. Section 00 73 56: Hazardous Materials Procedures and Requirements.

1.3 SUBMITTAL

A. Submit copy of the signed waste manifests indicating the place, time, and exact quantity of asbestos received by an approved landfill.

1.4 QUALITY ASSURANCE

A. Qualifications: Entity having minimum five (5) years' documented experience, holding required current licenses for the removal, transport, disposal, and related activities relative to the work, having the required personal protective equipment for abatement operations, with current liability insurance, and who employs workers fully trained and knowledgeable in the removal of hazardous materials.

B. Stop Asbestos Removal:
1. If a verbal or written Stop Asbestos Removal Order is given**,** immediately stop asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed Asbestos Contained Material (ACM).
2. Do not resume asbestos removal activity until authorized to do so in writing from District.
3. A stop asbestos removal order may be issued at any time by the District if it is determined that abatement conditions/activities are not within regulatory requirements or that an imminent hazard exists to human health or the environment.
4. Work stoppage will continue until conditions have been corrected.

PART 2 MATERIALS (NOT USED)

PART 3 EXECUTION

3.1 REMEDIATION

A. Owner has conducted an asbestos survey and has determined that asbestos may be present in areas where Work will be performed. The survey is made available for review:
1. As part of the Work, Owner requires asbestos removal to be performed under the construction Contract.
2. Asbestos may be present in vinyl tile under architectural woodwork or covered by, but

not encapsulated, carpet materials and other types of flooring.
3. Asbestos may be present in the ductwork above the ceiling panels.
4. If asbestos is found, stop work in the area and engage an asbestos removal firm to remediate the asbestos from the area. Do not resume work in the affected areas until the abatement is complete and authorization to proceed with work in the affected areas is given. Work in areas not affected by asbestos may continue.

B. Assume responsibility and liability for compliance with applicable federal, state, and local regulations related to the asbestos abatement work:
1. Provide and maintain training, accreditations, medical exams, medical records, and personal protective equipment (PPE) including respiratory protection and respirator fit testing, as required by applicable federal, state, and local regulations.
2. Post required notices prior to the commencement of the work.
3. Restrict access to containment areas to authorized, trained, and protected personnel.
4. Prepare and post an emergency plan in clean room and equipment room of the decontamination unit.
5. Do not permit workers to eat, drink, smoke, chew gum or tobacco, or break the protection of the respiratory protection system in the work area.

C. Entering and Existing Procedures: Establish procedures for entering and existing containment area. Provide personnel decontainment unit with disposable coveralls, head covers, and clean respirators. Provide shower room between personnel decontainment area and equipment room.

D. Decontamination Procedures: Establish and ensure that procedures for decontamination upon leaving containment area are in accordance with federal and state regulations.

E. Provide negative pressure filtration systems to complete air exchange four (4) times per hour. Provide standby system in the event of a machine failure or emergency:
1. Continuously monitor and record the pressure differential between the work area and the building outside of the work area.

F. Prepare the Affected Area: Remove furnishings and materials to the extent necessary to remediate the asbestos.

G. Containment of Areas:
1. Provide a secure containment work area in accordance with federal and state regulations. Avoid damage to existing partitions and ceilings scheduled to remain to the extent possible:
   a. Establish critical barriers over each opening into the work area.
   b. Close out vents and air ducts to prevent particulates from entering the HVAC system.

H. Debris:
1. Place contaminated debris in a designated location within the containment area:
   a. Place debris in minimum six (6) mil poly bags before removing from contaminated areas. Pass clean or decontaminated bags through a double six (6) mil flap doorway into another bag or fiber drum. Remove to disposal dumpster/gondola/vehicle. Do not permit unprotected personnel to come in contact with contaminated bags.
   b. Remove and dispose of contaminated debris legally.

I. Testing: Perform required tests and inspections upon completion of the work. Collect air samples and analyze in accordance with regulations. Upon satisfactory conclusion of testing, remove critical barriers.

J. After thorough decontamination, complete asbestos abatement work upon meeting the regulated area clearance criteria and fulfilling the following:
   1. Remove equipment, materials, and debris from the Project area.
   2. Package and dispose of asbestos waste, as required.
   3. Repair or replace all interior finishes damaged during the abatement work.
   4. Fulfill other Project closeout requirements as specified elsewhere in this Specification.

3.2 CERTIFICATE OF COMPLETION BY CONTRACTOR

A. Submit a signed *Certificate of Completion* at the completion of the abatement and decontamination of the regulated area.

END OF SECTION 02 82 00

SECTION 02 83 00 LEAD REMEDIATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Recognition of lead-based material and its definition.
2. Federal and state requirement reference.
3. Contractor's Liability.
4. Contractor's Acknowledgment.

B. Related Sections:
1. Section 00 73 56: Hazardous Materials Procedures and Requirements.

C. Lead as a Health Hazard:
1. Lead poisoning is recognized as a serious environmental health hazard facing children today. Even at low levels of exposure - much lower than previously believed - lead can impair the development of a child's central nervous system, causing learning disabilities and leading to serious behavioral problems. Lead enters the environment as tiny lead particles and lead dust disburses when paint chips or chalks peels or wears away over time, or is otherwise disturbed. Ingestion of lead dust is the most common pathway of childhood poisoning; lead dust gets on a child's hands and toys and then into a child's mouth through common hand-to-mouth activity. Exposures may result from construction or remodeling activities that disturb lead paint, from ordinary wear and tear of windows and doors, or from friction on other surfaces.
2. Ordinary construction and renovation or repainting activities carried out without lead-safe work practices can disturb lead-based paint and create significant hazards. Improper removal practices, such as dry scraping, sanding, or water blasting painted surfaces, are likely to generate high volumes of lead dust.
3. Because Contractor and his employees will be providing services for the District, and because Contractor's work may disturb lead-containing building materials, CONTRACTOR IS HEREBY NOTIFIED of the potential presence of lead-containing materials located within certain buildings utilized by the District. All school buildings built prior to 1978 are presumed to contain some lead-based paint until sampling proves otherwise.
4. Refer to "Asbestos and Lead-Based Paint Survey Report – Appendix A" in this Project manual.
5. Education Code section 32240 et seq. is known as the Lead-Safe Schools Protection Act. Under this act, the Department of Health Services is to conduct a sample survey of schools in the State of California for the purpose of developing risk factors to predict lead contamination in public schools (Ed. Code, § 32241).
6. Any school that undertakes any action to abate existing risk factors for lead is required to utilize trained and state-certified contractors, inspectors, and workers (Ed. Code, § 32243, sub. [b]). Moreover, lead-based paint, lead plumbing, solders, or other potential sources of lead contamination shall not be utilized in the construction of any new school facility, or the modernization or renovation of any existing school facility (Ed. Code, § 32244).
7. Both the Federal Occupational Safety and Health Administration (Fed/OSHA) and the California Division of Occupational Safety and Health (Cal/OSHA) have implemented

safety orders applicable to all construction work where a contractor's employee may be occupationally exposed to lead.

8. The OSHA Regulations contain specific and detailed requirements imposed on contractors subject to that regulation. The OSHA Regulations define construction work as work for construction, alteration, and/or repair, including painting and decorating. It includes, but is not limited to, the following:
   a. Demolition or salvage of structures where lead or materials containing lead are present.
   b. Removal or encapsulation of materials containing lead.
   c. New construction, alteration, repair, or renovation of structures, substrates, or portions thereof that contain lead, or materials containing lead.
   d. Installation of products containing lead.
   e. Lead contamination/emergency cleanup.
   f. Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed.
   g. Maintenance operations associated with the construction activities described in Section 01 78 23: Operation and Maintenance Data, or within this Section.
9. Because it is assumed by the District that a portion of painted surfaces (interior as well as exterior) within the District contain some level of lead, it is imperative that Contractor, workers, and subcontractors fully and adequately comply with all applicable laws, rules, and regulations governing lead-based materials, including title 8, California Code of Regulations, section 1532.1.
10. Contractor shall notify the District if any Work may result in the disturbance of lead-containing building materials. Any and all Work that may result in the disturbance of lead-containing building materials shall be coordinated through the District. A signed copy of this Certification shall be on file prior to beginning Work on the Project, along with all current insurance certificates.

D. Renovation, Repair, and Painting Rule:
   1. Toxic Substance Control Act Section 402(a):
      h. The EPA requires lead safe work practices to reduce exposure to lead hazards created by renovation, repair, and painting activities that disturb lead-based paint. Pursuant to the Renovation, Repair and Painting Rule (RRP), renovations in homes, childcare facilities, and schools built prior to 1978 must be conducted by certified renovations firms, using renovators with training by a EPA-accredited training provider, and fully and adequately complying with all applicable laws, rules, and regulations governing lead-based materials, including those rules and regulations appearing within title 40 of the Code of Federal Regulations as part 745 (40 CFR 745).
      i. The RRP requirements apply to all contractors who disturb lead-based paint in a six (6) square foot or greater area indoors or a 20 square foot or greater area outdoors. If a DPH-certified inspector or risk assessor determines that a structure constructed before 1978 is lead-free, the federal certification is not required for anyone working on that particular building.

1.3 SUBMITTAL

A. Contractors Acknowledgment (bottom of Section).

B. Submit copy of the signed waste manifests indicating the place, time, and exact quantity of material received by an approved landfill.

1.4 CONTRACTOR'S LIABILITY

A. If Contractor fails to comply with any applicable laws, rules, or regulations, and that failure results in a site or worker contamination, Contractor will be held solely responsible for all

costs involved in any required corrective actions, and shall defend, indemnify, and hold harmless the District, pursuant to the indemnification provisions of the Contract, for all damages and other claims arising therefrom.

B. If lead disturbance is anticipated in the Work, only persons with appropriate accreditation, registrations, licenses, and training shall conduct this Work.

C. It shall be the responsibility of Contractor to properly dispose of any and all waste products, including, but not limited to, paint chips, any collected residue, or any other visual material that may occur from the prepping of any painted surface. It will be the responsibility of Contractor to provide the proper disposal of any hazardous waste by a certified hazardous waste hauler. This company shall be registered with the Department of Transportation (DOT) and shall be able to issue a current manifest number upon transporting any hazardous material from any Project site.

D. Contractor shall provide the District with any sample results prior to beginning Work, during the Work, and after the completion of the Work. The District may request to examine, prior to the commencement of the Work, the lead training records of each employee of Contractor.

SECTION CONTINUES ON NEXT PAGE

CONTRACTOR HEREBY ACKNOWLEDGES UNDER PENALTY OF PERJURY THAT IT:

1. HAS RECEIVED NOTIFICATION OF POTENTIAL LEAD-BASED MATERIALS ON OWNER'S PROPERTY;

2. IS KNOWLEDGEABLE REGARDING AND WILL COMPLY WITH ALL APPLICABLE LAWS, RULES, AND REGULATIONS GOVERNING WORK WITH, AND DISPOSAL OF, LEAD.

THE UNDERSIGNED WARRANTS THAT HE/SHE HAS THE AUTHORITY TO SIGN ON BEHALF OF AND BIND CONTRACTOR. THE DISTRICT MAY REQUIRE PROOF OF SUCH AUTHORITY.

Date: _____

Proper Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

PROJECT/CONTRACT NO.: _____ (Project or Contract)

between Ojai Unified School District (District) and _____ (Contractor or Bidder).

This certification provides notice to Contractor that:

3. Contractor's work may disturb lead-containing building materials.

4. Contractor shall notify the District if any work may result in the disturbance of lead-containing building materials.

5. Contractor shall comply with the Renovation, Repair, and Painting Rule, if lead-based paint is disturbed in a six (6) square-foot or greater area indoors or a 20-square-foot or greater area outdoors.

END OF SECTION 02 83 00

SECTION 03 02 00 CONCRETE RESURFACING, REPAIR, AND MOISTURE VAPOR MITIGATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes preparation of existing interior concrete slabs, including shot blasting, surface defect repair, application of moisture vapor control system, and moisture vapor and pH testing, where indicated on Drawings, for underlayment and finish flooring specified in other Sections.

B. Reference Standards (Use Current Versions):
1. ASTM F3010 Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Covering.
2. ASTM C1583 Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
3. ASTM D7234 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
4. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
5. ICRI Guide 310.2R Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.
6. RFCI Recommended Work Practices for the Removal of Resilient Floor Coverings, Resilient Floor Covering Institute.

1.3 SUBMITTALS

A. Product Data:
1. Submit manufacturer’s data sheets and supporting information for each product and process specified including:
   a. Product specifications.
   b. Installation instructions.
   c. Manufacturer’s certification that moisture vapor control products meet requirements of current version of ASTM F3010.
   d. Independent test reports supporting product manufacturer’s certificate of conformance to ASTM F3010.
   e. Completed manufacturer’s pre-installation checklist.
   f. Warranty Information.

B. Moisture Tests: Submit concrete floor moisture test results required by floor covering manufacturer. Perform moisture testing as described in ASTM F710. Testing shall be performed according to the floor covering manufacturer’s specified ASTM Standard Test Method by an independent testing agency. Testing shall be performed by ICRI Tier 2 Certified Moisture Testing Technician. Provide moisture test results to Architect, Owner, General Contractor, and moisture vapor control system manufacturer's representative.

1.4 QUALITY ASSURANCE

A. Qualifications of Applicator:

1. Employ an applicator trained and currently approved by the moisture vapor control system manufacturer, experienced in surface preparation and application of the products of this Section, and subject to observation by the manufacturer.
2. Submit list of at least three (3) similar projects performed by the applicator within the previous five (5) years that used the same products and similar moisture vapor control system design.

B. Manufacturer's Qualifications:
1. Manufacturer shall have not less than ten (10) years' experience in manufacturing moisture vapor control systems. The moisture vapor control system must be specifically formulated and marketed for concrete floor slab moisture vapor control and pH control.

C. Provide manufacturer's standard 15 year warranty at no additional cost. Applicator of moisture vapor control system shall provide standard installation warranty for workmanship.

D. Mockup: Install the moisture control system in a minimum 100-square-foot mockup area, using the same methods and equipment that will be used for the entire installation. Test tensile bond strength of the moisture mitigation system to the concrete substrate following ASTM D7234. The results must be equal to or greater than 200 psi with failure in the concrete before proceeding with installation of the moisture control system.

E. Scheduling: The independent testing agency will coordinate scheduling with Owner for moisture testing to permit sufficient time to test, submit and evaluate test results, and install the moisture vapor control system before installation of floor coverings.

F. VOC Limits:
1. VOC's for all concrete primers and concrete sealers shall be limited to 100 grams per liter or less.
2. VOC's for all sealants and all adhesives shall be limited as follows:
   g. Low-solid adhesives and sealants: VOC's shall be limited to 70 grams per liter of material, or less.
   h. Non-low-solid adhesives and sealants: VOC's shall be limited to 70 grams per liter of adhesive or sealant less water and less exempted compounds as specified by South Coast Air Quality Management District (SCAQMD) Rule 1168, or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the jobsite in original unopened containers, clearly labeled with the manufacturer's name and brand designation. Each container shall be marked with batch or lot code traceable to manufacturing information.

B. Store products in an approved ventilated dry area; protect from dampness, freezing, and direct sunlight. Product shall not be stored in areas with temperatures in excess of 90 degrees F or below 50 degrees F unless permitted by manufacturer's instructions.

C. Handle products using methods that prevent breakage or damage of containers and prevent contamination of products.

D. Project/Site Conditions:
1. Environmental Conditions:
   i. Do not apply moisture vapor control system to surfaces that may be exposed to uncontrolled weather conditions such as precipitation, wind, direct sunlight, etc. Do not apply when moisture is accumulated on the surface of the concrete or if precipitation is anticipated before the moisture control coating has cured.

j. Do not apply moisture vapor control system when temperature is lower than 50 degrees F or higher than 90 degrees F or expected to fall outside this temperature range within 24 hours after application. Do not apply moisture vapor control coating when temperature is above 80 degrees F and rising or expected to rise during curing period of the moisture control coating.

E. Protection: Protect moisture vapor control system after installation to prevent damage from topical moisture, direct sunlight, and construction traffic for a minimum period of 24 hours after application.

F. The moisture vapor control system manufacturer's instructions must allow installation as early as seven (7) days after concrete placement.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: **KOSTER VAP I® 2000 System**, as manufactured by KOSTER American Corporation, 2585 Aviator Drive, Virginia Beach, VA 23453; (757) 425-1206; www.kosterusa.com

B. Moisture vapor control system shall be the product of a single manufacturer. Equivalent products of other manufacturers may be submitted for review and approval as substitutions in accordance with Section 01 25 13: Product Substitution Procedures.

2.2 MATERIALS

A. General: Use materials of one manufacturer throughout the Project as hereinafter specified.

B. Moisture Vapor Control Coating:
1. Select from among the following products (if fast setting time is not essential, use the first option below):
   k. KOSTER VAP I® 2000 ZERO VOC; 12-hour setting time, Zero VOC, 2-part epoxy resin coating.
   l. KOSTER VAP I® 2000 FS; 4 to 5-hour setting time, Zero VOC. 2-part epoxy resin coating.
   m. KOSTER VAP I® 2000 UFS; 3 to 4-hour setting time, low VOC, 2-part epoxy resin coating.

C. Primer for Underlayment:
1. KOSTER VAP I® 06 Primer – non-porous substrate primer for use on VAP I® 2000 resin coating.

D. Self-Leveling Underlayment:
1. Select from among the following products:
   n. KOSTER SL Premium.
   o. KOSTER SC.

E. Primer for porous concrete containing excessive near-surface voids or high concrete surface profile:
1. KOSTER KB-Pox IN, low viscosity, high modulus, 2-part epoxy resin.

F. Repair resin for non-movement joints and cracks:

1. KOSTER KB-Pox IN low-viscosity, high modulus 2-part epoxy gravity-feed, crack injection resin.

G. Thickening agent for repairing spalls and excessively rough concrete:
   1. KOSTER TA Fiber thickening agent, non-silica.

H. Movement Joint Sealant:
   1. KOSTER FS-H polysulfide resin joint sealant.
   2. Backer rod and accessory materials.

PART 3 EXECUTION

3.1 EXAMINATION OF SUBSTRATE BEFORE INSTALLATION

A. Provide information required in moisture control system manufacturer's pre-job checklist. Submit completed checklist to moisture control system manufacturer for review before installation of the moisture control system.

B. Concrete floor slab moisture testing is not required prior to application of moisture control system:
   1. If moisture testing is performed, moisture testing shall be conducted according to the latest version of ASTM F2170 using relative humidity probes that have been allowed to equilibrate at each test location for at least two (2) hours. Provide report in accordance with ASTM F2170 and floor plan showing moisture test results.

C. Testing and evaluation for deleterious materials and contaminants that inhibit moisture control coating adhesion:
   1. It is the responsibility of Owner to provide a concrete floor slab free of contaminants and deleterious materials that can inhibit bond to the moisture control coating or develop deleterious reactions after the concrete floor slab is sealed.
   2. Concrete substrates must be structurally sound, solid, and meet industry standards as defined in ACI Committee 201 Report "Guide to Durable Concrete." Surfaces must be free of moisture-sensitive patching and leveling materials, adhesives, coatings, curing compounds, concrete sealers, efflorescence, dust, grease, oils, and any other materials or contaminants that can act as bond breakers.
   3. The floor slab surface must be capable of withstanding steel shot blast preparation to ICRI CSP3. Excessively weak, soft, dusty, cracked, or uneven surfaces may not be suitable substrates, and may require additional concrete surface removal or patching before application of the moisture control coating. Such compounds must be long term resistant to high moisture and high pH.
   4. Contaminated concrete may not be suitable to receive a moisture control coating. Testing and evaluation for contaminants and concrete condition is not required but is strongly recommended. Testing and evaluation of the floor slab can include:
      p. Solvent extraction and analysis for organic compounds such as oil, grease, plasticizers, silicones, solvents, and other chemical compounds that can inhibit bond to the epoxy moisture control coating.
      q. Microscopical (petrographic) examination according to ASTM C856 to evaluate the concrete condition.
   5. Do not install moisture control system if substrate testing reveals unacceptable conditions.

3.2 PREPARATION

A. Remove existing floor finishes including floor coverings, coatings, paint, and adhesives. Follow RFCI Recommended Work Practices for the Removal of Resilient Floor Coverings.

B. Abrasive Surface Preparation:
   1. Grind perimeter of rooms and areas inaccessible to shotblasting using dry diamond media with vacuum dust extraction. Grind to ICRI CSP2. Do not smooth polish these areas. Grinding is allowed only in areas not accessible to shot blasting
   2. Shot blast floors to ICRI CSP3. Shot blast as close as possible to walls, doorways, casework, and other permanently installed objects. Remove residual steel shot.
   3. Acid etching is not permitted.

C. Remove residual dust and debris by vacuum and dry sweeping. Do not use sweeping compound. Remove all foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, shot blast beads, etc.

D. Test concrete surface tensile strength after abrasive preparation in accordance with requirements of ASTM F3010 following Test Method C1583. If test results are less than 200 psi, repair concrete or repeat surface preparation to achieve required concrete surface tensile strength.

E. Repair non-movement cracks, control joints, and large surface defects such as spalls, holes, and voids in accordance with manufacturer's recommendations. Use low-viscosity, gravity-fed crack mending resin for non-movement cracks and joints. Crack repair compound can be mixed with not more than three-part clean, washed, dry silica sand for saw cut control joints and wide cracks. Brush interior walls of crack or joint with neat crack repair epoxy resin before applying sand-resin mixture. After curing, grind surface flush with surrounding concrete.

F. Repair spalls or excessively rough concrete surface using manufacturer's fiber thickening agent mixed 1:1 by volume with moisture control resin. Mix thickening agent and resin thoroughly to a uniform creamy consistency and apply by trowel, working material tightly against clean, roughened concrete surface.

G. Do not fill designed movement joints with moisture control epoxy resin. Fill movement joints with manufacturer's recommended flexible joint filling compound or mechanical movement joint cover.

H. Reinforcing fibers that become visible after shot blasting must be removed and vacuumed leaving no fibers exposed above the concrete surfaces. Provide an uncontaminated, clean, sound surface.

3.3 MIXING

A. Mix two-part moisture control resin and hardener thoroughly for three (3) minutes in manufacturer supplied containers following manufacturer's requirements to obtain a homogeneous mixture. Use a low speed motor less than 400 rpm and a two-bladed Jiffy-type mixing blade only. Do not aerate.

B. If smaller quantities are required, maintain manufacturer's specified mix ratios by volume.

C. Do not dilute with solvent.

3.4 APPLICATION

A. After mixing, immediately pour material on the substrate in a ribbon. Empty can completely. Do not invert can to drain on concrete.

B. Spread moisture control coating using manufacturer's recommended notched squeegee and back-roll with a 3/8-inch nap epoxy-rated, lint-free roller. Completely cover the entire concrete surface with a uniform application of the moisture control coating as quickly as possible and allow the coating to self-level. Work into a wet edge and assure continuity of the coating across the entire area.

C. Spread coating on ICRI CSP3 shot blasted concrete surface at 100 to 150 square-feet-per-gallon. Concrete prepared to CSP3 coated at 100 to 150 square-feet-per-gallon will yield average cured coating thickness 11 to 16 mils (0.011 to 0.016 inch). A rougher surface profile or a porous or absorptive concrete will require the use of more material to achieve sufficient coating thickness. KOSTER VAP I® 2000 moisture control coatings must be installed at a minimum layer thickness of at least 11 mils (0.011 inch). Less layer thickness results in a higher permeance of the cured coating that will not meet performance requirements of ASTM F3010.

D. Allow coating to cure the minimum length of time specified for the product.

3.5 INSPECTION

A. Inspect cured moisture control coating for complete, uniform coverage. Repair or install additional coats as necessary to produce a uniform, flat, and smooth coating surface that meets manufacturer's minimum thickness requirements in all areas.

B. Test adhesion of the moisture control coating to the concrete substrate as required in ASTM F3010 following Test Method D7234. Tensile bond strength of the coating must be at least 200 psi with failure in the concrete. Repair or replace areas that do not meet this requirement.

3.6 CEMENTITIOUS UNDERLAYMENT

A. After installation of the moisture control coating, self-leveling cementitious underlayment or trowelable cementitious skim coat can be installed:
   1. Apply KOSTER VAPI®06 Primer at 650 to 800 square-feet-per-gallon using a lint-free short-nap roller. Apply a thin, uniform coating over the entire cured moisture control epoxy coating. Do not dilute with water or solvent. Do not apply thicker than 650 square-feet-per-gallon.
   2. Mix and apply KOSTER SL standard underlayment, KOSTER SL Premium underlayment, or KOSTER SC skim coat following manufacturer's instructions. Allow to cure and dry according to manufacturer's instructions before installing floor coverings.

3.7 CLEANING

A. Clean tools and equipment in contact with epoxy resins using xylene or other suitable cleaning agent immediately after use.

B. Remove debris and unused materials from Project site. Dispose chemicals, rags, and other materials in accordance with applicable regulations and specific jobsite instructions.

3.8 PROTECTION

A. Protect applications of the moisture control system during the specified cure period from traffic, topical moisture, and contaminants.

B. Protect installed cementitious underlayment or skim coat until floor covering installation.

END OF SECTION 03 02 00

SECTION 03100 – CONCRETE FORMWORK & ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY:

A. Provide concrete formwork and accessories as indicated on the drawings and specifications, including the following:

1. Design and construction of formwork for concrete.

2. Setting in forms, all anchor bolts, metal inserts, sleeves, etc., embedded in concrete.

3. Miscellaneous concrete work, including but not limited to areaways, cast-in-place valve boxes, pits, splash blocks, equipment bases, and other items as shown or required to complete all Work.

B. Design and carry out the engineering and construction of all formwork, shoring, and bracing, by and under the direction of the Contractor. The Contractor shall be responsible for the engineering, construction, maintenance, and safety of all formwork during the entire construction period. The formwork shall be designed for the loads and lateral pressures outlined ACI 347, and other forces as specified by the Building Code.

1.2 QUALITY ASSURANCE:

A. Construct forms according to ACI 347 "Recommended Practice for Concrete Formwork", and conforming to tolerances specified in ACI 301, "Specifications for Structural Concrete for Buildings", as applicable, unless exceeded by code requirements or otherwise indicated or specified.

B. Prior to construction of formwork for concrete beams and slabs above grade, Contractor shall conduct a meeting at the site to determine and define all cambers required for the project. The Architect, Structural Engineer of record, Contractor and Contractor's formwork installer shall be in attendance at this meeting.

1.3 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials for forms in timely manner to ensure uninterrupted progress.

B. Store materials by methods that prevent damage and permit ready access for inspection and identification.

PART 2 PRODUCTS

2.1 CONCRETE FORMWORK AND ACCESSORIES:

A. Forms for Unexposed Concrete: Form concrete surfaces which will not be exposed in the finished structure with plywood, lumber, metal or other acceptable material.

1. Lumber: Standard or better grade Douglas fir, meeting the requirements of WCLIB "Standard No. 17, Grading Rules for West Coast Lumber" or WWPA "Western Lumber Grading Rules 91". Use boards which are surfaced on at least 2 edges and one side for a tight fit.

2. Plywood: B-B Plyform, Class I, Exterior grade meeting the requirements of PS 1-96 & PS 1-83, 5/8 inch minimum thickness for 12 inch stud spacing and 3/4 inch minimum thickness for 16 inch stud spacing.

B. Forms for Exposed Finish Concrete: Construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practical sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

1. Provide High Density Overlay Plyform Class I Exterior plywood meeting the requirements of PS 1-83 for concealed surfaces.

2. Provide B-B Plyform Class I Exterior plywood meeting the requirements of PS 1-83 for exposed surfaces.

C. Form Liners: Form architectural finish concrete surfaces with PVC or ABS plastic, fiber glass reinforced plastic or elastomeric urethane form liners of face design indicated.

D. Waterstops: Provide PVC water stops of the shape and size indicated, and meeting the minimum requirements of Corps of Engineers Specification CRD-C-572-89.

E. Framing, Studding and Bracing: "Standard" or "Construction" grade Douglas fir, rough or S4S, meeting the requirements of WCLIB "Standard No. 17, Grading Rules for West Coast Lumber" or WWPA "Western Lumber Grading Rules 91".

F. Form Ties and Spreaders: Standard metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Inner tie rod shall be left in concrete when forms are removed. Wire ties or wood spreaders will not be permitted.

G. Form Coating: Non-grain raising and non-staining type that will not leave residual matter on surface of concrete or adversely affect proper bonding of subsequent application of other material applied to concrete surface. Coatings containing mineral oils or other nondrying ingredients will not be permitted. Form coating for use with form liners shall be of type recommended by form liner manufacturer.

H. Nails: Common wire, steel.

PART 3 EXECUTION

3.1 CONSTRUCTION

A. Conform to ACI 301 and ACI 347 except as exceeded by the requirements of Building Code, regulatory agencies, or herein.

B. Earth Forms: Earth forms may be used for footings only where the soil is firm and stable and the concrete will not be exposed to view. Where earth forms are to be used, excavations shall be cut neat and accurately to size for placing of concrete directly against the excavation. Except for bottom of footings, allow for two inches of additional concrete beyond the dimensions or profiles shown on the drawings. Construct wood edge strips at each side of trench at top to secure reinforcing and prevent trench from sloughing. Form sides of footings where earth sloughs more than six inches. Earth forms shall be tamped firm and cleaned of all debris and loose material before depositing concrete.

C. Wood Forms: Construct forms of sound material to the correct shape and dimensions, mortar tight, and of sufficient strength, and so braced and tied together that the movement of men, equipment, materials, or placing and vibrating the concrete will not throw them out of exact shape under imposed loads. They shall be so constructed that they may be easily removed without damage to the concrete. Before concrete is placed in forms, carefully verify the horizontal and vertical position of the form and correct inaccuracies. Complete wedging and bracing in advance of placing of concrete.

D. Form Liners: Position liners on the forms so that grooves and joints are aligned with tie slots. Attach form liners to plywood forms with staples and to metal forms with sheet metal screws or pop rivets. Space fasteners not to exceed 4 inches on centers around the perimeter of each sheet. Place staples perpendicular to the edges. Install staples using a power staple with pressure regulated so that staple heads are driven flush with the surface. Seal joints between liners and joints at top and bottoms of liners with foam tape placed on the back side of liners.

E. Framing bracing, supporting members, and centering shall be of ample size and strength to safely carry, without deflection, dead and live loads to which forms may be subjected, and shall be spaced sufficiently close to prevent bulging or sagging of forms. Concrete out of line, level, or plumb will be cause for rejection of the whole construction affected.

F. Tolerances: Formwork shall be constructed so as to ensure that the concrete surfaces will conform to the tolerances of ACI 117. Camber formwork where necessary to compensate for anticipated deflections due to fresh concrete and construction loads.

G. Chamfered Corners: Chamfer exposed corners 3/4 inch, unless otherwise indicated. Provide molding in forms for all chamfering required.

H. Form Ties: Use ties of sufficient strength and in sufficient quantities to prevent spreading of the forms. Place ties at least 1 inch away from the finished surface of the concrete.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Joints: Install construction joints, isolation joints, shrinkage control joints and expansion joints as approved. Coordinate location of construction joints, particularly those exposed to view at walls and columns, in advance of concrete placement.

K. Embedded Piping and Rough Hardware:

1. Coordinate with other trades who are required to fasten materials to formwork, or who are required to insert piping, boxes, bolts, anchors, inserts, or other rough hardware, within the forms.

2. Locate conduits or pipes sleeves so as not to reduce the strength of the construction. Do not bury conduit in a concrete slabs unless prior approval is obtained from the engineer.

L. Waterstops: Install PVC water stops to form a continuous diaphragm at each joint. Make provisions to support and protect exposed waterstops during progress of construction. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

M. Coating of Forms: Thoroughly clean forms and coat with specified form coating before each use. Do not reuse forms for exposed construction which cannot be reconditioned to "like new" condition. Apply form coating to forms in accordance with the manufacturer's specifications. Apply form coating to forms before placing reinforcing steel.

N. Inspection: Before placing of concrete, and after placement of reinforcing steel in the forms, provide sufficient prior notification so that proper inspection can be made.

O. Rejection of Defective Work: Any movement or bellying of forms during construction or variations in excess of the tolerances specified will be considered just cause for the removal of such forms and, in addition, the concrete construction so affected. Reconstruct forms, place new concrete and required reinforcing steel at no additional cost to the Owner.

3.3 REMOVAL OF FORMS:

A. Form Removal: Do not remove concrete forms until concrete attains sufficient strength to support its own weight and all superimposed loads as determine by testing field cured concrete cylinders, but not sooner than specified in ACI 347.

1. Reshore structural members as specified below because of design requirements or construction conditions to permit successive construction.

2. Remove formwork progressively so unbalanced loads are not imposed on the structure.

3. Avoid damage concrete surfaces during form removal.

4. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.

5. Remove formwork in same sequence as concrete placement to achieve similar concrete surface coloration.

B. Formwork for walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations, particularly when form ties will be bent by the removal operations, but not sooner than 24 hours after placing concrete.

C. Formwork for girder and beam soffits and above grade slabs and other parts that support the weight of concrete, shall remain in place until the concrete has reached its specified 28-day strength, unless otherwise specified or permitted. Load supporting forms may be removed when concrete has attained 75 percent of required 28 day compressive strength, provided construction is reshored.

D. When shores and other vertical supports are so arranged that the form facing material may be removed without loosening or disturbing the shores and supports, the facing material may be removed at an earlier age as specified or permitted. The shores and supports shall remain in place until the concrete has reached its specified 28-day strength, unless otherwise specified or permitted.

E. Whenever the formwork is removed during the curing period, cure the exposed concrete by one of the methods specified in Section 03300.

F. Construction loads exceeding the design loads shall not be imposed on any member unless it is properly shored and braced.

G. Use softwood wedges to release form faces from concrete. Do not pry with metal tool.

3.4 RESHORING:

A. When reshoring is permitted or required the operations shall be planned in advance and shall be subject to review.

B. Perform reshoring for the purpose of early form removal so that at no time will large areas of new construction be required to support their own weight. While reshoring is under way, no live loads shall be permitted on the new construction. Tighten re-shores to carry their required loads but do not over tightened so that the new construction is overstressed. Re-shores shall remain in place until the concrete has reached its specified 28-day strength, unless otherwise specified or permitted.

3.5 FIELD QUALITY CONTROL

A. Inspection: Obtain inspection and approval of forms before placing structural concrete.

END OF SECTION 03100

SECTION 03 20 00 CONCRETE REINFORCING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section is related to concrete reinforcement and includes:
1. Reinforcing steel for cast-in-place concrete foundations.
2. Reinforcing steel for cast-in-place concrete slabs-on-grade.
3. Supports and accessories for steel reinforcement.

B. Related Sections:
1. Section 03 10 00: Concrete Forming and Accessories.
2. Section 03 30 00: Cast-in-Place Concrete.
3. Section 05 12 00: Structural Steel Framing.

C. Reference Standards:
1. ACI 301 Specifications for Structural Concrete.
2. ACI 318 Building Code Requirements for Structural Concrete and Commentary.
3. ACI SP-066 ACI Detailing Manual.
4. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
5. ASTM A706/A706M Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
6. ASTM A775/A775M Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
7. ASTM D3963/D3963M Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
8. AWS D1.4 Structural Welding Code - Reinforcing Steel.
9. CRSI Concrete Reinforcing Steel Institute Manual of Standard Practice.
10. CRSI Concrete Reinforcing Steel Institute Placing Reinforcing Bars.

1.3 SUBMITTALS

A. See Section 01 33 00: Submittal Procedures.

B. Shop Drawings:
1. Comply with requirements of ACI SP-066. Include the following:
   a. Complete bar layout.
   b. Representative sections.
   c. Details for congested conditions.
   d. Proposed layout where vertical and horizontal bars intersect.
   e. Bar schedules.
   f. Typical bending diagrams and offsets.
   g. Shapes of bent bars.
   h. Spacing of bars.
   i. Splice lengths and locations.

C. Where welding is proposed:
1. Detail welding to conform to AWS D1.4.

2. Submit copies of welding operator's certificate.
3. Where reinforcement complying with ASTM A615 is to be welded, chemical tests shall be performed to determine the weldability in accordance with ACI 318.
4. Weld procedure specifications (WPS):
   j. All WPS's shall be submitted to the Structural Engineer of Record (SEOR) for review and approval prior to use.
   k. For WPS's that have been qualified by test, the supporting Procedure Qualification Record (PQR) shall be submitted to the SEOR for review and approval.
   l. Included shall be WPS for repair welds.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A. Comply with the pertinent provisions of Section 01 40 00: Quality Requirements.

B. Perform work of this Section in accordance with ACI 301.

C. Welders' Certificates: Submit certifications for welders employed on the Project, verifying AWS qualification within the previous 12 months.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 60 00: Product Requirements, delivering materials in a timely manner to ensure uninterrupted progress.

B. Bundle bars, tag with identification, and transport and store so as not to damage any material. Use metal tags indicating size, length, and other marking shown on placement drawings. Maintain tags after bundles are broken.

C. Avoid exposure to dirt, moisture, or conditions harmful to reinforcement.

D. Extra Material:
1. Provide an allowance of an additional ten percent (10%) of the total reinforced steel tonnage in addition to the quantities shown on the Drawings. This additional steel shall be installed in sizes and locations as directed by the structural Engineer.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel:
1. ASTM A615/A615M, Grade 60 (60,000 psi):
   m. Deformed billet-steel bars.
   n. Unfinished.
   o. Only to be used for conditions where bars will not be welded.

B. Reinforcing Steel:
1. ASTM A706/A706M, Grade 60 (60,000 psi) deformed low-alloy steel bars:
   p. Unfinished.
   q. Used in all cases where welding of bars is required.

C. Reinforcement Accessories:
1. Tie wire: ASTM A1064, annealed copper bearing steel, minimum 16 gage, 0.0508 inch.
2. Chairs, bolsters, bar supports, spacers:

r. Sized and shaped for adequate support of reinforcement during concrete placement. Standard manufactured products shall conform to the Concrete Reinforcing Institute Manual of Standard Practice, latest edition.

3. Use dense precast concrete supports with embedded wire ties for reinforcement placed on grade. Elsewhere, use wire bar supports.

D. Welding electrodes: AWS D1.4, Table 5.1 and 5.3, low hydrogen electrodes, E8018 for Grade 60 steel.

2.2 REBAR SPLICING

A. Coupler Systems: Mechanical devices for splicing reinforcing bars conforming to the requirements of ACI 318; capable of developing 1.25fy of the steel reinforcing yield strength in tension and compression.

B. For reinforcement, all mechanical splices in Special Structural Walls, Special Moment Frames, and Concrete Diaphragms shall be Type 2, conforming to the requirements of ACI 318, capable of developing 1.25fy of the steel reinforcing yield strength in tension and compression, and develop the specified tensile strength of the spliced bar:

1. Products:
   s. Dayton Superior Corporation; Bar Lock Coupler System: www.daytonsuperior.com (ICC-ESR 2481).
   t. Lenton Lock Couplers (IAPMO-ES 129).

C. Dowel Bar Splicer with Dowel-Ins:

1. Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.
   u. Products:
      1) Dayton Superior Corporation; Dowel Bar Splicer D101A with Straight Dowel-In: www.daytonsuperior.com.
      2) Lenton Form Savers (IAPMO-ES 129).

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI - Manual of Standard Practice.

B. Bending and Forming:

1. Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials.
2. Do not heat reinforcement for bending.
3. Bend bars No. 6 size and larger in the shop only.
4. Bars with unscheduled kinks or bends are subject to rejection.
5. Use only tested and approved bar materials.

C. Welding:

1. Use only ASTM A706 steel where welding is proposed:
   v. Perform welding where shown or approved, by the direct electric arc process in accordance with AWS D1.4 using specified low hydrogen electrodes.
   w. Preheat six inches (6") each side of joint.
   x. Protect joints from drafts during the cooling process; accelerated cooling is prohibited.
   y. Do not tack weld bars.
   z. Welding shall not be done on or within two (2) bar diameters of any bent portion of a bar that has been bent cold.
   aa. Welding of crossing bars shall not be permitted for assembly reinforcement unless

authorized by the SEOR.

bb. Clean metal surfaces to be welded of all loose scale and foreign material.
cc. Clean welds each time electrode is changed and chip burned edges before placing welds.
dd. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration to the base metal.
ee. Cut out welds or parts of welds found defective with chisel and replace with proper welding.
ff. Fillet welds may be considered prequalified per AWS D1.4.
gg. Other welds are to be qualified per AWS D1.4.

D. Where ASTM A615 steel is to be used or occurs in existing elements and is to be welded:
1. Complete chemical analyses shall be performed to determine chemical composition and, for a new bar, provided in the mill certifications to determine weldability in accordance with ACI 318 with modifications per AWS D1.4.
2. The carbon equivalency (CE) shall be clearly defined and bars with a CE above 0.75 shall not be welded.
3. Welding Procedure Specifications and supporting PQRs with required testing per AWS D1.4 shall be provided for review and approval prior to welding.
4. These WPS and PQRs shall be specific to the CE as determined above, and shall, in addition to the other AWS requirement, include minimum and maximum preheat and interpass temperatures that are specified to the CE. This preheat and interpass temperature shall be strictly enforced in the field.
5. If separate shipments of bars vary the weldability, the process listed in the above requirements shall be repeated for these new bars.

E. Locate reinforcing splices not indicated on Drawings at point of minimum stress. Review locations of splices with SEOR.

PART 3 EXECUTION

3.1 PLACEMENT

A. Before placing bars, and again before concrete is placed, clean bars of loose rust and/or mill scale, dirt, oil, or any other coating that may be deleterious or could reduce bond with the concrete.

B. Securing in place:
1. Accurately place bars and wire tie in precise position where bars cross.
2. Bend ends of wire ties away from the forms.
3. Wire tie bars to the corners of ties and stirrups.
4. Support bars according to the Concrete Reinforcing Steel Institute (CRSI) "Placing Reinforcing Bars," using approved accessories and chairs.
5. Place precast concrete cubes with embedded wire ties to supporting reinforcing steel bars in concrete placed on grade and in footings.
6. Take adequate precautions to ensure that reinforcing bar position and spacing is maintained during concrete placement.

C. Do not displace or damage vapor barrier.

D. Maintain concrete cover around reinforcing per requirements on Drawings.

E. Splices:
1. Do not splice reinforcing bars at the points of maximum stress except where indicated.

2. Lap splices as shown or required to develop the full strength or stress of the bars.
3. Stagger splices in horizontal wall bars at least 48 inches longitudinally in alternate bars and opposite faces.

F. Field Welding: As specified for fabrication.

3.2 FIELD QUALITY CONTROL

A. Comply with all pertinent provisions of Section 01 40 00: Quality Requirements.

B. Supervision: Perform Work to this Section under supervision of a capable superintendent.

C. An independent testing agency, as specified in Section 01 40 00: Quality Requirements, shall inspect installed reinforcement for conformance to Contract Documents before concrete placement.

D. Where welding is done in the shop or at the site, perform welding of reinforcing bars under inspection of the testing laboratory welding inspector in accordance with Chapter 17 of the CBC. The welding inspector shall make a systematic record of all welds:
1. Identification marks of welders.
2. List of defective welds.
3. Manner of correction of defects:
   hh. The welding inspector shall check the material, equipment details of construction and procedures, as well as the welds. The inspector shall check the ability of the welder. The welding inspector shall furnish the structural Engineer and the enforcement agency with a verified report that the welding required to be inspected is proper and has been done in conformity with the approved Plans and Specifications. The welding inspector shall use all means necessary to determine the quality of the weld. The inspector may use gamma ray, magnaflux, trepanning, sonics, or any other aid to visual inspection, which the inspector may deem necessary to assure the adequacy of the welding.

END OF SECTION 03 20 00

SECTION 03300 – CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install cast in place concrete as indicated on the drawings and specified including, the following:

1. Placing, patching, and initial curing of cast-in-place concrete unless otherwise specified.

   Fly ash shall be used to replace minimum 20% of the portland cement in the mix.

2. Grout and drypack, except as otherwise specified.
3. Placing of embedded anchor bolts and inserts.
4. Miscellaneous concrete work, including but not limited to areaways, cast-in-place valve boxes, pits, splash blocks, equipment bases, and other items as shown or required to complete all Work.
5. Slurry concrete.

1.2 SUBMITTALS:

A. Shop Drawings: Not Required.

B. Product Data: Submit the coloring admix manufacturer's technical data for products, methods, and color control procedures.

C. Certificates: Certify that materials meet requirements of paragraph "Quality Assurance".

D. Delivery Tickets: With each transit truck, provide delivery ticket, signed by an authorized representative of the batch plant, containing all information required by ASTM C94, as well as time batched, type and brand of cement, cement content, maximum size of aggregate and total water content.

1.3 QUALITY ASSURANCE:

A. Compliance with Regulations: All materials shall comply with the current rules and regulations of the local air quality management district, with the rules regarding volatile organic compounds, and with FDA rules and regulations for dangerous substances in construction products.

B. Concrete Manufacturer: Furnish concrete from licensed commercial ready-mix concrete plants conforming to ASTM C94 and approved by Building Official. Requirements herein govern when exceeding ASTM C94.

C. Allowable Tolerances: Construct concrete conforming to the tolerances specified in ACI 117 "Recommended Tolerances for Concrete Construction and Materials", as applicable, unless exceeded by requirements of regulatory agencies or otherwise indicated or specified.

D. Source Quality Control: Refer to the following paragraphs for specific procedures. Concrete materials which, by previous tests or actual service, have shown conformance may be used without testing when so approved by the Architect and Building Official. Testing Laboratory shall perform following conformance testing.

1. Portland Cement: Furnish Mill Certificates, acceptable to Architect and Building Official, showing conformance with requirements specified; otherwise, the Testing Laboratory shall test each 250 barrels of cement in accordance with ASTM C150.

2. Aggregate For Normal Weight Concrete: Test the aggregate before and after concrete mix is designed and whenever character of aggregate varies or source of material is changed. Include a sieve analysis. Obtain samples of aggregates at the dry batching or ready-mix concrete plant in accordance with ASTM D75 and perform tests for the following properties:

PHYSICAL PROPERTIES		
Physical Properties, units	**Test Method**	**Minimum values**
Sieve analysis	ASTM C136	
Organic impurities	ASTM C40	Fine aggregate not darker than reference standard color
Soundness	ASTM C88	Loss after 5 cycles not more than 8 percent of coarse aggregate, nor more than 10 percent of fine aggregate
Abrasion	ASTM C131	Weight loss not more than 10.5 percent after 100 revolutions, 42 percent after 500 revolutions
Deleterious materials	ASTM C33	
Materials finer than No. 200 sieve	ASTM C117	Not over 1 percent for gravel, 1.5 percent for crushed aggregate
Reactivity potential	ASTM C227, C289, C342	Ratio of silica released to reduction in alkalinity not to exceed 1.0.
Sand equivalent	ASTM D2419	California sand equivalent values operating range not below 71 percent

3. Lightweight Aggregates: Test the lightweight aggregates before mix is designed and whenever the character of aggregate varies or source is changed in accordance with ASTM C330. Include a sieve analysis and report on unit weights, deleterious substances, unburned or underburned lumps, loss on ignition, soundness, and staining materials.

4. Color Control for Integrally-Colored Concrete: Color admix manufacturer shall furnish the services of his technical representatives equipped with wet-batch color control test devices at ready-mix plant and site as required to assure concrete of uniform color matching approved Samples, at no extra cost.

5. Exposed Architectural Concrete: Where exposed architectural concrete is indicated by the architect, concrete shall be constructed in accordance with the recommendations of ACI 303 – “Guide to Cast-in-Place Architectural Concrete Practice.”

6. Admixtures: The admixturer manufacturer’s technical representative shall review and approve the final mix designs with proposed admixtures for applicability to the project requirements.

1.4 CONCRETE MIX DESIGNS

A. **Testing Laboratory** shall design concrete mixes for concrete requiring 28-day compressive strength exceeding 2,500 psi. Contractor shall bear all costs for concrete mix designs.

B. **Strength Requirements**: Design mixes for structural concrete for minimum 28-day compressive strengths required by Drawings and Specifications. All mix designs for structural concrete shall be proportioned in accordance with ACI 318 – Chapter 5 and ACI 301. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve an average compressive strength 1,200 psi higher than the specified strength. This over-design shall be increased to 1,400 psi when concrete strengths over 5,000 psi are used.

C. **Basis of Mix Designs:** Design all mixes for workability and durability of concrete. Control mixes in accordance with ACI 318 – Chapter 4 and ACI 301. Make adjustments in water/cement ratios as necessary for required concrete strengths at the Contractor's expense. Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.

D. **Maximum Aggregate Sizes:** Not exceeding 3/4 of minimum clear space between bars and between bars and forms, nor larger than 1/5 of least dimensions between the forms. Design the mixes with 3/4" maximum size, except maximum 1-1/2" size for foundations and maximum 3/8" size at congested reinforcing or thin sections, when approved by the Architect.

E. **Lightweight Structural Concrete:** Design for air-dry density of 110 pounds per cubic foot maximum. With each mix design, include test reports showing that concrete covered by the mix design meets shrinkage test requirements specified under Article "Field Quality Control" herein, or include certified test reports showing conformance as furnished by ready-mix concrete manufacturer.

F. Air Content: All concrete shall contain an air-entraining agent producing air content of 3.5% to 6.5% by volume and adjusted for weather conditions, and other concrete requirements.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver all materials in timely manner to ensure uninterrupted progress of the Work.

B. Store materials by methods that prevent damage and permit ready access for inspection and identification.

1.6 PROJECT SITE CONDITIONS:

A. Do not place concrete during rain or adverse weather conditions without means to prevent all damage. Conform to requirements specified hereinafter whenever concrete placement is required during cold or hot weather.

PART 2 PRODUCTS

2.1 MATERIALS:

A. Portland cement: ASTM C150, Type I, Type II, low alkali. Do not change brand or source without prior approval.

B. White Portland Cement: ASTM C150, Type I, from one approved source. Use for integrally-colored concrete.

C. Aggregates:

1. Normal weight aggregates: ASTM C33.
2. Lightweight aggregates: ASTM C330, expanded shale type coarse aggregate, dry loose weight maximum 38 pounds per cubic foot, maximum 9/16" size; all aggregate vacuum or thermally fully saturated for pumped concrete.

D. Admixtures:

1. Chemical (Water Reducing) Admixture: ASTM C494, Type A, D, or E. Only one brand.

When used, are subject to approval of Architect.

2. Air-entraining admix: ASTM C260.

3. Pozzolan: ASTM C618, Class F or C Fly Ash, 100 pounds maximum per cubic yard, containing 1 percent or less carbon. Fly ash shall not be used in excess of 20 percent by weight of total cement quantity.

4. Super-Plasticizers (High Range Water Reducers): ASTM C494, Type F or G. Only one brand, when used, are subject to approval of architect.

5. Color Admixture: As indicated or approved by architect.

E. Water: From potable domestic source.

F. Curing Materials:

1. Liquid Curing compound: Comply with the requirements of ASTM C309 and as recommended in ACI 308 – “Standard Practice for Curing Concrete”.

2. Curing sheet: Comply with the requirements of ASTM C171, non-staining white types, and as recommended in ACI 308 – “Standard Practice for Curing Concrete.

G. Non-shrink grout: Conform to Corps of Engineers CRD-C 621, and as follows:

1. Metallic for concealed areas: Master Builders "Embeco 885," or equal, non-gas-forming and free of oxidizing catalysts and inorganic accelerators, used as dry or damp pack, or mixed to a 20-second flow (CRC-C 621), without segregation or bleeding at any temperature between 45 degrees F and 100 degrees F. Working time 30 minutes or more.

2. Non-metallic for exposed areas: Master Builders "Masterflow 928," or Euclid "Euco Hi-Flow Grout,” with same characteristics as specified for concealed areas.

3. Epoxy grout where indicated: Multi-component, premeasured, fast-curing combination of thermosetting resins and inert fillers, Master Builders "Ceilcote 648," Sikadur 42 Industrial Group-Pak by Sika Chemical Corporation, or Euclid "Euco High Strength Grout."

H. Drypack: Field mixture of 1 part Portland cement to 2 parts fine aggregate mixed to a damp consistency such that a ball molded in the hands will stick together and hold its shape. At Contractor's option, the specified admixture may be added for increased workability at lower water/cement ratio. In lieu of field mixing, Contractor may use factory mixed drypack material, such as Master Builders "SetGrout" or Euclid "Euco Dry Pack Grout."

I. Expansion Joint Filler: Asphalt impregnated fiber or non extruding foam type, conforming to

ASTM D994 and D1751, or D1752.

J. Construction Joint Materials: As approved by engineer, of profiles indicated.

K. Bonding Agent: "Weld-Crete," manufactured by Larsen Products Co., P.O. Box 2127, Rockville, MD 20852, Master Builders "Concresive," or equal.

2.2 CONCRETE MIXING

A. Furnish ready-mixed concrete from an approved concrete batch plant. Conform to ASTM C94, except materials, testing, and mix designs as specified herein. Use transit mixer trucks equipped with automatic devices for recording number of revolutions of drum.

B. Admixtures: All approved admixtures shall be introduced into the concrete at the batch plant. Field additions are not acceptable.

C. Slump: Adjust quantity of water so concrete at point and time of placing does not exceed the following slumps when tested according to ASTM C143. Use the minimum water necessary for workability required by part of structure being cast.

SLUMP AND WATER/CEMENT RATIOS

Part of Structure	**Maximum Slump Inches***	**Maximum Water-Cement Ratio**
Footings, foundation walls, and mass concrete.	4	0.60
Slabs on grade, reinforced and non-reinforced	4	0.60
Reinforced concrete over 8" thick	4	0.60
Reinforced concrete 8" or less thick	4	0.60
All other concrete	4	0.60

*If super-plasticizers are used, slumps may be as indicated by admixture manufacturer, with water-cement ratio unchanged or lower than slumps without admixture.

2.3 REQUIREMENTS FOR COLORED CONCRETE

A. Cement for the entire project shall be same type and brand, and from the same mill. Aggregate,

both fine and coarse, shall be supplied from one source. Mix design shall remain constant for all colored concrete. Slump shall not exceed 4 inches.

B. Mixers transporting concrete shall be thoroughly cleaned prior to loading colored concrete.

C. Pigments shall be added to mix at the plant, and shall be measured accurately. The mixer shall be operated at charging speed for 5 to 10 minutes while color is being added.

2.4 SLURRY CONCRETE

A. Slurry concrete shall conform to requirements of this section for regular concrete, except that testing will not be required. Slurring concrete shall contain not less than 2 sacks of cement per cubic yard. Aggregate may be material selected from excavation, free from organic matter, or imported fill, conforming to the following gradation:

Sieve Size	Percent passing
1-1/2"	100
1"	80 - 100
3/4"	60 - 100
3/8"	50 - 100
No. 4	40 - 80
No. 100	10 - 40

B. Sufficient water shall be added to produce a fluid, workable mix that will flow and can be pumped without segregation of aggregate. Materials shall be mechanically mixed until the cement and water are thoroughly dispersed.

PART 3 EXECUTION

3.1 PREPARATION FOR CONCRETE PLACING:

A. **Remove all free water** from forms before concrete is deposited. Remove hardened concrete, debris, and foreign materials from interior surfaces of forms, exposed reinforcing, and from surfaces of mixing and conveying equipment.

B. **Wetting:** Wet wood forms sufficiently to tighten up cracks. Wet other materials sufficiently to reduce adsorption and to help maintain concrete workability.

C. **Earth Subgrade:** Dampen 24 hours before placing concrete, but do not muddy. Re-roll where

necessary for smoothness and remove loose material.

D. **Gravel Fill:** Recompact disturbed gravel and bring to correct elevation.

E. **Sand Beds or Subslab Drainage Fill:** Recompact disturbed material and bring to correct elevation.

3.2 CONCRETE PLACING

A. **Conveying and Placing:** Do not place concrete until the reinforcing steel, forms, or metal decking have been approved. Do not use aluminum tubes or any aluminum equipment for pumping concrete, nor allow concrete to free fall from its point of release at mixer, hoppers, tremies, or conveying equipment more than 6 feet for concealed concrete and 3 feet for exposed concrete. Deposit concrete so that the surface is kept level throughout, a minimum being permitted to flow from one portion to another. Place concrete in horizontal layers not more than 18" thick within 45 minutes after water is first added to the batch. Place concrete by methods that prevent segregation of materials.

1. Where new concrete is placed against or on old or existing concrete, clean and roughen existing surface to 1/4” amplitude and apply bonding agent to properly prepared surface of old concrete prior to placement of new concrete.

B. **Joints In Concrete:** Locate joints only where approved, and obtain prior approval for points of stoppage of any pour. Clean and roughen the surface of construction joints by removing the entire surface and exposing 1/4" amplitude of clean aggregate solidly embedded in mortar matrix by sandblasting, chipping, use of an approved surface retarder, or equal. Water and keep hardened concrete wet for not less than 24 hours and slush with portland cement slurry just before placing joining concrete. Cover horizontal surfaces of existing or previously placed and hardened concrete with a 2" thick layer of fresh concrete less 50% of coarse aggregate just before balance of concrete is placed.

C. **Compacting:** Compact each layer of the concrete as placed with mechanical vibrators or equivalent equipment. Transmit vibration directly to concrete and in no case through the forms unless approved. Accomplish thorough compaction. Supplement by rodding or spading by hand

adjacent to forms. Compact concrete into corners and angles of forms and around reinforcement and embedded fixtures. Recompact deep sections with congestion due to reinforcing steel as required.

D. Operation of Vibrators: Do not horizontally transport concrete in forms with vibrators nor allow vibrators to contact forms or reinforcing. Push vibrators vertically into the preceding layers that are still plastic and slowly withdraw, producing maximum obtainable density in concrete without creating voids or segregation. In no case disturb concrete that has partially set. Vibrate at intervals not exceeding two-thirds the effective visible vibration diameter of the submerged vibrator. Avoid excessive vibration that causes segregation. Use and type of vibrators shall conform to ACI 309 "Recommended Practice for Consolidation of Concrete".

E. Correction of Segregation: Before placing next layer of concrete, and at the top of last placement for vertical elements, remove concrete containing excess water or fine aggregate or showing deficiency of coarse aggregate and fill the space with compacted concrete of correct proportions.

F. Waterproof Membranes: Perform work adjacent to waterproof membranes to prevent damage to membranes. Arrange work so that membrane is left unprotected for minimum period of time, as approved. Prior to placing concrete, inspect the membrane and arrange for repair to all damage which may have occurred.

G. Concrete Encased Columns: Clean columns as specified for cleaning other steel in contact with concrete. When concrete is not carried to structure above, stop concrete perpendicular to column axis at the same elevation on all parts of all columns in the space. Float top neatly to column.

H. Slabs:

1. Float Finish: Place, consolidate, strike off and level concrete slab to proper elevation. Use highway straightedge, bull float or darby. Remove all bleed water. After the concrete has stiffened sufficiently to permit the operation, and water sheen has disappeared, the surface shall be floated, at least twice, to a uniform sandy texture.

2. On-Grade Slabs: Place with maximum 40-foot edge dimension. Generally locate joints on column lines, exact locations as directed or approved.

3. On-Grade Slab Construction and Contraction Joints: Use types as indicated at column lines and intermediate locations.

4. Expansion Joints: Conform to details and approved submittal. Provide expansion joint

filler finished flush with slab surface except for those joints shown to be sealed with sealant.

5. Control Joints: Provide for concrete slabs as indicated. At Contractor's option, "Soff-Cut" saw may be used to depth of 1-1/4" providing spalling or undercutting of the concrete does not occur, and in no case shall slab reinforcement be cut or damaged. Conventional saws shall be used as soon as possible without dislodging aggregate to 1/4 slab thickness. Complete sawing of joints within 12 hours after finishing is completed. If early sawing causes undercutting or washing of the concrete, delay the sawing operation and repair the damaged areas. The saw cut shall not vary more than 1/2 inch from the true joint alignment. Discontinue sawing if a crack develops ahead of a saw cut. Immediately after each joint is sawed, thoroughly clean the saw cut and adjacent concrete surface. Respray surfaces treated with curing compound which are damaged during the sawing operations as soon as the water disappears. Protect joints in a manner to prevent the curing compound from entering the joints.

3.3 COLD WEATHER PROVISIONS

A. **Conform to the provisions of ACI 306**, Recommended Practice for Cold Weather Concreting, except as modified herein.

B. **Normal Concrete:** When the temperature is below 40 degrees F. the temperature of the concrete placed in the forms shall be at least 60 degrees F. When the temperature is below 30 degrees F. the temperature of the concrete as mixed shall be 65 degrees F. In all cases, when the daily average temperature is below 40 degrees F. the concrete shall be kept at 55 degrees F. for the 72 hours and then allowed to drop uniformly to the air temperature over the next 24 hours.

1. Concrete temperature shall be measured by placing a thermometer 2" from the top of the concrete being placed.

C. **Air-entrained concrete** shall be kept at the above temperature for 27 hours and above freezing for an additional 72 hours.

D. **No calcium chloride** shall be used to accelerate hardening of concrete. Contractor to certify that any additive used does not contain calcium chloride.

E. **If low temperature accelerating admixture is proposed**, adjust concrete mix as required and obtain approval of Architect.

F. All concrete materials, reinforcement, forming materials and ground with which concrete is to come in contact shall be free of frost.

G. **The covering or other protection** used in connection with the curing shall remain in place and intact for at least 24 hours.

H. The work shall be protected from the elements, flowing water, and defacements of any nature during the construction operations.

3.4 HOT WEATHER PROVISIONS

A. Conform to ACI 305R and the following requirements.

B. Take extra care to reduce the temperature of the concrete being placed, and to prevent rapid drying of newly placed concrete. When the outdoor ambient temperature is more than 90 degrees F., shade the fresh concrete as soon as possible after placing, and start curing as soon as the surface of the fresh concrete is sufficiently hard to permit it without damage.

C. Concrete placement temperatures shall be controlled by the Contractor and shall not be limited to:

1. Shading and cooling the aggregate;
2. Avoiding use of hot cement;
3. Cooling mixing water by additions of ice;
4. Insulating water supply lines and tanks; and
5. Insulating mixer drums or cooling them with sprays or wet burlap.

3.5 CONCRETE CURING

A. Comply with the recommendations of ACI 308 – “Standard Practice for Curing Concrete.”

B. Keep forms containing concrete in a wet condition until removed. Keep concrete continuously moist for not less than 7 days after placement. Keep concrete moist with a fine fog water spray until protected by curing media.

C. During times of dry or excessive winds, high ambient temperature, low humidity, or other ambient conditions causing rapid drying, use specified evaporation retardant and finishing aid

material according to the manufacturer's instructions and cure concrete with a fine fog spray of water, or equal, applied both during and after finishing and continued until final curing operations are started.

D. Use the water curing method, curing sheet material, or a clear liquid membrane-forming curing compound except as otherwise specified.

E. Do not use any type of finishing or curing materials or methods that interfere with the correct application or bonding of subsequent materials; verify exact requirements as they apply to all applicable materials.

3.6 PATCHING FORMED CONCRETE

A. Remove fins, projections, and offsets. Cut out rock pockets, honeycomb, and all other defects to sound concrete, with edges of cuts straight and back-beveled. Dampen cut-outs and edges, and scrub with neat portland cement slurry just before patching, or an apply approved epoxy concrete adhesive.

B. Saturate form tie holes with water and fill voids and patches with flush smooth-finished mortar of same mix as concrete (less coarse aggregate), cure, and dry.

3.7 FINISHING

A. Match up finish work to adjacent or nearby surfaces at all joints, edges, and corners. Coordinate sawn joints, to keep all joints straight and continuous. Keep joint lines uniform and free of damage.

B. Floating, troweling, and special finishes shall be as noted on the Drawings. Do not begin floting until bleed water is gone and avoid over-troweling. Do not dust cement to expedite troweling start time. Remove any marks left by finishing tools.

C. Complete finishes as shown on the Drawings including trowelded finish for walking surfaces or those receiving floor covering or membrane. Broom finish shall be light, medium or coarse, at the direction of the architect. Scratched finish for surfaces to receive Cementitious material. Non-slip finish for steps, landings, platforms, and ramps.

D. After first floating check plane of surface with 10’ steel straightedge. Finish work, measured with a 10’ straightedge, must be a tolerance of 1/8” in 10’ in any direction for slabs under flooring; a true plane of 1/4” in 10’ for intermediate grade work.

3.8 GROUTING AND DRYPACKING

A. Install as indicated or required. Where grouting and drypacking is part of the work of other sections, it shall conform to the following requirements, as applicable.

B. Drypacking: Mix materials thoroughly with minimum amount of water. Install drypack by forcing and rodding to fill voids and provide complete bearing under plates. Finish exposed surfaces smooth and cure with damp burlap or liquid curing compound.

C. Non-Shrink Grouting:

1. Mixing: Mix the approved non-shrink grout material with sufficient water per manufacturers recommendations.

2. Application: Surfaces to receive the non-shrink grout shall be clean, and shall be moistened thoroughly immediately before placing the mortar. Before grouting, surfaces to be in contact shall be roughened and cleaned thoroughly, all loose particles shall be removed and the surface flushed thoroughly with neat cement grout immediately before the grouting mortar is placed. Place fluid grout from one side only and puddle, chain, or pump for complete filling of voids; do not remove the dams or forms until grout attains initial set. Finish exposed surfaces smooth, and cure as recommended by grout manufacturer.

3.9 OFF-SITE CONCRETE WORK

A. Provide new concrete items where indicated, and replace existing items damaged by Contractor's operations. Secure and pay for required permits, inspections, engineering, and surveying.

3.10 SLURRY CONCRETE

A. Slurry concrete may be used as fill or backfill where indicated or approved by the geotechnical engineer. Slurry concrete shall be placed within 1 hour after mixing, and shall be placed in manner that will prevent voids in, or segregation of, the concrete.

B. Backfilling over slurry concrete shall not be done less than 4 hours after placing.

3.11 FIELD QUALITY CONTROL

A. Level of Floors: Continuously monitor concrete placing to maintain level floor by use of an instrument level, transit, or laser.

B. Continuous Inspection: Construct structural concrete exceeding 2,500 psi compressive strength under continuous inspection of Inspector. Obtain inspection and approval of forms and reinforcing by Building Department as required and by the Inspector before placing structural

concrete.

C. Testing of Concrete: Testing Laboratory shall perform following tests. Samples for testing shall be obtained in accordance with ASTM C172, and shall be taken from as close to point of placement as possible.

1. Compressive Strength Tests: Cast one set of four or more cylinders from each day's placing and each 150 cubic yards, or fraction thereof, or not less than once for each 2,000 square feet of surface area for slabs and walls, of each strength of structural concrete. Date cylinders, assign record number, and tag showing the location from which sample was taken. Also record slump test result of sample. Do not make more than two series of tests from any one location or batch of concrete.

2. Test Cylinders: Samples will be made in accordance with ASTM C172. Cast cylinders according to ASTM C31; 24 hours later, store cylinders under moist curing conditions at about 70 degrees F. Test according to ASTM C39 at 7 and 28 day ages. The remaining cylinder shall be kept in reserve in case tests are unsatisfactory.

3. Control Test Cylinders: Cast a set of two or more cylinders for each day's placing of concrete for slabs supported on shoring. Place test cylinders on slabs represented by cylinders and cure the same as slabs. Test cylinders to determine proper times for removal of shores and reshoring. A strength test shall be the average of the compressive strengths of 2 cylinders made from the same sample of concrete.

D. Tests for Lightweight Structural Concrete: Perform following test for each 150 cubic yards of lightweight structural concrete.

1. Along with slump test, ASTM C143, and from same sample, determine air content, unit weight and yield per ASTM C138.

2. Shrinkage Test: Cast 4" by 4" by 11" long bars with 10" effective gauge length, cured for 7 days in moist room and as specified in ASTM C157. Make measurements at 7-day intervals to 35 day age. Allowable shrinkage shall not exceed 0.05% after period of 35 days.

3. Previous Shrinkage Tests: Ready-mix concrete manufacturer may furnish certified test reports from an approved Testing Laboratory as proof of meeting shrinkage requirements provided aggregates used and concrete covered by such test reports conform to the mix design approved for use on the Work.

E. Core Tests: If tests show the compressive strength of any concrete falls below the required minimum, additional testing of concrete which unsatisfactory tests represent may be required. Make core tests according to ASTM C42. Fill core holes with drypack concrete of strength required for concrete. Contractor shall bear cost of tests for below-strength concrete even if such tests indicate concrete has attained required minimum compressive strength, and all costs for required corrections.

END OF SECTION 03300

SECTION 03 35 47 CONCRETE FLOOR SLAB MOISTURE VAPOR CONTROL SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes furnishing, installing, and testing of systems for control of moisture vapor and pH for interior concrete slabs to receive moisture-sensitive finish floor coverings.

B. Related Sections:
1. Section 03 30 00: Cast-In Place Concrete.
2. Section 04 22 00: Concrete Unit Masonry.

C. Reference Standards:
1. ASTM F3010 Standard Practice for Two-Component Resin Based Membrane- Forming Moisture Mitigation Systems for Use Under Resilient Floor Covering.
2. ASTM C1583 Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
3. ASTM D7234 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
4. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
5. ICRI Guide 310.2R Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.
6. RFCI Recommended Work Practices for the Removal of Resilient Floor Coverings, Resilient Floor Covering Institute.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the requirements and Conditions of the Contract in Division 01 Specification Sections.

B. Product Data:
1. Submit manufacturer’s data sheets and supporting information for each product and process specified including:
   a. Product specifications.
   b. Installation instructions.
   c. Manufacturer’s certification that moisture vapor control products meet requirements of current version of ASTM F3010.
   d. Independent test reports supporting product manufacturer’s certificate of conformance to ASTM F3010.
   e. Completed manufacturer’s pre-installation checklist.
   f. Warranty information.

C. Moisture Tests: Submit concrete floor moisture test results required by floor covering manufacturer. Perform moisture testing as described in ASTM Practice F710. Testing shall be performed according to the floor covering manufacturer’s specified ASTM Standard Test Method by an independent testing agency. Testing shall be performed by ICRI Tier 2 certified moisture testing technician. Provide moisture test results to Architect, Owner,

General Contractor, and moisture vapor control system manufacturer's representative.

1.4 QUALITY ASSURANCE

A. Qualifications of Applicator:
   1. Employ an applicator trained and currently approved by the moisture vapor control system manufacturer, experienced in surface preparation and application of the products of this Section, and subject to observation by the manufacturer.
   2. Submit list of at least three (3) similar projects performed by the applicator within the previous five (5) years that used the same products and similar moisture vapor control system design.

B. Manufacturer's Qualifications:
   1. Manufacturer shall have not less than ten (10) years' experience in manufacturing moisture vapor control systems. The moisture vapor control system must be specifically formulated and marketed for concrete floor slab moisture vapor control and pH control.

C. Provide manufacturer's standard 15-year warranty at no additional cost. Applicator of moisture vapor control system shall provide standard installation warranty for workmanship.

D. Mockup:
   1. Install the moisture control system in a minimum 100 square foot mockup area, using the same methods and equipment that will be used for the entire installation. Test tensile bond strength of the moisture mitigation system to the concrete substrate following ASTM D7234. The results must be equal to or greater than 200 psi with failure in the concrete before proceeding with installation of the moisture control system.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the jobsite in original unopened containers, clearly labeled with the manufacturer's name and brand designation. Each container shall be marked with batch or lot code traceable to manufacturing information.

B. Store products in an approved ventilated dry area; protect from dampness, freezing, and direct sunlight. Product shall not be stored in areas with temperatures in excess of 90 degrees F or below 50 degrees F unless permitted by manufacturer's instructions.

C. Handle products using methods that prevent breakage or damage of containers and prevent contamination of products.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Moisture vapor control system shall be the product of a single manufacturer.

B. Basis of Design:
   1. KOSTER VAP I® 2000 System by: KOSTER American Corporation
      Corporate Headquarters: 2585 Aviator Drive, Virginia Beach, VA 23453 Phone: (757) 425-1206 – Fax: (757) 425-9951
      Web address: www.kosterusa.com

C. Approved equal per Section 01 25 00: Submission Procedures and Form.

2.2 MATERIALS

A. General: Use materials of one manufacturer throughout the Project as hereinafter specified.

B. Moisture Vapor Control Coating:
1. Select from among the following products:
   g. KOSTER VAP I® 2000 12 hour setting time, low VOC, 2-part epoxy resin coating.
   h. KOSTER VAP I® 2000 FS 4 - 5 hour setting time, Zero VOC. 2-part epoxy resin coating.
   i. KOSTER VAP I® 2000 UFS 3 – 4 hour setting time, low VOC, 2-part epoxy resin coating.
   j. KOSTER VAP I® 2000 ZERO VOC 12 hour setting time, Zero VOC, 2-part epoxy resin coating.

C. Primer for Underlayment:
1. KOSTER VAP I® 06 Primer – non-porous substrate primer for use on VAP I® 2000 resin coating.

D. Self-Leveling Underlayment:
1. Select from among the following products:
   k. KOSTER SL.
   l. KOSTER SL Premium.
   m. KOSTER SC.

E. Primer for porous concrete containing excessive near-surface voids or high concrete surface profile:
1. KOSTER KB-Pox IN, low viscosity, high modulus, 2-part epoxy resin.

F. Repair Resin for Non-Movement Joints and Cracks:
1. KOSTER KB-Pox IN low-viscosity, high modulus 2-part epoxy gravity-feed, crack injection resin.

G. Thickening Agent for Repairing Spalls and Excessively Rough Concrete:
1. KOSTER TA fiber thickening agent, non-silica.

H. Movement Joint Sealant:
1. KOSTER FS-H polysulfide resin joint sealant.
2. Backer rod and accessory materials.

PART 3 EXECUTION

3.1 PROJECT/SITE CONDITIONS

A. Environmental Conditions:
1. Do not apply moisture vapor control system to surfaces that may be exposed to uncontrolled weather conditions such as precipitation, wind, direct sunlight, etc. Do not apply when moisture is accumulated on the surface of the concrete or if precipitation is anticipated before the moisture control coating has cured.
2. Do not apply moisture vapor control system when temperature is lower than 50 degrees F or higher than 90 degrees F or expected to fall outside this temperature range within 24 hours after application. Do not apply moisture vapor control coating when temperature is above 80 degrees F and rising or expected to rise during curing period of the moisture control coating.

B. Protection:

1. Protect moisture vapor control system after installation to prevent damage from topical moisture, direct sunlight, and construction traffic for a minimum period of 24 hours after application.

3.2 SCHEDULING

A. The independent testing agency will coordinate scheduling with Owner for moisture testing to permit sufficient time to test, submit and evaluate test results, and install the moisture vapor control system before installation of floor coverings.

B. The moisture vapor control system manufacturer's instructions must allow installation as early as seven (7) days after concrete placement.

3.3 EXAMINATION OF SUBSTRATE BEFORE INSTALLATION

A. Provide information required in moisture control system manufacturer's pre-job checklist. Submit completed checklist to moisture control system manufacturer for review before installation of the moisture control system.

B. Test concrete floor slab moisture prior to application of moisture control system:
   1. If moisture testing is performed, moisture testing shall be conducted according to the latest version of ASTM F2170 using relative humidity probes that have been allowed to equilibrate at each test location for at least two (2) hours. Provide report in accordance with ASTM F2170 and floor plan showing moisture test results.

C. Testing and evaluation for deleterious materials and contaminants that inhibit moisture control coating adhesion:
   1. It is the responsibility of Owner to provide a concrete floor slab free of contaminants and deleterious materials that can inhibit bond to the moisture control coating or develop deleterious reactions after the concrete floor slab is sealed.
   2. Concrete substrates must be structurally sound, solid, and meet industry standards as defined in ACI Committee 201 Report "Guide to Durable Concrete." Surfaces must be free of moisture-sensitive patching and leveling materials, adhesives, coatings, curing compounds, concrete sealers, efflorescence, dust, grease, oils, and any other materials or contaminants that can act as bond breakers.
   3. The floor slab surface must be capable of withstanding steel shotblast preparation to ICRI CSP3. Excessively weak, soft, dusty, cracked, or uneven surfaces may not be suitable substrates, and may require additional concrete surface removal or patching before application of the moisture control coating. Such compounds must be long term resistant to high moisture and high pH.
   4. Contaminated concrete may not be suitable to receive a moisture control coating. Testing and evaluation for contaminants and concrete condition is not required but is strongly recommended. Testing and evaluation of the floor slab can include:
      n. Solvent extraction and analysis for organic compounds such as oil, grease, plasticizers, silicones, solvents, and other chemical compounds that can inhibit bond to the epoxy moisture control coating.
      o. Microscopical (petrographic) examination according to ASTM C856 to evaluate the concrete condition, potential deleterious substances, and suitability for shot blasting and coating adhesion.
   5. Do not install moisture control system if substrate testing reveals unacceptable conditions.

3.4 SURFACE PREPARATION

A. Remove existing floor finishes including floor coverings, coatings, paint, and adhesives.

Follow RFCI Recommended Work Practices for the Removal of Resilient Floor Coverings.

B. Abrasive Surface Preparation:
   1. Grind perimeter of rooms and areas inaccessible to shot blasting using dry diamond media with vacuum dust extraction. Grind to ICRI CSP2. Do not smooth polish these areas. Grinding is allowed only in areas not accessible to shot blasting.
   2. Shot blast floors to ICRI CSP3. Shot blast as close as possible to walls, doorways, casework, and other permanently installed objects. Remove residual steel shot.
   3. Acid etching is not permitted.

C. Remove residual dust and debris by vacuum and dry sweeping. Do not use sweeping compound. Remove all foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, shot blast beads, etc.

D. Test concrete surface tensile strength after abrasive preparation in accordance with requirements of ASTM F3010 following Test Method C1583. If test results are less than 200 psi, repair concrete or repeat surface preparation to achieve required concrete surface tensile strength.

E. Repair non-movement cracks, control joints, and large surface defects such as spalls, holes, and voids in accordance with manufacturer's recommendations. Use low-viscosity, gravity fed crack mending resin for non-movement cracks and joints. Crack repair compound can be mixed with not more than three-parts clean, washed, dry silica sand for sawcut control joints and wide cracks. Brush interior walls of crack or joint with neat crack repair epoxy resin before applying sand-resin mixture. After curing, grind surface flush with surrounding concrete.

F. Repair spalls or excessively rough concrete surface using manufacturer's fiber thickening agent mixed 1:1 by volume with moisture control resin. Mix thickening agent and resin thoroughly to uniform creamy consistency and apply by trowel, working material tightly against clean, roughened concrete surface.

G. Do not fill designed movement joints with moisture control epoxy resin. Fill movement joints with manufacturer's recommended flexible joint filling compound or mechanical movement joint cover.

H. Reinforcing fibers that become visible after shot blasting must be removed and vacuumed leaving no fibers exposed above the concrete surfaces. Provide an uncontaminated, clean, sound surface.

3.5 MIXING

A. Mix two-part moisture control resin and hardener thoroughly for three (3) minutes in manufacturer supplied containers following manufacturer's requirements to obtain a homogeneous mixture. Use a low speed motor less than 400 rpm and a two-bladed Jiffy-type mixing blade only. Do not aerate.

B. If smaller quantities are required, maintain manufacturer's specified mix ratios by volume.

C. Do not dilute with solvent.

3.6 APPLICATION

A. After mixing, immediately pour material on the substrate in a ribbon. Empty can completely.

Do not invert can to drain on concrete.

B. Spread moisture control coating using manufacturer's recommended notched squeegee and back-roll with a 3/8-inch nap epoxy-rated, lint-free roller. Completely cover the entire concrete surface with a uniform application of the moisture control coating as quickly as possible and allow the coating to self-level. Work into a wet edge and assure continuity of the coating across the entire area.

C. Spread coating on ICRI CSP3 shot blasted concrete surface at 100 to 150 square feet per gallon. Concrete prepared to CSP3 coated at 100 to 150 square feet per gallon will yield average cured coating thickness 11 to 16 mils (0.011" to 0.016"). A rougher surface profile or a porous or absorptive concrete will require the use of more material to achieve sufficient coating thickness. KOSTER VAP I® 2000 moisture control coatings must be installed at a minimum layer thickness of at least 11 mils (0.011"). Less layer thickness results in a higher permeance of the cured coating that will not meet performance requirements of ASTM F3010.

D. Allow coating to cure the minimum length of time specified for the product.

3.7 INSPECTION

A. Inspect cured moisture control coating for complete, uniform coverage. Note any defects to be repaired such as pinholes, bubbles, or thin spots.

B. Repair or install additional coats as necessary to produce a uniform, flat, smooth coating surface that meets manufacturer's minimum thickness requirements in all areas.

C. Test adhesion of the moisture control coating to the concrete substrate as required in ASTM F3010 following Test Method D7234. Tensile bond strength of the coating must be at least 200 psi with failure in the concrete. Repair or replace areas that do not meet this requirement.

3.8 CEMENTITIOUS UNDERLAYMENT

A. After installation of the moisture control coating, self-leveling cementitious underlayment or trowelable cementitious skim coat can be installed:
   1. Apply KOSTER VAPI®06 Primer at 650 to 800 square feet per gallon using a non-linting short-nap roller. Apply a thin, uniform coating over the entire cured moisture control epoxy coating. Do not dilute with water or solvent. Do not apply thicker than 650 square feet per gallon.
   2. Mix and apply KOSTER SL standard underlayment, KOSTER SL Premium underlayment, or KOSTER SC skim coat following manufacturer's instructions. Allow to cure and dry according to manufacturer's instructions before installing floor coverings.

3.9 CLEANING

A. Clean tools and equipment in contact with epoxy resins using xylene or other suitable cleaning agent immediately after use.

B. Remove debris and unused materials from Project site. Dispose chemicals, rags, and other materials in accordance with applicable regulations and specific jobsite instructions.

3.10 PROTECTION

A. Protect applications of the moisture control system during the specified cure period from

traffic, topical moisture, and contaminants.

B. Protect installed cementitious underlayment or skim coat until floor covering installation.

END OF SECTION 03 35 47

SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:
1. Coordinate the work of this Section with related trades.
2. Verify applicable dimensions, clearances, and heights at the jobsite.
3. Furnish materials and perform labor required to execute this work as indicated on the Drawings, as specified herein, and as necessary to complete the work required by Project conditions, including but not limited to:
   a. Structural steel.
   b. Architectural steel.
   c. All cast-in-place bolts, nuts, plates, etc.
   d. Ten-gauge steel or 3/4-inch plywood templates for column anchor bolts.
   e. Field filling of holes in steel beams and columns.
   f. Field preparation, priming, and finish painting of all exposed exterior steel:
      1) Field preparation, priming, and painting of interior exposed steel, including but not limited to:
         a) Structural steel.
         b) Exposed columns, beams, etc.
         c) Refer to Section 09 90 00: Painting and Coating and Drawings.
      2) Field preparation, priming, and painting of exterior exposed steel, including but not limited to:
         a) Structural steel.
         b) Exposed columns, beams, etc.
         c) Refer to Section 09 90 00: Painting and Coating and Drawings.

B. Related Sections:
1. Section 01 74 19: Construction Waste Management and Disposal.
2. Section 03 30 00: Cast-In-Place Concrete.
3. Section 05 31 00: Steel Decking.
4. Section 09 90 00: Painting and Coating.

C. Reference Standards:
1. 2019 California Code of Regulations (CCR), Title 24, California Building Standards Commission (CBSC) www.bsc.ca.gov current edition at time of permit issuance:
   g. (CCR) Title 24, (CBSC) Chapter 11 – California Green Building Standards Code:
      1) Non-residential new construction:
         a) All occupancy types.
         b) First time tenant improvements.
2. 2010 ADA Standards.
3. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines, current version.
4. Refer to Specifications, including, but not limited to California Building Codes. Associations, Standards, Definitions, and Miscellaneous Requirements.
5. American Institute of Steel Construction (AISC):
   h. AISC Steel Construction Manual, including, but not limited to:
      1) Specification for Structural Steel Buildings, most current edition.

2) RCSC Specification for Structural Joints.
3) Code of Standard Practice for Steel Buildings and Bridges.

i. AISC Specifications for Architecturally Exposed Structural Steel.
j. AISC 303.
k. AISC 360.

6. American Society For Testing and Materials (ASTM):
   l. ASTM A6 Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
   m. ASTM A36 Standard Specification for Carbon Structural Steel.
   n. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; Types E or S, Grade B.
   o. ASTM A108 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
   p. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
   q. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   r. ASTM A327 Standard Test Methods for Impact Testing of Cast Irons.
   s. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; Grade B.
   t. ASTM A563 Standard Specification for Carbon and Alloy Steel Nuts.
   u. ASTM A992 Standard Specification for Structural Steel Shapes.
   v. ASTM E23 Standard Test Methods for Notched Bar Impact Testing of Metallic Materials.
   w. ASTM E94 Standard Guide for Radiographic Examination Using Industrial Radiographic Film.
   x. ASTM E164 Standard Practice for Contact Ultrasonic Testing of Weldments.
   y. ASTM F436 Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
   z. ASTM F959 Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series.
7. American Welding Society (AWS):
   aa. AWS Standard Code for Arc and Gas Welding in Building Construction.
8. Welding Procedures Specifications (WPS).
9. Steel Structures Painting Council (SSPC).

1.3 SUBMITTALS

A. Refer to Section 01 33 00: Submittal Procedures and Section 01 25 00: Substitution Procedures and Form.

B. Submit Manufacturer's Data and Shop Drawings:
   1. Product data: Include laboratory test reports and other data to show compliance with Specifications (include specified standards). Include certified copies of mill reports covering chemical and physical properties of each type of structural steel.
   2. Shop drawings:
      bb. Shop drawings shall include, but not be limited to:
         1) Complete details for fabrication and assembly of structural steel members, procedures, and diagrams.
         2) Complete schedules for fabrication and assembly of structural steel members, procedures, and diagrams.
         3) Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.
         4) Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorage's to be installed by others.
      cc. Dimensions required for locating structural steel for manufactured items such as

mechanical equipment, electrical equipment, dock levelers, etc., shall be coordinated and provided by the General Contractor. General Contractor shall also coordinate and provide dimensions to locate structural steel for window or equipment supports.

C. Submit Procedures:
1. Provide weld procedures for both pre-qualified welds and special welds to be submitted to the Owner's testing laboratory and the Architect. All Group 4 and 5 shapes and plates greater than two inches (2") shall have additional weld procedures and pre-qualification by testing prior to fabrication.
2. Provide installation procedure and inspection for direct tension indicator washers detailed in supplemental specifications provided by the manufacturer for approval.
3. Procedures shall be submitted for both shop and field welds.
4. Written description of preparation, priming, and finish painting of steel.

D. Compliance Letter Pertaining to Primer and Painting of Steel, Extent of Work, Products, etc.:
1. Refer to Section 09 90 00: Painting and Coating.

E. Coordination:
1. The following shall be provided; including, but not limited to:
dd. General Contractor, floor framing fabricator, floor framing Installer, roof framing fabricator, roof framing installer, metal decking installer, and mechanical contractor shall coordinate the size/dimensioning and extent of all roof and floor openings for mechanical equipment, ductwork, and shafts as part of their submittal to the design team.

1.4 QUALITY ASSURANCE

A. Refer to Section 01 40 00: Quality Requirements.

B. AISC Group 4 and 5 shapes and built up members shall meet the requirements for joints in AISC Sections J1.7, J1.8, J2.6, and M2.2.

C. All steel to be exposed and painted shall be repaired for an architectural finish.

D. Performance, Testing, and Inspection:
1. General:
ee. Comply with manufacturer's standards.
ff. Comply with state and local building codes.
gg. Jobsite inspections shall be done as herein specified and as listed in Drawings.
hh. Testing shall be done as herein specified and as listed in Drawings.
2. Standards:

Item	Name of Test	Performance	Testing Std.
Unidentified materials	Test Lab	Refer to Structural Plans	Refer to Structural Plans
Examine seam welds of structural tubes and pipes	Special Inspection	Refer to Structural Plans	Refer to Structural Plans
Material verification	Special Inspection	Refer to Structural Plans	Refer to Structural Plans
High-strength bolts, nuts and washers	Test Lab	Refer to Structural Plans	Refer to Structural Plans
Bearing type connections	Special Inspection	Refer to Structural Plans	Refer to Structural Plans
Slip critical connections	Special Inspection	Refer to Structural Plans	Refer to Structural Plans

Non-destructive testing of partial joint penetration welds and complete joint penetration welds	Ultrasonic or magnetic particle (Test Lab)	Refer to Structural Plans	Refer to Structural Plans
Comply with Standards, Codes, Drawings, Specifications, and in accordance with agencies having jurisdiction.			
Refer to Drawings and as herein specified.			

3. Testing and inspections:
   ii. General:
      1) Shall comply with 2019 CBC, including but not limited to Chapter 22.
   jj. Testing laboratory:
      2) An inspection and testing laboratory will be selected by the Owner for testing and inspection as required by the Contract Documents.
      3) The selected laboratory shall conform to the requirements of ASTM E329.
      4) Documentary evidence of such conformance shall be submitted to the Owner.
   kk. All materials, work, methods and equipment shall be subject to inspection at the mill, fabricating plant, and at the building site:
      5) Material or workmanship not complying fully with the Contract Documents will not be accepted.
      6) The General Contractor shall give the testing laboratory reasonable notice when ready for inspection and shall supply samples and test pieces and all facilities for inspection without extra charge.
      7) The Owner will assume the expense of making the tests and inspection except as otherwise specified in Section 01 40 00: Quality Requirements.
      8) All welding and high strength bolting shall be inspected. All high strength bolts shall be sampled and tested by an independent agency.
   ll. The testing laboratory will check field fabrication for conformance to the Drawings and the referenced standards.
   mm. Testing laboratory will inspect prime paint for thickness, coverage, and compliance with Specifications.
   nn. Cost of testing and inspection:
      9) Costs of testing and inspection of structural steel, except as specified hereunder and in Section 01 45 23: Testing and Inspecting Services, will be paid for by the Owner
      10) All transportation costs and per diem living costs for inspection at fabricators' plant further than 75 miles from the jobsite will be back charged to the General Contractor.
      11) It is assumed that all fabrication will take place in one shop location only. All additional inspection costs will be back charged to the General Contractor.
      12) All mill tests and costs of re-test of plain materials shall be at the expense of the General Contractor.
      13) Tests required due to General Contractor's failure to provide steel identifiable in accordance with the indicated ASTM designation shall be at the expense of the General Contractor.
      14) Re-testing of items that failed original tests due to General Contractor’s poor and/or failed construction shall be at the expense of the Contractor.
   oo. Structural steel testing and inspection:
      15) For shapes, plates, bars, pipe and tubing, manufacturer's certified mill test reports, and analysis for each heat will be acceptable in lieu of testing for steel identifiable in accordance with indicated ASTM designation. Mill test reports shall indicate the physical and chemical properties of all structural steel used. Correlate individual heat numbers with each specified structural section. Tests shall also be reviewed for supplemental requirements S91 and S5 per materials in this Section.

16) For unidentifiable steels listed above, one (1) tension and elongation test and one (1) bend or flattening test for each five (5) tons or fractional part thereof for each size will be performed by the testing laboratory:
    a) Comply with 2019 CBC.

pp. Welding Inspection:

17) All shop and field welded operations will be inspected by a qualified welding inspector employed by the testing laboratory. Such inspector will be a person trained and thoroughly experienced in inspection of welds on work requiring unquestioned reliability. The inspector's ability to distinguish between sound and unsound welding will be reliably established.
18) The welding inspector will make a systematic record of all welds. This record shall include:
    a) Identification marks of welders.
    b) List of defective welds.
    c) Manner of correction of defects.
19) The welding inspector will check the material, equipment, and procedure, as well as the welds. He will also check the ability of the welder. He will furnish the Architect with a report, duly verified by him, that the welding required to be inspected is proper and has been done in conformity with the Contract Documents, and that he has used all means to determine the quality of the welds.
20) All full penetration groove welds will be subject to ultrasonic testing. All defective welds shall be repaired and retested with ultrasonic equipment at the General Contractor’s expense.
21) Column flanges: An area extending six inches (6") above and below point where girder flanges are attached will be inspected. Column flange edges will be inspected visually and entire area ultrasonically for laminations, plate discontinuities, and non-metallic inclusions.
22) Ultrasonic testing will test all partial penetration groove welds.
23) When ultrasonic indications arising from the weld root are interpreted as either a weld defect or the backing strip itself, the Engineer and Owner will be notified. The Owner may require the removal of backing strip. The backing strip will be removed at the expense of the General Contractor, and if no root defect is visible the weld will be retested. If no defect is indicated on this retest, and no significant amount of base and weld metal have been removed, no further repair of welding is necessary. If a defect is indicated, it will be repaired and retested at General Contractor’s expense.
24) The technician to evaluate the quality of the welds will calibrate the ultrasonic instrumentation.
25) Other methods of inspection, for example, X-Ray, gamma ray, magnetic particle, or dye penetrant, may be used on welds if felt necessary by the inspection laboratory, and with the approval of the Owner:
    a) Comply with 2019 CBC Chapter 17, including but not limited to Sections; 1704.3.1.
26) Base metal thicker than 1-1/2 inch, when subjected to through thickness weld shrinkage strains, shall be ultrasonically inspected for discontinuities directly behind such weld before and after joint completion.
27) Tests of end-welded studs:
    a) Comply with 2019 CBC Section 1704.3.1 and AWS D1.1.
    b) Randomly test a minimum of ten (10) studs total with a minimum of three (3) from each heat. Physical properties shall conform to the minimums noted herein under Material Bolts.
28) Ultrasonic testing:
    a) At the discretion of the Owner’s testing agency, the ultrasonic testing frequency may be reduced but may not be less than the following:
        1. Initially, all welds requiring ultrasonic testing will be tested at the rate

of 100 percent in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than five percent (5%) of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25 percent. If the reject rate increases to five percent (5%) or more, 100 percent testing will be re-established until the rate is reduced to less than five percent (5%). The percentage of rejects will be calculated for each welder independently.

2. A sampling of at least 40 completed welds will be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over three feet (3') in length, each 12 linear inch increment of welds, one inch (1") or less in thickness, will be considered as one (1) weld. For evaluating the reject rate of continuous welds greater than one inch (1") thickness, each six (6) linear inches will be considered one (1) weld.

29) See structural plans for additional inspection requirements.

qq. High strength bolting tests and inspection:

30) Furnish certified test reports for each lot of bolts in accordance with Section 9 of ASTM A325:
   a) Install bolts under the supervision of a qualified inspector in accordance with Section 9, Research Council using ASTM A325 bolts.
31) Testing laboratory will visually inspect all high strength bolts for tension:
   a) The bolts with the largest load indicator gaps (approximately ten percent [10%]) will be checked with a metal feeler gauge.
   b) Comply with 2019 CBC Sections.
32) Direct tension indicator washer testing:
   a) Perform testing of not less than three (3) indicator washers for each diameter and grade of fastener in a calibration device capable of indicating bolt tension.
   b) The test assembly shall include flat hardened washers, if required in the actual connection, arranged as those in the actual connections to be tensioned.
   c) The calibration test shall demonstrate that the indicator washers indicates a tension not less than five percent (5%) greater than that required by Table 4 of the AISC Specification for Structural Joints using ASTM A325 bolts.
   d) Manufacturer's installation procedure as required in Section 01 33 00: Submittal Procedures, shall be followed for installation of bolts in calibration device and in all connections.

1.5 WARRANTY

A. Refer to Section 01 77 00: Closeout Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 01 60 00: Product Requirements.

B. Store materials to permit easy access for inspection and identification:
   1. Keep steel members off the ground, using pallets, platforms, or other supports.
   2. Protect steel members and packaged materials from erosion and deterioration.

C. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Single Source Responsibility: Specified items shall be from one (1) manufacturer for each product type.

B. Acceptable manufacturers shall be as herein listed and in Drawings:
1. Substitutions and deviations shall require Architect's approval and shall be given in letterform.
2. Refer to Section 01 33 00: Submittal Procedures.
3. Proposed alternate products must be equal in terms of chemical composition, color, finish, configuration, performance standards, etc.

C. All products and materials indicated shall be installed according to current listed Specification requirements and manufacturers specifications/recommendations.

D. Refer to Drawings, details, and other related Specification Sections, whether listed or not.

E. Details shall set basic requirements for size and configuration of systems.

2.2 MATERIALS

A. Structural Steel:
1. W shapes: ASTM A992 unless indicated otherwise on Drawings.
2. Channels and other rolled shapes: ASTM A36 unless indicated otherwise on Drawings.
3. Plates and bars: ASTM A36 unless indicated otherwise on Drawings.

B. AISC Group 4 and 5 shapes and plates greater than two inches (2") thick:
1. ASTM A36/ASTM A572 Grade 50 with supplementary requirements S91 Fine Austenitic Grain Size and S5 Charpy V-Notch (CVN) Impact Test.
2. For location of CVN test, see AISC figure C-A3.1c.
3. CVN test shall be per ASTM A673, frequency P and shall meet a minimum average value of 20 ft-lbs absorbed energy at 70^{o}F.
4. Elements of the moment frames only.

C. Cold-Formed Steel Tubing: ASTM A500, Grade B.

D. Steel Pipe: ASTM A53, Type E or S, Grade B.

E. Anchor Bolts:
1. All anchor bolts cast in concrete shall be headed bolts with cut threads conforming to:
   rr. ASTM A307 or ASTM A36 or ASTM F1554; Grade 36, or ASTM F1554; Grade 55 as indicated on Drawings.

F. Machine Bolts: ASTM A307.

G. High Strength Bolts, Nuts, and Washers:
1. Bolt specifications:
   ss. Bolts shall conform to the requirements of the most current adopted edition of the Specifications of the American Society for Testing and Materials for High-Strength Bolts for Structural Steel Joints, ASTM A325, Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength, as indicated on Drawings.
2. Bolt geometry:
   tt. Bolt dimensions shall conform to the current requirements of the American National

Standards Institute for Heavy Hex Structural Bolts.

uu. The length of bolts shall be such that the end of the bolt will be flush with or outside the face of the nut when properly installed.

3. Nut specifications:

vv. Nuts shall conform to the current chemical and mechanical requirements of the American Society for Testing and Materials Standard Specification for Carbon and Alloy Steel Nuts, ASTM A563.

4. Washers:

ww. Flat circular washers and square or rectangular beveled washers shall conform to the current requirements of the American Society for Testing and Materials Standard Specification for Hardened Steel Washers, ASTM F436.

5. Direct tension indicator washers – ASTM F959: TurnaSure DTI (www.turnasure.com), Type 325.
6. Tension control fastener system: Lohr (www.lohrfasteners.com), LeJeune Bolt (www.lejeunebolt.com), Nucor Fastener (www.nucor.com), or Cordova Bolt, Inc. (www.cordovabolt.com).

H. Threaded Stud Bolts:

1. Comply with ASTM A108:

xx. Tensile strength: 60,000 psi.
yy. Elongation in two inches (2”): 20 percent.
zz. Reduction of area: 50 percent.

I. Headed Stud-Type Shear Connectors:

1. Comply with ASTM A108 Grade 1015 or 1020 cold-finished carbon steel with dimensions complying with AISC Specifications:

aaa. Tensile strength: 60,000 psi.
bbb. Elongation in two inches (2”): 20 percent.
ccc. Reduction of area: 50 percent.

J. Provide hexagonal heads and nuts for all connections per ASTM A563, Appendix Table X1.1.

K. Electrodes for Welding:

1. Comply with AWS Code, E70 Series minimum.
2. Fabricator to select proper electrodes according to weld procedures as submitted.

L. Powder Driven Fasteners:

1. Tempered steel pins with special corrosive resistant plating or coating.
2. Pins shall have guide washers to accurately control penetration.
3. Fastening shall be accomplished by low-velocity piston-driven power activated tool.
4. Pins and tool shall be as manufactured by Hilti Fastening Systems (www.hilti.com).

M. Expansion Bolts: Hilti Fastening Systems (www.hilti.com) or approved equal.

N. Non-Shrink Grout: Refer to Section 03 30 00: Cast-In-Place Concrete.

O. Shop Primer:

1. Primer shall be compatible with primer and finish coats for exposed steel per Section 09 90 00: Painting and Coating.
2. Primers for concealed steel not to be painted per Section 09 90 00: Painting and Coating:

ddd. Type A material - Tnemec Company, Inc. Series 88HS Azeron H.S. Primer (www.tnemec.com):

1) Exposed conditions use primer in accordance with Section 09 90 00: Painting and Coating.

eee. Type B material - Tnemec Company, Inc. Series 90-97 Tneme-Zinc:
2) Exposed conditions use primer in accordance with Section 09 90 00: Painting and Coating.
fff. All paints shall meet the California Air Resources Board Standards.

P. Primers and Finish Paint: Refer to Section 09 90 00: Painting and Coating.

Q. Hole Filler for Steel Columns and Beams: JB Weld (www.jbweld.com).

2.3 STEEL STRUCTURES PAINTING COUNCIL (SSPC)

A. Cleaning Standards:
1. SSPC-Vis 1 Pictorial Surface Preparation Standards for Painting Steel Structures.
2. SSPC-SP2 Hand Tool Cleaning.
3. SSPC-SP3 Power Tool Cleaning.
4. SSPC-SP6 Commercial Blast Cleaning.
5. SSPC-PA2 Measurement of Dry Paint Thickness with Magnetic Gauges.

B. Paint:
1. As herein indicated and in accordance with Section 09 90 00: Painting and Coating.
2. Coordination of Work:
ggg. Review other Sections in which prime paints are to be provided to ensure compatibility of coatings system for various substrates.
hhh. Shop priming may be omitted if approved by Owner and covered under Section 09 90 00: Painting and Coating.
3. Requirements of regulatory agencies: Comply with applicable rules and regulations of governing agencies for air quality control.

C. Shop Primer:
1. All paints shall meet the California Air Resources Board Standards:
2. Concealed steel: As herein listed.
3. Exposed steel:
iii. Comply with Section 09 90 00: Painting and Coating.
jjj. Shop priming may be omitted if approved by Owner and covered under Section 09 90 00: Painting and Coating.

PART 3 EXECUTION

3.1 JOB CONDITIONS

A. All steel shall be dry and clean per paint manufacturer's recommendations as herein specified and listed in Section 09 90 00: Painting and Coating prior to field shop and/or field painting.

3.2 COORDINATION

A. Refer to Section 01 31 00: Project Management and Coordination.

B. General Contractor shall coordinate work as herein specified, in accordance with Drawings and as required to complete scope of work with all related trades.

3.3 SEQUENCING/SCHEDULING

A. Cooperate and coordinate this work with other trades for anchor bolts, and other required inserts, templates, painting, etc.:

1. Align this work prior to installation of other materials.

3.4 INSPECTION/EXAMINATION

A. Verification of Conditions:
   1. Examine areas and conditions under which work is to be performed.
   2. Identify conditions detrimental to proper or timely completion of work and coordinate with General Contractor to rectify.
   3. Do not proceed until unsatisfactory conditions are corrected.
   4. Proceeding with the work signifies that Contractor accepts the substrate, surfaces, and conditions, and any problems related to the substrate shall be repaired to the satisfaction of the Owner's representative without any additional cost to the Owner.

3.5 PREPARATION

A. Prepare work, substrates, etc. in accordance with manufacturer's recommendations.

B. Protection:
   1. Protect finish surfaces at all times from surfaces and material adjacent to them.
   2. Finish work defaced with other materials on surface shall be replaced.
   3. Protect work under this Section from damage by other trades.

3.6 FABRICATION

A. Exterior Steel: All exterior exposed steel shall be welded watertight to all steel including, but not limited to, steel columns, beams, outriggers, eave beams, metal decking, etc.

B. Shop Fabrication and Assembly:
   1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated:
      kkk. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
      lll. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

C. Connections: Weld or bolt shop connections, as indicted. Bolt field connections, except where welded connections or other connections are indicated.

D. High Strength Bolts: Install in accordance with requirements for A325 and A490 slip critical and snug tight conditions as indicated on Drawings. Tighten nuts by the turn-of-the nut method or by use of a direct tension indicator. Install hardened washers in conformance with AISC Specifications. Mark bolts that have been completely tightened with an identifying symbol. Final tightening of high strength bolts in webs of beam to column moment connection shall be performed after completion of flange welding.

E. Install high strength bolts with snug tight type connections with threads excluded from shear plane except as otherwise noted. Holes are 1/16 inch larger unless noted otherwise in Drawings. Tighten high strength bolts to the bolt tension required by the referenced AISC standard using direct tension indicators.

F. Unless noted otherwise, make holes 1/16 inch larger than the nominal bolt diameter unless noted otherwise in Drawings.

G. Welding, Shop, and Field: Weld by Shielded Metal Arc Welding (SMAW) method, submerged arc method, Flux Core Arc Welding (FCAW) method, or other method approved by AWS. Perform welding in accordance with AWS Code. All welders, both manual and automatic, shall be certified in accordance with AWS "Standard Qualification Procedure" for the Work to be performed. See paragraph "welding" herein, for detailed requirements. If sizes of fillet welds are not shown on Drawings, use AWS minimum weld size but not less than 3/16-inch fillet welds.

H. Bolt Holes for Other Work:
1. Provide holes required for securing other work to structural steel framing:
mmm. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.
nnn. Cut, drill, or punch holes perpendicular to metal surfaces and remove all burrs. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

I. High Strength Bolts:
1. Installation and tightening:
ooo. Handling and storage of fasteners - Fasteners shall be protected from dirt and moisture at the jobsite. Only as many fasteners as are anticipated to be installed and tightened during a work shift shall be taken from protected storage. Fasteners not used shall be returned to protected storage at the end of the shift. Fasteners shall not be cleaned of lubricant that is present in as-delivered condition.
ppp. Tension calibrator - A tension measuring device shall be required at all jobsites where bolts in slip-critical joints are being installed and tightened. The tension measuring device shall be used to confirm (1) the suitability to satisfy the requirements of AISC for the complete fastener assembly, including lubrication if required to be used in the work, (2) calibration of wrenches, if applicable, and (3) the understanding and proper use by the bolting crew of the method to be used. The frequency of confirmation testing, the number of tests to be performed, and the test procedure shall be as specified below, as applicable. The accuracy of the tension measuring device shall be confirmed through calibration by an approved testing agency at least annually.
qqq. Joint assembly and tightening of shear/bearing connections - Bolts in connections not within the slip-critical category shall be installed in properly aligned holes, but need only be tightened to the snug tight condition. The snug tight condition is defined as the tightness that exists when all plies in a joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. If a slotted hole occurs in an outer ply, a flat hardened washer or common plate washer shall be installed over the slot.
rrr. Joint assembly and tightening of connections requiring full pre-tensioning - Slip-critical connections shall be installed in properly aligned holes and tightened by one of the following methods:
1) Turn-of-nut tightening: When turn-of-nut tightening is used, hardened washers are not required except as specified in the AISC. A representative sample of not less than three (3) bolts and nuts of each diameter, length, and grade to be used in the Work shall be checked at the start of work in a device capable of indicating bolt tension. The test shall demonstrate that the method of estimating the snug-tight condition and controlling turns from snug tight to be used by the bolting crews develops a tension not less than five percent (5%) greater than the tension required for slip-critical connections.
2) Installation of alternate design bolts: A representative sample of not less than three (3) bolts of each diameter, length, and grade shall be checked at the jobsite in a device capable of indicating bolt tension. The test assembly shall include flat hardened washers, if required in the actual connection, arranged as in the actual connections to be tensioned. The calibration test shall demonstrate that each bolt develops a tension not less than five percent

(5%) greater than the tension required by AISC. Manufacturer's installation procedure shall be followed for installation of bolts in the calibration device and in all connections. When alternate design features of the fasteners involve an irreversible mechanism such as yield or twist-off of an element, bolts shall be installed in all holes of the connection and initially brought to a snug tight condition. All fasteners shall then be tightened, progressing systematically from the most rigid part of the connection to the free edges in a manner that will minimize relaxation of previously tightened fasteners prior to final twist-off or yielding of the control or indicator element of the individual fasteners. In some cases, proper tensioning of the bolts may require more than a single cycle of systematic tightening.

3) Mark bolts that have been completely tightened with an identifying symbol. Final tightening of high strength bolts in webs of beam to column moment connections shall be performed after completion of flange welding.

3.7 WELDING

A. General:
   1. Quality of materials and design and fabrication of all welded connections shall conform to AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Building," "AWS Code for Welding in Building Construction," and requirements of this Section:
      sss. Location and type of all welds shall be as shown. Make no other welded splices, except those shown on Drawings, without prior approval of the Architect and Engineer.

B. Exterior Steel: All exterior steel metal decking shall be welded continuous and watertight to steel connections.

C. Automatic Welding: Use electrode wire and flux for automatic and semi-automatic welding acceptable to Architect. All methods, sequences, qualification and procedures, including preheating, and post heating if necessary, shall be detailed in writing and submitted to the Architect for review.

D. Qualification of Welders:
   1. Structural steel welding: Manual and automatic welds for structural steel construction shall be made only by operators who have been previous qualified by tests to perform type of work required.
   2. Welders shall be checked by welding inspector. Those not doing satisfactory work may be removed and may be required to pass qualification tests again. All qualification testing shall be at the General Contractor’s expense.
   3. Only welders whose weld procedures and pre-qualification by testing that have passed shall be considered qualified for such welds.

E. Control cooling process after weld is completed by either step down post heat or thermal blankets as determined by procedures and pre-qualification.

F. Flame cut surfaces shall be ground to remove contaminated steel layer to provide welds proper fusion without impurities.

G. Preparation of Surface: Surfaces to be welded shall be free of loose scale, slag, rust, grease, paint, and any other foreign material.

H. Welding Equipment: Welding equipment to be used in each case shall be acceptable to welding inspector. Use equipment with suitable devices to regulate speed and manually

adjust operating amperage and voltage. The amperage capacity shall be sufficient to overcome line drop and to give adequate welding heat.

I. Remove runoffs tabs and grind surfaces smooth where the tabs would interfere with fireproofing and architectural finishes.

J. Automatic End-Welded Studs: Automatically end-weld in accordance with the manufacturer's recommendations in such a manner as to provide complete fusion between the end of the stud and the plates. There shall be no porosity or evidence of lack of fusion between the welded end of the stud and the plate. The stud shall decrease in length during welding approximately 1/8 inch for 5/8 inch, and 3/16 inch for 3/4-inch diameter. Stud sizes indicated on Drawings represent the finish stud height.

K. Welding requirements shall be as follows:
1. The General Contractor shall be required to furnish a fabrication/erection inspector and the Owner to employ a verification inspector. Visual inspection means that the inspector visually inspects the welding for adherence to the approved weld procedure specification starting with fit-up and proceeding through the welding process. Reliance only upon use of Non-Destructive Examination (NDE) at the end of the welding should be avoided. Use visual inspection in conjunction with NDE for a sound weld.
2. A Welding Procedure Specifications (WPS) shall be submitted to the Owner and the enforcement agency for acceptance prior to the start of work. The WPS shall be used in providing the required special inspection. The WPS shall contain the actual values to be used for the welding parameters and variable so that instruction is provided to welders; as a minimum the WPS shall list the position, electrode type, and size, travel speed, electrode stick-out, voltage and amperage with acceptable limits, bead size, weld sequence, stress relieving, and other pertinent data. A copy of the filler metal manufacturer’s technical data sheet shall be submitted with each WPS. Welding consumables must be used within the positions, thickness, temperatures, and other parameters provided by the manufacturer. For WPSs requiring qualification, Procedure Qualification Records (PQRs) shall also be submitted for acceptance. Production welding heat input should be limited based on the PQR.
3. WPSs for FCAW shall be qualified by testing. The tests shall include CVN tests to the weld metal.
4. SMAW and FCAW, both self-shielded (FCAW-SS) and gas shielded (FCAW-G), are suitable processes.
5. The maximum diameter for the flat and horizontal position shall be limited to 7/64 inch.
6. Maximum width and thickness of weld layers shall be:
   ttt. The thickness of a root layer shall not exceed 1/4 inch.
   uuu. The maximum width of a layer in any position shall not exceed 5/8 inch.
   vvv. The width of a weave bead shall not exceed three times the electrode (wire) diameter, d, when d > 3/32 inch, or five times the electrode diameter when d < 5/64 inch.
7. The filler metal used shall have a notch toughness not less than of 20 ft-lbs as measured by a standard CVN test, ASTM E23. The CVN test temperature shall be at least 0°F. The minimum required energy absorption is 20 ft-lbs average. One (1) specimen may be less than the minimum average, but not less than 15 ft-lbs. The test shall be conducted in accordance with the applicable filler metal specification and may be performed by the manufacturer.
8. For highly restrained joints, or where shrinkage is likely to cause problems, the General Contractor shall submit a weld shrinkage and distortion control plan to the Engineer/Owner for review to determine compliance with design intent.
9. All welds shall be started and ended with a full cross section weld for a minimum length of one inch (1”) on weld tabs (“run off” tabs) except at access holes in beam/girder webs. All weld tabs shall be removed, the affected area ground smooth and magnetic particle tested for defects. Minimum weld tab length shall be the greater of one inch

(1") or 1.5 times the beam flange thickness but need not exceed four inches (4").

10. If backing bars are used under the bottom beam flange to column flange CJP groove weld, the backing bar shall be removed, the removal area ground to sound, bright metal and the area magnetic particle tested for defects. A reinforcing fillet weld, at least 1/4 of the bottom flange thickness but not greater than 3/8 inch, shall be placed in this location.
11. If a backing bar is used under the top beam flange to column CJP groove weld and is not removed, the backing bar shall be attached to the column and beam flanges by either a fillet weld along the complete bar length on the underside of the bar, or by a partial penetration weld from the underside of the bar, for the full length of the bar. Other methods of welding the bar to the column and beam may be used subject to the Engineer's and Owner's approval.
12. Weld dams are not allowed. Weld dams are weld tabs not aligned in such a manner to provide an extension of the joint preparation. Weld dams are typically perpendicular to proper weld tabs.
13. All tack welds shall be of the same quality as the final welds. This includes requirements for preheat. All tack welds not incorporated into the final welds shall be removed.
14. Preheat, if required by the following requirement, shall be used for all welds including tack welds. Preheat and interpass temperatures shall be determined using the hydrogen controlled method. The maximum interpass temperature shall not exceed 550 degrees. Welds for sections in ASTM A6 Shape Size Groups 4 and 5 and plates with a thickness greater than 2-1/2 inches shall have a minimum preheat of 350°F. To ensure that the work piece is properly heated, the temperature of the part shall be measured at a distance from the axis of the weld equal to twice the thickness of the thickest part being welded, but in no case less than three inches (3") in all directions, including the through thickness dimension of the part being welded, for the full length of the weld joint. Preheat shall be verified by the inspector before welding commences. The cooling rate of the weldment shall be controlled with thermal insulation or other appropriate methods to a maximum of 250°F/hr.
15. An acceptable method for installing flat reinforcing plates aligned parallel to the top or bottom flange is as follows: The reinforcing plate for the bottom flange shall be welded to the column in the fabricating shop using a complete penetration, two-sided, double joint. This weld shall be inspected by ultrasonic examination. The balance of the welding is to be done in the field. The reinforcing plate for the top flange shall be shipped loose. After the top flange has been welded to the column, ultrasonically examined, and accepted, the top flange weld surface shall be prepared, and the reinforcing plate fitted for welding to the column. The reinforcing plate shall be restrained from rotation during welding to the column. After completion of the reinforcing plate to the column weld, the reinforcing plate shall be welded to the top flange.
16. Welders that will make welds with restricted access, such as, but not limited to, the beam bottom flange to column welds through a cope hole or access hole in the beam web, or where access to the bottom of a groove weld is restricted by the presence of a column flange, shall be qualified by the General Contractor using the same welding procedure as will be used for production and a mock-up assembly that simulates the construction configuration.
17. Mill scale shall be removed from the column in the area where the beam flange will be welded to the column.
18. General Contractor shall submit to the structural Engineer, for acceptance, a quality control or inspection plan that addresses all inspection issues, including in-process and final inspection.
19. The qualification of the General Contractor's Inspectors and NDE personnel shall be submitted to the Owner for acceptance.
20. In cases of differences of opinion between the Owner's inspector and the General Contractor's' inspector regarding conformance of a weld with the Specifications, the

issue shall be brought to the Owner's structural Engineer and the enforcement agency as part of the resolution process.

21. All groove welds in the girder-to-column connection shall be ultrasonically examined for the full length. Backing bar removal areas and fillet welds on continuity plates shall be examined for the full length by the magnetic particle testing (MPT) method.
22. Shear connection plates shall be sized so that they do not interfere with welders' access to make flange welds or to perform work that is required to install or remove backing or to place reinforcing fillet welds.

L. Cleaning, Priming, and Finish Painting:
1. All exterior steel and other locations indicated to be exposed or painted shall be sandblasted.
2. All interior steel shall be cleaned in accordance with SSPC guidelines:
www. Exposed steel shall be sandblasted for architectural appearance.

3.8 INSTALLATION/ERECTION

A. Exterior Steel: All construction shall be modified as approved by structural Engineer and Owner for a watertight finish product including, but not limited to, metal filler putty and welding for a watertight assembly typical.

B. Structural Steel Erection: Comply with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Building", current adopted edition at time of permit issuance.

C. Erection Sequence: Erect steel in accordance with special erection sequences where special erection sequences are indicated on the Contract Documents.

D. Before and during erection, keep all structural steel clean. Ship, handle, and store steel in manner to avoid injury to members. Steel members showing evidence to rough handling or injury will be rejected.

E. Mark each member with erection identification corresponding to mark shown on erection drawings. When marking steel in exposed conditions, the markings shall be made with easily removable chalk or similar pencil to avoid bleed through after painting. Carefully plan erection of structural steel so that no cutting and removal of material will be necessary. Do not torch burn in the field, unless specifically permitted by Engineer.

F. Provide sufficient bracing, shoring, and guys to effect safe and satisfactory erection. Provide bracing and shoring capable of holding steel work plumb and properly aligned while field connections are being made and until lateral force resisting elements are deemed by Architect capable of bracing structure. Temporary bracing shall be adequate to resist lateral forces from wind or seismic prior to the completion of the lateral resisting system.

G. Set bearing and base plates with extreme care. Bring level to line and grade with leveling plates or by leveling nuts and bolts. Grout solid under plates with a flowable non-shrink grout per Section 03 30 00: Cast-In-Place Concrete prior to applying vertical loads.

H. Field Assembly:
1. Set structural framing accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment:
xxx. Level and plumb individual members of the structure within specified AISC tolerances except as noted herein.

I. All welds shall be full and clean and conform to AISC and AWS specifications.

J. Erection Tolerances:
1. Individual pieces shall be erected so that the deviation from plumb, level, and alignment shall not exceed 1 to 500 except that:
yyy. The maximum overall height displacement of the centerline of columns at elevator shafts, from the established column line, shall not be more than one inch (1") at any point, measured from base of shaft to top of shaft.
zzz. In order to provide a true, flat plane for the exterior elevations, install all steel framing at the exterior walls of the building so that the center lines of such framing do not vary by more than one inch (1") for the length of the building.
aaaa. All columns and beams shall adhere to Section M2.7 of the referenced "Specification for Structural Steel for Buildings," which states that completed members shall be free of twists, bends, and open joints. Take special care that column base plates are parallel and perpendicular to faces of columns and that bolt holes are accurately placed.

K. Temporary Flooring:
1. Provide planking and scaffolding necessary in connection with erection of structural steel, support of erection machinery, and construction materials. Temporary floors and use of steel shall be as required by applicable regulatory requirements.
2. If steel decking is used as a working platform, it shall be temporarily tack-welded to supports to extent necessary for such use in accordance with applicable regulatory requirements. The concentrated loading from welding machines and other heavy machinery required for steel erection shall be distributed by planking or other approved means. Metal decking that becomes damaged as the result of being used as a working platform shall be replaced at no additional cost to the Owner.

3.9 PAINTING AND REPAIR/TREATMENT

A. General:
1. Prior to paint applications, clean all loose rust, mill scale, oil, dirt, and all other materials from all steel to be left exposed.
2. Clean contact surfaces of high strength bolts of all burrs and material that might prevent solid seating of the parts.
3. After erection, field touch up all welded areas, high strength bolts, and damaged areas. For all steel to remain exposed, remove all blemishes, paint drips, and touch up prime coat.
4. After erection of steel to be exposed and painted, fill in all dimples and like defects from steel rolling and other sources prior to finishing.
5. Shop prime all steel except the following:
bbbb. Steel encased in concrete.
cccc. Contact surfaces for high strength bolts.
dddd. Areas within four inches (4") of field welds.
eeee. Steel to be fireproofed.
ffff. Surfaces to be galvanized.
gggg. Steel that will be primed and finish painted under Section 09 90 00: Painting and Coating:
1) Coordinate with Section for type and schedule of painting.

B. Exposed Interior Steelwork - When approved by Architect, use the following cleaning and priming/finish painting schedule/method:
1. Use primer and finish paint as required under Section 09 90 00: Painting and Coating.
2. Surface preparation:
hhhh. Sequence:
1) First, use hand tool (SP-2) as required to assist with preparation.

2) Second, use power tool (SP-3) as required to assist with preparation.
3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
4) Fourth, use SSPC-SP6 Commercial Blast Cleaning as final preparation method.

3. Application - Follow coating manufacturer's printed directions:
iiii. Apply two (2) shop prime coats to areas that will be inaccessible after erection.
jjjj. Finish painting in field in accordance with Section 09 90 00: Painting and Coating:
1) Apply finish paint to area's concealed when installed in the field.
4. Material:
kkkk. Exposed: Refer to Section 09 90 00: Painting and Coating.
5. Number of Coats:
llll. Exposed: Refer to Section 09 90 00: Painting and Coating.
6. Dry Film Thickness:
mmmm. Exposed: Refer to Section 09 90 00: Painting and Coating.
7. Volume Solids:
nnnn. Exposed: Refer to Section 09 90 00: Painting and Coating.

C. Concealed Interior Steelwork - When approved by Architect, use the following cleaning and primer painting schedule/method:
1. For concealed conditions not to be finish painted, use primer paint as required under Section 09 90 00: Painting and Coating.
2. Surface Preparation:
oooo. Sequence:
1) First, use hand tool (SP-2) as required to assist with preparation.
2) Second, use power tool (SP-3) as required to assist with preparation.
3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
3. Application - Follow coating manufacturer's printed directions:
pppp. Apply two (2) shop prime coats to areas that will be inaccessible after erection.
4. Material:
qqqq. Exposed: Refer to Section 09 90 00: Painting and Coating.
5. Number of Coats:
rrrr. Exposed: Refer to Section 09 90 00: Painting and Coating.
6. Dry Film Thickness:
ssss. Exposed: Refer to Section 09 90 00: Painting and Coating.
7. Volume Solids:
tttt. Exposed: Refer to Section 09 90 00: Painting and Coating.

D. Exposed Exterior Steelwork - When approved by Architect, use the following cleaning and priming/finish painting schedule/method:
1. Use primer and finish paint as required under Section 09 90 00: Painting and Coating.
2. Surface Preparation:
uuuu. Sequence:
1) First, use hand tool (SP-2) as required to assist with preparation.
2) Second, use power tool (SP-3) as required to assist with preparation.
3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
4) Fourth, use SSPC-SP6 Commercial Blast Cleaning as final preparation method.
vvvv. Fill holes for watertight assembly:
5) First, weld all holes as approved by structural Engineer
6) Second, holes not approved to be welded shall be filled with INDUSTRO WELD by JB Industries.
7) Install in accordance with manufacturers printed instructions.
3. Application - Follow coating manufacturer's printed directions:
wwww. Apply two (2) shop prime coats to areas that will be inaccessible after erection.
xxxx. Finish painting in field in accordance with Section 09 90 00: Painting and Coating:

1) Apply finish paint to area's concealed when installed in the field.

4. Material:
   yyyy. Exposed: Refer to Section 09 90 00: Painting and Coating.
5. Number of Coats:
   zzzz. Exposed: Refer to Section 09 90 00: Painting and Coating.
6. Dry Film Thickness:
   aaaaa. Exposed: Refer to Section 09 90 00: Painting and Coating.
7. Volume Solids:
   bbbbb. Exposed: Refer to Section 09 90 00: Painting and Coating.

E. Concealed Exterior Steelwork - When approved by Architect, use the following cleaning and primer painting schedule/method:
   1. For concealed conditions not to be finish painted, use primer paint as required under Specification Section 09 90 00: Painting and Coating or as approved alternate by Architect.
   2. Surface preparation:
      ccccc. Sequence:
         1) First, use hand tool (SP-2) as required to assist with preparation.
         2) Second, use power tool (SP-3) as required to assist with preparation.
         3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
   3. Application - Follow coating manufacturer's printed directions:
      ddddd. Apply two (2) shop prime coats to areas that will be inaccessible after erection.
   4. Material:
      eeeee. Exposed: Refer to Section 09 90 00: Painting and Coating.
   5. Number of Coats:
      fffff. Exposed: Refer to Section 09 90 00: Painting and Coating.
   6. Dry Film Thickness:
      ggggg. Exposed: Refer to Section 09 90 00: Painting and Coating.
   7. Volume Solids:
      hhhhh. Exposed: Refer to Section 09 90 00: Painting and Coating.

3.10 HOISTING AND BRACING

A. Provide all hoisting and erecting equipment and power.

B. Provide and maintain any and all safety railings, toe boards, etc. required for the erection of steel framing and metal decking.

C. Brace the erected frame in a manner that will assure safety and proper alignment to receive the metal decking and until the concrete slabs have been poured and have set.

D. Erect building frame true and level. Erect columns in a manner to allow for movement due to welding shrinkage and thermal expansion and contraction of framing. Check plumbness after erection of each level. Maintain structural stability of frame during erection. Provide temporary bracing where necessary to maintain frame stability and to support required loads, including equipment and its operation.

3.11 PROTECTION AND CLEAN UP

A. Subcontractor will keep the work areas in a clean and safe condition so his rubbish, waste, and debris do not interfere with the work of others.

B. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades:
   1. Clean adjacent surfaces free of rust and oil, flux with mechanical action or solvent as

necessary, avoiding damage to other materials.

C. Perform work in accordance with manufacturer's recommendations, as herein specified, and in accordance with Drawings.

D. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no cost to the Owner.

E. After completion of work in this Section, remove all erection equipment and implements of service, and debris:
   1. Leave entire area in a neat, clean, acceptable condition.

F. Provide guarantee/warranties and bonds as required in this Section.

G. Provide record drawings in accordance with Section 01 77 00: Closeout Procedures and Section 01 78 39: Project Record Documents.

H. Closeout onsite inspection will be at the discretion of the Architect after he receives the General Contractor's notice of Certificate of Substantial Completion.

END OF SECTION 05 12 00

SECTION 05 12 13 ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes Architecturally Exposed Structural Steel (AESS):
   1. Requirements in Section 05 12 00: Structural Steel Framing also apply to AESS.

B. Related Sections:
   1. Section 05 12 00: Structural Steel Framing.
   2. Section 05 50 00: Metal Fabrications.
   3. Section 09 90 00: Painting and Coating.

1.3 DEFINITIONS

A. AESS: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.

B. Category 1 AESS: AESS that is within 96 inches vertically and 36 inches horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 1 architecturally exposed structural steel" or "AESS-1" in the Contract Documents.

C. Category 2 AESS: AESS that is within 20 feet vertically and horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 2 architecturally exposed structural steel" or "AESS-2" in the Contract Documents.

D. Category 3 AESS: AESS that is not defined as Category 1 or Category 2 or that is designated as "Category 3 architecturally exposed structural steel" or "AESS-3" in the Contract Documents or that is indicated to receive intumescent mastic fireproofing.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS are specifically identified and requirements below are met for AESS:
      a. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
      b. Include embedment drawings.
      c. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
      d. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation of bolt heads.

e. Indicate exposed surfaces and edges and surface preparation being used.
f. Indicate special tolerances and erection requirements.

B. Samples:
1. Submit samples of AESS to set quality standards for exposed welds:
a. Two (2) steel plates, 3/8 by eight (8) by four (4) inches, with long edges joined by a groove weld and with weld ground smooth.
b. Steel plate, 3/8 by eight (8) by eight (8) inches, with one end of a short length of rectangular steel tube, four (4) by six (6) by 3/8 inches, welded to plate with a continuous fillet weld and with weld ground smooth and blended.
c. Round steel tube or pipe, minimum eight inches (8”) in diameter, with end of another round steel tube or pipe, approximately four inches (4”) in diameter, welded to its side at a 45-degree angle with a continuous fillet weld and with weld ground smooth and blended.

C. Qualification Data: For installer and fabricator.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Mockups:
1. Build mockups of AESS to set quality standards for fabrication and installation:
a. Build mockup of typical portion of AESS as shown on Drawings.
b. Coordinate painting requirements with Section 09 90 00: Painting and Coating.
c. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Pre-Installation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration:
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.1 BOLTS, CONNECTORS, AND ANCHORS

A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies:
1. Type 1, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers:

a. Finish: Mechanically deposited zinc coating.

B. Corrosion-Resisting (Weathering Steel), Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: Type 3, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

2.2 FILLER

A. Filler: Polyester filler intended for use in repairing dents in automobile bodies.

2.3 PRIMER

A. Primer: Comply with Section 09 90 00: Painting and Coating.

B. Etching Cleaner for Galvanized Metal: MPI#25.

C. Galvanizing Repair Paint: ASTM A780/A780M.

D. Shop Primer for Galvanized Steel: MPI#26, cementitious galvanized metal primer.

2.4 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

B. In addition to special care used to handle and fabricate AESS, comply with the following:
1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
2. Grind sheared, punched, and flame-cut edges of Category 1 AESS to remove burrs and provide smooth surfaces and edges.
3. Fabricate Category 1 AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
4. Fabricate Category 1 and Category 2 AESS with exposed surfaces free of seams to maximum extent possible.
5. Remove blemishes by filling or grinding or by welding and grinding before cleaning, treating, and shop priming.
6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
7. Fabricate Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
8. Fabricate Category 2 and Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.
9. Seal-weld open ends of hollow structural sections with 3/8-inch closure plates for Category 1 AESS.

C. Curved Members:
1. Fabricate indicated members to curved shape by rolling to final shape in fabrication shop:
   a. Distortion of webs, stems, outstanding flanges, and legs of angles shall not be visible from a distance of 20 feet under any lighting conditions.
   b. Tolerances for walls of hollow steel sections after rolling shall be approximately 1/2 inch.

D. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch with a tolerance of 1/32

inch for Category 1 AESS.

E. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

F. Cleaning Corrosion-Resisting Structural Steel: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

G. Holes:
1. Provide holes required for securing other work to structural steel and for other work to pass through steel members:
   a. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   b. Baseplate holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   c. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.5 SHOP CONNECTIONS

A. High-Strength Bolts:
1. Shop install high-strength bolts according to RCSC's Specification for Structural Joints Using ASTM F3125 Bolts for type of bolt and type of joint specified:
   a. Joint type: Snug tightened or slip critical as indicated.

B. Weld Connections:
1. Comply with AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work, and comply with the following:
   a. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances.
   b. Use weld sizes, fabrication sequence, and equipment for AESS that limit distortions to allowable tolerances.
   c. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where Category 1 AESS is exposed to weather.
   d. Provide continuous welds of uniform size and profile where Category 1 AESS is welded.
   e. Grind butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch (0”) for Category 1 and Category 2 AESS.
   f. Make butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch (0”) for Category 1 and Category 2 AESS. Do not grind unless required for clearances or for fitting other components, or unless directed to correct unacceptable work.
   g. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AESS.
   h. At locations where welding on the far side of an exposed connection of Category 1 and Category 2 AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
   i. Make fillet welds for Category 1 and Category 2 AESS oversize and grind to uniform profile with smooth face and transition.
   j. Make fillet welds for Category 1 and Category 2 AESS of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.

2.6 GALVANIZING

A. Hot-Dip Galvanized Finish:

1. Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M:
   a. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
   b. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
   c. Galvanize lintels attached to structural-steel frame and located in exterior walls.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of two inches (2”).
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials.
   5. Galvanized surfaces.

B. Surface Preparation for Non-Galvanized Steel:
   1. Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
      a. SSPC-SP 2 Hand Tool Cleaning.
      b. SSPC-SP 3 Power Tool Cleaning.
      c. SSPC-SP 7/NACE No. 4 Brush-off Blast Cleaning.
      d. SSPC-SP 14/NACE No. 8 Industrial Blast Cleaning.
      e. SSPC-SP 11 Power Tool Cleaning to Bare Metal.
      f. SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
      g. SSPC-SP 10/NACE No. 2 Near-White Blast Cleaning.
      h. SSPC-SP 5/NACE No. 1 White Metal Blast Cleaning.
      i. SSPC-SP 8 Pickling.

C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. Priming:
   1. Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces:
      a. Stripe paint corners, crevices, bolts, welds, and sharp edges.
      b. Apply two (2) coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

3.2 FIELD CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

3.3 EXAMINATION

A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements:
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

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

3.4 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated:
   1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.
   2. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.5 ERECTION

A. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360:
   1. Erect Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
   2. Erect Category 2 and Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.

B. Do not use thermal cutting during erection unless approved by Architect.

3.6 FIELD CONNECTIONS

A. High-Strength Bolts:
   1. Install high-strength bolts according to RCSC's Specification for Structural Joints Using ASTM F3125 Bolts for type of bolt and type of joint specified:
      a. Joint type: Snug tightened or slip critical as indicated.
      b. Orient bolt heads in same direction for each connection and to maximum extent possible in same direction for similar connections.

B. Weld Connections:
   1. Comply with requirements in "Weld Connections" paragraph in "Shop Connections" article:
      a. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AESS.
      b. Remove erection bolts in Category 1 and Category 2 AESS, fill holes, and grind smooth.
      c. Fill weld access holes in Category 1 and Category 2 AESS and grind smooth.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency

to inspect AESS as specified in Section 05 12 00: Structural Steel Framing. The testing agency is not responsible for enforcing requirements relating to aesthetic effect.

B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.8 REPAIRS AND PROTECTION

A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

C. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces:
      a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

D. Touchup Painting: Cleaning and touchup painting are specified in Section 09 90 00: Painting and Coating.

E. Touchup Priming: Cleaning and touchup priming are specified in Section 09 96 00: High Performance Coatings.

END OF SECTION 05 12 13

SECTION 05 40 00 COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Load bearing wall framing.
2. Exterior non-load bearing wall framing.
3. Floor joist framing.
4. Roof rafter framing.
5. Ceiling joist framing.
6. Soffit framing.
7. Accessories necessary for a complete installation.

B. Related Sections:

C. Related Sections:
1. Section 03 30 00: Cast in Place Concrete.
2. Section 05 40 00: Cold-Formed Steel Framing.
3. Section 05 50 00: Metal Fabrications.
4. Section 09 21 16: Gypsum Board Assemblies.
5. Section 09 24 00: Cement Plastering.
6. Section 09 90 00: Painting and Coating.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: General Contractor shall engage a qualified professional engineer, licensed in the State of California, to design cold formed steel framing.

B. Structural Performance - Delegated design engineer shall provide cold-formed steel framing designs capable of withstanding all code required design loads within limits and under conditions indicated on the construction documents and within this Specification:
1. Design loads: Designs shall be capable of withstanding the worst case loading as indicated on the structural drawings, and/or as required by the locally adopted Building Code. The design shall cover the worst case loading in all instances.
2. Coordinate the requirements on the structural and architectural Drawings with the requirements of this Section. If a conflict exists, notations on the structural drawings take precedence.
3. The following document governs the Work, except where more restrictive items are specified:
   a. AISI Design of Cold-Formed Steel Structural Members Wind Load:
      1) Minimum design loads for exterior and/or load bearing and/or soffit applications:
         a) As required by code officials having jurisdiction.
         b) Deflection: 1/600 for clear simple spans.
         c) Deflection: 1/300 for cantilever conditions and roof parapets.
         d) Gauge: 16 gauge minimum, unless noted otherwise.
      2) Minimum design loads for interior and/or exterior suspended furr-downs with

a maximum vertical drop on either side of five feet (5') or greater:
a) As required by code officials having jurisdiction.
b) Deflection: 1/600 for clear simple spans.
c) Deflection: 1/300 for cantilever conditions and roof parapets.
d) Gauge: 20 gauge minimum, unless noted otherwise.

4. It is a common practice for studs thinner than 20 gauge to be crimped and/or ribbed to increase the strength of the overall stud cross section for various loading applications. These studs are typically noted by manufacturer as "equivalent" to a thicker gauge. These "equivalent" type studs are not allowed in a vertically suspended application with greater than five feet (5') of vertical wall drop, 20 gauge is the minimum thickness allowed for these applications.
5. Welding qualifications: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."
6. Studs, tracks, channels, and other light gauge framing members shall conform to requirements of ASTM C955.
7. Fire-rated assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.
8. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F (67 degrees C).
9. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure:
   a. Upward and downward movement of 1-1/2 inches (38 mm).
10. Design exterior non-load bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold Formed Steel Framing Design Standards:
1. Wall studs: AISI S211.
2. Headers: AISI S212.
3. Lateral design: AISI S213.

1.4 SUBMITTALS

A. Product Data: Technical data for cold formed steel framing product and accessories including factory applied primers.

B. Shop Drawings:
1. Submit layout, spacings, sizes, thickness, and types of cold formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners:
   a. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   b. Shall bear the seal of a Registered Professional Engineer, licensed in the State of California.

C. Supplementary Design Details: The general design is presumed adequate to permit compliance with the specified performance. Provide engineering calculations and shop drawings to supplement the general design. Calculations shall bear the seal of a Registered Professional Engineer, licensed in the State of California. Calculations and shop drawings must show design will withstand wind loading commiserate with class and rating of the Project.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Welding qualifications:
      a. Qualify procedures and personnel according to the following:
         1) AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
         2) CCFSS Technical Bulletin: “AISI Specification Provision for Screw Connections.”
   2. Comply with AISI North American Specification for the Design of Cold Formed Steel Structural Members and Standard for Cold Formed Steel Framing - General Provisions:
      a. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
   3. Fire resistance ratings: ASTM E119; testing by a UL. Identify products with appropriate markings of applicable testing agency. Indicate design designations from UL *Fire Resistance Directory*.
   4. Installer qualifications: Company specializing in the installation of cold formed metal framing components with minimum five (5) years’ documented experience.
   5. Install system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   6. Install system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
   7. Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.

B. Professional Engineer Qualifications:
   1. A professional engineer who is legally qualified to practice in the State of California and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold formed metal framing that are similar to those indicated in material, design, and extent:
      a. Engineering responsibility: Preparation of shop drawings, design calculations, and structural data.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   1. CEMCO.
   2. ClarkDietrich Building Systems.
   3. Consolidated Fabricators Corp.
   4. SCAFCO Corporation.
   5. Substitutions with Architect’s approval, pursuant to conditions of Divisions 00 and 01.

2.2 LOAD BEARING WALL FRAMING

A. Steel Studs:
   1. C-shaped steel studs, of web depths indicated, punched, with stiffened flanges:
      a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange width: 1-5/8 inches (41 mm).
      c. Section properties: Refer to the Drawings.

B. Steel Track:
   1. U-shaped steel track, of web depths indicated, unpunched, with straight flanges:
      a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange width: 1-1/4 inches (32 mm).

C. Steel Box or Back to Back Headers:
   1. C-shape used to form header beams, of web depths indicated, unpunched, with stiffened flanges:
      a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange width: 1-5/8 inches (41 mm).

D. Steel Single or Double L Headers:
   1. L-shapes used to form header beams, of web depths indicated:
      a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Top flange width: 1-5/8 inches (41 mm).
      c. Section properties: Refer to the Drawings.

2.3 EXTERIOR NONLOAD BEARING WALL FRAMING

A. Steel Studs:
   1. C-shaped steel studs, of web depths indicated, punched, with stiffened flanges:
      a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange width: 1-5/8 inches (41 mm).
      c. Section properties: Refer to the Drawings.

B. Steel Track:
   1. U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
      a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange width: 1-1/4 inches (32 mm).

C. Vertical Deflection Clips:
   1. Head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web:
      a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
         1) ClarkDietrich Building Systems.
         2) SCAFCO Corporation.
         3) Simpson Strong-Tie Co., Inc.
         4) Steeler, Inc.
         5) Substitutions with Architect’s approval, pursuant to conditions of Divisions 00 and 01.

D. Single Deflection Track:
   1. Single, deep leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure:
      a. Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.

E. Double Deflection Tracks:
   1. Double, deep leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges:
      a. Outer track - Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure:
         1) Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
         2) Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.

   2. Inner track - of web depth indicated:
      a. Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.

F. Drift Clips: Bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.4 CEILING JOIST FRAMING

A. Steel Ceiling Joists:
   1. C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges:
      a. Minimum base metal thickness: 0.0428 inch (1.09 mm).
      b. Flange width: Two inches (51 mm), minimum.

2.5 SOFFIT FRAMING

A. Exterior Soffit Frame:
   1. C-shaped steel sections, of web depths indicated, with stiffened flanges:
      a. Minimum base metal thickness: **[0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)].**
      b. Flange width: 1-5/8 inches (41 mm) minimum.

2.6 FRAMING ACCESSORIES

A. Fabricate steel framing accessories from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of appropriate thickness and configuration, unless otherwise indicated:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.

4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

C. Anchors, Clips, and Fasteners:
1. Steel shapes and clips: ASTM A36/A36M, zinc coated by hot dip process according to ASTM A123/A123M.
2. Expansion anchors: Fabricated from corrosion resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488 conducted by a qualified testing agency.
3. Power actuated anchors: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with allowable load capacities calculated, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
4. Mechanical fasteners:
   a. ASTM C1513, corrosion resistant coated, self-drilling, self-tapping, steel drill screws:
      1) Head type: Low profile head beneath sheathing.
5. Welding electrodes: Comply with AWS standards.

D. Miscellaneous Materials:
1. Galvanizing repair paint: SSPC-Paint 20 or ASTM A780.
2. Non-metallic, non-shrink grout: Premixed, non-metallic, non-corrosive, non-staining grout containing selected silica sands, portland cement, shrinkage compensating agents, and plasticizing and water reducing agents, complying with ASTM C1107/C1107M, with fluid consistency and 30-minute working time.
3. Shims: Load bearing, high density multimonomer plastic, and non-leaching; or of cold formed steel of same grade and coating as framing members supported by shims.
4. Sealer gaskets: Closed cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

A. Fabricate cold formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI specifications and standards, manufacturer written instructions, and specified requirements:
1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted:
   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to shop drawings, with screw penetrating joined members by no fewer than three (3) exposed screw threads.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances:

1. Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in ten (10) feet (1:960) and as follows:
   a. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   b. Squareness: Fabricate each cold formed steel framing assembly to a maximum out of square tolerance of 1/8 inch (3 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

3.2 PREPARATION

A. Before sprayed fire resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire resistive materials, remove only as much as necessary to complete installation of cold formed framing without reducing thickness of fire resistive materials below required thickness to obtain fire resistance rating indicated. Protect remaining fire resistive materials from damage.

C. Install load bearing shims or grout between the underside of load bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 ERECTION

A. General:
   1. Track anchors: Install anchors maximum four feet (4') on center; design anchors and spacing to carry live, dead, and wind loads.
   2. Track splices: Provide channel inserts or weld track splices.
   3. Erection: Install members plumb, level, and in a true plane.
   4. Fastenings: Make assembly rigid and secure, with welds free of voids and burnouts.

B. Install metal framing systems in accordance with stud manufacturer's printed instructions.

C. Runner Tracks:
   1. Install continuous tracks sized to match studs.
   2. Align tracks accurately to layout at base and tops of studs.
   3. Secure tracks as recommended by stud manufacturer, except do not exceed 24 inches on center for nail or power-driven fasteners, nor 16 inches on center for other types of attachment.
   4. Provide fasteners at corners and ends of tracks.
   5. Tracks shall be anchored to structural steel prior to installing sprayed on insulation.
   6. Provide deflection track (DT), at top of stud walls at floor or roof above, typically. Allow for 1/2-inch movement of primary structure. Do not attach studs directly to deflection track.

7. Vertical deflection clips: Provide manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure.

D. Secure studs to top track and bottom runner track by means of approved self-drilling screws or welding at both inside and outside flanges of 14 gauge or heavier material. Screws and welds shall be of sufficient size to insure strength of connection. All welding shall comply with American Welding Society "Specification for Welding Sheet Steel in Structures."

E. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

F. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure. Use Zee clips as specified above. Weld "Z" shaped clips to structural members as shown on drawings. Maximum two feet (2') on center vertical.

G. Install supplementary framing, blocking, and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.

H. Frame wall openings with extra studs, equal to the number of studs interrupted by wall openings, placed at each side of wall openings. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with shoes or by welding, and space jack studs same as full-height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.

I. Install bracing/bridging in accordance with manufacturer's instructions and design conditions.

J. Touch up field welds and damaged galvanized coating, except touch up of field cut studs is not required.

K. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.

L. Install horizontal stiffeners in stud system, space (vertical distance) at no more than 54 inches on center. Weld at each intersection.

3.4 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track:
   1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
   2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel stud sections as indicated on shop drawings.

C. Space joists not more than two inches (51 mm) from abutting walls:

1. Joist spacing: 16 inches (406 mm).

D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on shop drawings:
   1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on shop drawings. Fasten bridging at each joist intersection as follows:
   1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold down angles, anchors, and fasteners, to provide a complete and stable joist framing assembly.

END OF SECTION 05 40 00

SECTION 05 50 00 METAL FABRICATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Metal ladders.
2. Pipe, downspout guards.
3. Handrails and brackets.
4. Mechanical Curbs.
5. Accessories necessary for a coordinated and complete installation.

B. Related Sections:
1. Section 03 30 00: Cast in Place Concrete.
2. Section 05 40 00: Cold-Formed Steel Framing.
3. Section 09 21 16: Gypsum Board Assemblies.
4. Section 09 24 00: Cement Plastering.
5. Section 09 90 00: Painting and Coating.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders and landings capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements:
1. Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:
a. Temperature change (range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

1.4 SUBMITTALS

A. Product Data: Submit data for miscellaneous metal fabrications and paint, coatings, and grout accessories.

B. Shop Drawings:
1. Submit shop drawings detailing the fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items:
a. For installed products indicated to comply with design loads, include structural analysis data, for information only, signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding Certificates.

D. Paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code - comply with applicable provisions of the CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
      a. CBC Section 11B-504 where applicable.
   2. Welding - qualify procedures and personnel according to the following:
      a. AWS D1.1/D1.1M Structural Welding Code – Steel.
      b. AWS D1.2/D1.2M Structural Welding Code - Aluminum.
      c. AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
      d. AWS D1.6/D1.6M Structural Welding Code - Stainless Steel.
      e. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. Fabricator/Installer Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project for a minimum of five (5) years, with a record of successful in-service performance, with sufficient production capacity to produce required units without causing delay in the work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store metal fabrications in a dry, well ventilated, weathertight place. Deliver and handle to prevent any type of damage to the fabricated work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

D. Stainless Steel Bars and Shapes: ASTM A276, Type 304.

E. Rolled Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

F. Rolled Stainless Steel Floor Plate: ASTM A793.

G. Abrasive Surface Floor Plate:
   1. Steel plate with abrasive granules rolled into surface or with abrasive material metallically bonded to steel:
      a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
         1) IKG Industries, a division of Harsco Corporation.
         2) SlipNOT Metal Safety Flooring; W.S. Molnar Company.

H. Steel Tubing: ASTM A500/A500M, cold formed steel tubing.

I. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

J. Zinc Coated Steel Wire Rope - ASTM A741:
1. Wire rope fittings: Hot dip galvanized steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

K. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

L. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

M. Aluminum Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

N. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

O. Fasteners:
1. Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required:
   a. Provide stainless steel fasteners for fastening stainless steel.
   b. Steel bolts and nuts: Regular hexagon head bolts, ASTM A307, Grade A with hex nuts, ASTM A563 and, where indicated, flat washers.
   c. Steel bolts and nuts: Regular hexagon head bolts, ASTM A325, Type 3 with hex nuts, ASTM A 563, Grade C3 and, where indicated, flat washers.
   d. Stainless steel bolts and nuts: Regular hexagon head annealed stainless steel bolts, ASTM F593 with hex nuts, ASTM F594 and, where indicated, flat washers; alloy.
   e. Anchor bolts - ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 and, where indicated, flat washers:
      1) Hot dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
   f. Anchors: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
   g. Post installed anchors - per Drawings:
      1) Material for interior locations: Carbon steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
      2) Material for exterior locations and where stainless steel is indicated: ASTM F593, and nuts, ASTM F594.
   h. Cast-in-place anchors in concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot dip galvanized per ASTM F2329.

P. Miscellaneous Materials:
1. Shop primer for ferrous metal: Universal primer, organic zinc rich primer, complying with SSPC-Paint 20 and compatible with topcoat. Provide 10-99 (red) or 10-09 (gray) by Tnemec Company.
2. Universal shop primer: Fast curing, lead and chromate free, universal modified alkyd primer and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc rich primer.
3. Water based primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel and compatible with topcoat.
4. Shop primer for galvanized steel: Primer formulated for exterior use over zinc coated

metal and compatible with finish paint systems indicated.

5. Galvanizing repair paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20. Provide Tneme-Zinc 90-97 by Tnemec Company.
6. Bituminous paint: Cold applied asphalt emulsion complying with SSPC-Paint 12, containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D1187.
7. Non-shrink, nonmetallic grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
8. Concrete materials and properties: Composed of ASTM C150 Type I Portland cement, ASTM C33 sand and coarse aggregates and potable water to produce a low slump mix suitable for placement. Grade coarse aggregate from 1/8 inch with at least 95 percent passing a 3/8-inch sieve and not more than ten percent (10%) passing a No. 8 sieve. Fill shall be proportioned to provide a minimum 28-day compressive strength of 3,000 psi (20 MPa).

2.2 FABRICATION

A. Shop Assembly:

1. Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation:
   a. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
   b. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
   c. Form exposed work with accurate angles and surfaces and straight edges.
   d. Weld corners and seams continuously to comply with the following:
      1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
      2) Obtain fusion without undercut or overlap.
      3) Remove welding flux immediately.
      4) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
   e. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
   f. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
   g. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
   h. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   i. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 inch by 1-1/2 inches (3.2 mm by 38 mm), with a minimum six-inch (150 mm) embedment and two-inch (50 mm) hook, not less than eight inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.
   j. Galvanize miscellaneous framing and supports at exterior locations; prime paint miscellaneous framing and supports at interior locations.

B. Miscellaneous Framing and Supports:
   1. Provide steel framing and supports necessary to complete the work and that are not a part of the structural framework, including, but not limited to, framing and supports for overhead lobby door frames, sliding doors, countertop and vanities, ceiling hung toilet compartments, tube framing for partial height walls, and mechanical and electrical equipment:
      k. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction. Cut, drill, and tap units to receive hardware, hangers, and similar items:
         1) Fabricate units from slotted channel framing where indicated.
         2) Furnish inserts for units installed after concrete is placed.

C. Shelf Angles:
   1. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19 mm) bolts, spaced not more than six inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated:
      a. Provide mitered and welded units at corners.
      b. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately two inches (50 mm) larger than expansion or control joint.
      c. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
      d. Galvanize and prime shelf angles located in exterior walls.
      e. Prime shelf angles located in exterior walls with zinc rich primer.
      f. Furnish wedge type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.3 LADDERS

A. Ladders - Comply with ANSI A14.3. For elevator pit ladders, comply with ASME A17.1/CSA B44:
   1. Steel ladders:
      a. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
      b. Siderails: Continuous, 1/2 inch by 2-1/2-inch (12.7 mm by 64 mm) steel flat bars, with eased edges.
      c. Rungs:
         1) 3/4-inch (19 mm) diameter steel bars.
         2) Fit rungs in centerline of siderails; plug weld and grind smooth on outer rail faces.
         3) Provide nonslip surfaces on top of each rung, either by coating rung with aluminum oxide granules set in epoxy resin adhesive or by using a type of manufactured rung filled with aluminum oxide grout.
         4) Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung:
         5) Manufacturers are subject to compliance with requirements; provide products by one of the following:
            a) Harsco Industrial IKG, a division of Harsco Corporation.
            b) SlipNOT Metal Safety Flooring; W.S. Molnar Company.
      d. Provide platforms as indicated fabricated from welded or pressure locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
      e. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
      f. Galvanize ladders, including brackets and fasteners.

2.4 MISCELLANEOUS STEEL TRIM

A. Miscellaneous Steel Trim:
   1. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible:
      a. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work:
         1) Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction, spaced not more than six inches (150 mm) from each end, six inches (150 mm) from corners, and 24 inches (600 mm) o.c.
         2) Galvanize miscellaneous steel trim.

2.5 PIPE, DOWNSPOUT GUARDS

A. Fabricate pipe, downspout guards from 3/8 inch (9.5 mm) thick by 12 inch (300 mm) wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with two inch (50 mm) clearance between pipe and pipe guard. Drill each end for two (2) 3/4-inch (19 mm) anchor bolts.

B. Galvanize and prime pipe, downspout guards.

2.6 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5mm).

D. Maximum Bow: 1/8 inch (3mm) in 48 inches (1.2m).

E. Maximum Deviation From Plane: 1/16 inch (1.5mm) in 48 inches (1.2m).

2.7 FINISHES

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.8 STEEL AND IRON FINISHES

A. Galvanizing:
   1. Hot dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products:
      a. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

D. Preparation for Shop Priming:
   1. Prepare surfaces to comply with requirements indicated below:
      a. Exterior items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
      b. Items indicated to receive zinc-rich primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
      c. Other items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming:
   1. Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting:
      a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

F. Stainless Steel Finishes:
   1. Remove tool and die marks and stretch lines, or blend into finish:
      a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
      b. Bright, directional polish: No. 4 finish.
      c. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.9 EXPANDED METAL GRATINGS

A. Provide expanded metal gratings in material, finish, style, size, thickness, weight, and type indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads. Manufacturer - Indiana Grating Inc. 212 W. Douglas St, Martinsville IN 46151. Grates to comply with CBC 11B-404, for accessible route of travel:
   1. Material: Steel
   2. Steel finish: Galvanized.
   3. Style designation: Light Duty Welded Steel Grating, see Drawings for details.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

3.2 FIELD CONDITIONS

A. Field Measurements:
   1. Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication:
      a. Established dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
      b. Provide allowance for trimming and fitting at site.

3.3 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation, with edges and surfaces level, plumb, true, and free of rack, and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding:
   1. Comply with the following requirements:
      a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
      b. Obtain fusion without undercut or overlap.
      c. Remove welding flux immediately.
      d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection:
   1. Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
      a. Cast aluminum: Heavy coat of bituminous paint.
      b. Extruded aluminum: Two (2) coats of clear lacquer.

3.4 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on shop drawings.

B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

3.5 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch (6mm) per story, noncumulative.

B. Maximum Offset from True Alignment: 1/4 inch (6mm).

C. Maximum Out of Position: 1/4 inch (6mm).

3.6 ADJUSTING AND CLEANING

A. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas.

Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop painted surfaces:

a. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00: Painting and Coating.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes rough carpentry, light hardware, and miscellaneous items of work not included in another Section. This Section also includes:
   1. Structural wood supports, grounds, backing, and blocking required for millwork and casework items that are an integral part of wall, floor, and/or ceiling construction.
   2. Plywood sheathing.

B. Related Sections:
   1. Section 03 10 00: Concrete Forming and Accessories.
   2. Section 03 30 00: Cast-In-Place Concrete.
   3. Section 07 21 00: Thermal Insulation.
   4. Section 07 92 00: Joint Sealants.
   5. Section 09 21 16: Gypsum Board Assemblies.
   6. Section 09 24 00: Cement Plaster.
   7. Section 10 28 13: Toilet Accessories.

C. Reference Standards:
   1. The following references, codes, and standards are hereby made a part of this Section and carpentry work shall conform to applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained in the Drawings or these Specifications shall be construed as permitting work that is contrary to code requirements:
      a. Standard Grading and Dressing Rule #16, of the West Coast Lumber Inspection Bureau.
      b. Grading Rules for Western Lumber of the Western Wood Products Association.
      c. Standard Specifications for Grades of California Redwood Lumber of the Redwood Inspection Service.
      d. American Wood Preservers Association (AWPA) Standard C 2-77 Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes.
      e. American Wood Preservers Bureau (AWPB) Quality Control Standards.

1.3 QUALITY ASSURANCE

A. Lumber and plywood shall be grade or quality marked by WWPA, WCLIB, APA, AWPB, or by other grading and inspection agencies acceptable to the Architect. Grade marks shall include the designation "S-DRY"(or "MC-15" as applies) where applicable. Grade and quality marks shall not be apparent on surfaces exposed in the finished work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store kiln dried materials in enclosed areas, protected from moisture and separated from contact with concrete or soil.

PART 2 PRODUCTS

2.1 MATERIALS

A. Temporary Construction: Clean lumber at Contractor's option, rough or smooth, as usage requires.

B. Lumber Not Otherwise Specified or Noted:
1. Douglas fir or larch, graded and grademarked, according to Reference Standard 1.02 A or B, #1 grade:
   a. Boards: Construction grade.

C. Sill Plates (On Concrete): Construction grade light framing, pressure treated as hereinafter specified; as noted on Plans.

D. Plywood for Walls and Roofs; As Noted On Plans:
1. Unless glue type is otherwise specified, exterior plywood, interior plywood exposed to continuing moisture, and pressure treated plywood shall be fabricated with exterior glue. Plywood with interior glue shall be fully protected from soaking or continuing moisture at all times.

E. Rough Hardware:
1. Nails, spikes, bolts, screws, tacks, and framing connectors of standard manufacture as required. Hot dip galvanize items exposed to moisture or to exterior and those items that are in contact with wood pressure treated with waterborne salts:
   a. Bolts and nuts: ASTM A307, Grade A.
   b. Lag bolts: Fed. Spec. FF-B-561. Pre-drill per CBC.
   c. Nails: Fed. Spec. FF-N-101, common unless otherwise noted or specified.
   d. Joist hangers and framing connectors: Simpson or approved equal, unless otherwise noted.
   e. Power driven fasteners: Hilti, Ramset, or approved equal, each use and fastener type subject to prior approval of Architect.

F. Pressure Treatment (Decay and Termite Prevention):
1. Pressure treat for decay and termite prevention, Douglas fir or larch wood materials that are embedded in or set against concrete.
2. Treat in accordance with Reference Standard 1.02 E and quality mark as per Reference Standard 1.02 F.
3. Treat with any of the following processes at Contractor option. Creosote type preservatives are not permitted:
   a. Penta in an LPG carrier (Cellon) or Penta in Hydrocarbon Solvent-Type D (Dow Process) AWPB LP-4 quality marked.
   b. Ammoniacal copper arsenate (ACA) or chromated copper arsenate (CCA) in a water carrier (AWPB LP-2 quality marked).
   c. Disodium Octaborate Tetrahydrate (DOT) such as Advance Guard/Hi-bor by Osmose, Inc.
   d. Members treated with waterborne salts shall be dried to a moisture content not exceeding 19 percent after treatment.
4. Where possible, precut material before treatment.
5. Holes and cutoffs and handling and storage shall be in accordance with AWPA M-4.
6. Ensure that ferrous metal fastenings and items in contact with wood treated with waterborne salts are hot dip galvanized (1.25 oz. coating) where required by ICC reports.

G. Building Paper and Felt: Kraft waterproof building paper or 15# unperforated asphalt saturated rag felt per CBC Standard 14-1.

H. Framing Connectors: Simpson Strong Tie Corp., or equal.

2.2 MOISTURE CONTENT

A. 19 percent maximum for two times thickness and less; 19 percent maximum for thickness greater than two times and less than four times; and 22 percent maximum for thickness greater than four times.

2.3 SIZES

A. Surfaced to "DRY" sizes. Sizes noted are nominal unless shown as net.

2.4 SURFACING

A. All wood materials exposed in the finished work shall have re-sawn surfaces of clean natural color unless noted or specified otherwise. Concealed framing lumber shall be S4S.

PART 3 EXECUTION

3.1 ERECTION AND INSTALLATION

A. Framing: Conform to CBC where same covers points not indicated on Drawings. Properly lay out framing with pieces closely fitted, accurately plumbed, leveled and aligned, and rigidly secured in place.

B. Except as specifically shown on structural drawings, cutting of all wood, etc. is limited to those cuts permitted by CBC.

C. Bridging and Blocking: Conform to CBC. Provide two times blocking at intersections of finished surfaces for adequate bearing and at points where required to support fixtures, cabinets, hardware, and other equipment mounted on walls.

D. Plywood (General): Unless more stringent requirements are indicated on the Drawings or required by code, application of plywood shall be in accordance with recommendations of the American Plywood Association.

E. Connections and Fastenings: Conform to CBC. Unless otherwise specified or shown on the Drawings, conform to minimum nailing requirements of CBC. For bolted connections, provide washers under heads and nuts bearing on wood, and draw nuts tight. Retighten before closing in framing. Exercise care in nailing through exposed sheathing and siding and ensure that fasteners penetrate into framing members

END OF SECTION 06 10 00

SECTION 06 10 53 MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood blocking, cants, and nailers.
4. Wood furring and grounds.
5. Wood sleepers and platform wood flooring.
6. Plywood backing panels.
7. Accessories necessary for a complete installation.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than two inches (2”) nominal (38 mm actual) size in least dimension.

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

1.4 SUBMITTALS

A. Product Data:
1. Submit each type of process and factory fabricated product. Indicate component and materials and dimensions and include construction and application details:
a. Wood treatment:
1) Submit data for wood preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained:
a) Include data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by qualified independent testing agency.
b) For fire retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
c) For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to site.

B. Laboratory and Testing Reports:
1. Laboratory test reports:
a. Submit report for installation adhesives indicating compliance with requirements for low emitting materials.

b. Post installed anchors.
c. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Building code: Comply with applicable requirements of CBC Chapter 23 for miscellaneous wood.
2. Fire retardant treated lumber and plywood by pressure process: Provide products with a flame spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
3. Level floor finishes to minimum requirement noted CBC Section 11B-302.1.

B. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 WOOD PRODUCTS

A. Lumber:
1. DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated:
a. Factory mark each piece of lumber with grade stamp of grading agency.
b. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
c. Dress lumber, S4S, unless otherwise indicated.
d. Maximum moisture content of lumber: 19 percent unless otherwise indicated.

B. Preservative Treatment by Pressure Process:
1. AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground:
a. Preservative chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
b. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
c. Kiln dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
d. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

e. Application - treat items indicated on Drawings and the following:
   1) Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2) Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

C. Fire Retardant Treatment:
   1. Where indicated as fire retardant treated, provide materials acceptable to authorities having jurisdiction, and with fire test response characteristics specified as determined by testing identical products per ASTM E84 by a qualified testing agency:
      a. Treatment shall not promote corrosion of metal fasteners.
      b. Exterior type: Comply with specified requirements for fire retardant treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
      c. Interior Type A: Provide treated materials with moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
      d. Design value adjustment factors:
         1) Test treated lumber according to ASTM D5664 and calculate design value adjustment factors according to ASTM D6841:
            a) For enclosed roof framing, framing in attic spaces, and where high temperature fire retardant treatment is indicated, provide material with adjustment factors of minimum 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for climatological zone.
      e. Kiln dry lumber after treatment to a maximum moisture content of 19 percent.
      f. Identify fire retardant treated wood with appropriate classification marking of qualified testing agency:
         1) For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
      g. For exposed items indicated to receive a stained or natural finish, verify chemical formulations shall not bleed through, contain colorants, or adversely affect finishes.
      h. Application:
         1) Treat items indicated on Drawings and the following:
            a) Framing for raised platforms.
            b) Concealed blocking.
            c) Roof framing and blocking.
            d) Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
            e) Plywood backing panels.
            f) Wood platform deck flooring.

D. Dimension Lumber Framing:
   1. Non load bearing interior partitions: Construction or No. 2 grade of any species.
   2. Other framing: Construction or No. 2 grade of any species.

E. Miscellaneous:
   1. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including but not limited to blocking, nailers, cants, grounds, furring, roof top equipment bases and support curbs, and utility shelving:
      a. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.
      b. For blocking not used for attachment of other construction, use utility, stud, or No. 3 grade lumber of any species provided that it is cut and selected to eliminate defects that interfere with attachment and purpose.
      c. For blocking and nailers used for attachment of other construction, select and cut

lumber to eliminate knots and other defects that interfere with attachment of work.
d. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
e. Utility shelving:
1) Lumber with 19 percent maximum moisture content of any of the following species and grades:
a) Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
b) Mixed southern pine or southern pine No. 2 grade; SPIB.
c) Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

F. Concealed Boards:
1. 19 percent maximum moisture content of any of the following species and grades:
a. Mixed southern pine or southern pine, No. 2 grade; SPIB.
b. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
c. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
d. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
e. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

G. Plywood Backing Panels (Sleepers):
1. Equipment backing panels: Plywood, DOC PS 1, Exterior, C-C Plugged or Exposure 1, C-D Plugged, fire retardant treated, in thickness not less than 3/4 inch (19 mm) nominal thickness.

H. Fasteners:
1. Provide fasteners of size and type indicated that comply with requirements:
a. Where carpentry is exposed to weather, in ground contact, pressure preservative treated, or in area of high relative humidity, provide fasteners with hot dip zinc coating complying with ASTM A153/A153M.
b. Nails, brads, and staples: ASTM F1667.
c. Screws for fastening to metal framing: ASTM C1002 drywall type or ASTM C954 nonload bearing steel stud, length recommended by screw manufacturer for material being fastened.
d. Power driven fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
e. Post installed anchors:
1) Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 mechanical, masonry, ICC-ES AC58 mechanical, concrete, ICC-ES AC193 adhesive, masonry, or ICC-ES AC308 adhesive, concrete as appropriate for the substrate:
a) Material, interior: Carbon steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
b) Material, exterior: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

I. Metal Framing Anchors:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:

a. Cleveland Steel Specialty Co.
b. KC Metals Products, Inc.
c. Phoenix Metal Products, Inc.
d. Simpson Strong-Tie Co., Inc.

2. Galvanized steel sheet: Hot dip, zinc coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation. Use for interior locations unless otherwise indicated.
3. Hot dip, heavy galvanized steel sheet - ASTM A653/A653M; structural steel (SS), high strength low alloy steel Type A (HSLAS Type A), or high strength low alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick. Use for wood preservative-treated lumber and where indicated:
   a. Stainless steel sheet: ASTM A666, Type 304 and Type 316 for exposed application in coastal environments. Use for exterior locations and where indicated.

J. Miscellaneous Materials:
1. Adhesives for gluing to concrete or masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
2. Flexible flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized asphalt compound, bonded to high density polyethylene film, aluminum foil, or spunbonded polyolefin to produce overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA WCD 1 Details for Conventional Wood Frame Construction unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels:
1. Install fire retardant treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

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

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim:
1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at

ceiling line of top story, and at not more than 96 inches (2,438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and two-inch nominal (2") (38-mm actual) thickness.

3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 square feet (9.3 sq. m) and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

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

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative treated lumber:
1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

J. Where wood preservative treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1 Fastening Schedule in the International Building Code.
2. ICC-ES evaluation report for fastener.

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

M. Wood Blocking and Nailer Installation:
1. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved:
   a. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
   b. Provide permanent grounds of dressed, pressure preservative treated, key beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.2 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality: Provide temporary ventilation during work. During and immediately after installation of treated wood, engineered wood products, and laminated wood products at interior spaces, provide temporary ventilation.

B. Waste Management:
1. Refer to Section 01 74 19: Construction Waste Management and Disposal, and Construction Waste Management Plan:
   a. Select lumber sizes to minimize waste; reuse scrap lumber to the greatest extent possible. Clearly separate scrap lumber for use onsite as accessory components,

including shims, bracing, and blocking.

b. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
c. Prevent sawdust and wood shavings from entering the storm drainage system.
d. Do not burn scrap lumber that has been pressure treated.
e. Do not send lumber treated with pentachlorophenol, CCA, or ACA to cogeneration facilities or waste to energy facilities.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron treated wood becomes wet, apply EPA registered borate treatment. Apply borate solution by spraying to comply with EPA registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA registered borate treatment. Apply borate solution by spraying to comply with EPA registered label.

END OF SECTION 06 10 53

SECTION 06 16 00 SHEATHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Wall sheathing.
   2. Underlayment.
   3. Sheathing joint and penetration treatment.
   4. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data:
   1. Technical data for each type of process and factory fabricated product. Indicate component materials and dimensions and include construction and application details:
      a. Include data for wood preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
      b. Include data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
      c. For fire retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
      d. For products receiving a waterborne treatment, include statement that moisture content of treated materials reduced to levels specified before shipment to Project site.
      e. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

A. Fire Test Response Characteristics:
   1. For assemblies with fire resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction:
      a. Fire resistance ratings: Indicated by design designations from UL Fire Resistance Directory or GA-600 Fire Resistance Design Manual.

B. Testing Agency Qualifications: For testing agency providing classification marking for fire retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 MATERIALS

A. Plywood: DOC PS 1.

B. Oriented Strand Board: DOC PS 2.

C. Thickness: As necessary to comply with requirements specified, but not less than thickness indicated.

D. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE TREATED PLYWOOD

A. Preservative Treatment by Pressure Process - AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground:
   1. Preservative chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE RETARDANT TREATED PLYWOOD

A. Where fire retardant treated materials are indicated, use materials complying with requirements acceptable to authorities having jurisdiction and with fire test response characteristics specified determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire Retardant Treated Plywood by Pressure Process:
   1. Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test:
      a. Use treatment that does not promote corrosion of metal fasteners.
      b. Exterior type: Treated materials shall comply with requirements specified above for fire retardant treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
      c. Design value adjustment factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high temperature fire retardant treatment is indicated, span ratings for temperatures up to 170 degrees F (76 degrees C) shall be not less than span ratings specified.

C. Kiln dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire retardant treated plywood with appropriate classification marking of qualified testing agency.

E. Application:
   1. Treat plywood indicated on Drawings and the following:
      a. Roof and wall sheathing within 48 inches (1,220 mm) of fire walls.
      b. Subflooring and underlayment for raised platforms.

2.4 WALL SHEATHING

A. Glass Mat Gypsum Wall Sheathing - ASTM C1177/C1177M:
   1. Product is subject to compliance with requirements; provide products by one of the following:
      a. CertainTeed Corporation: GlasRoc (basis of design).
      b. Georgia Pacific: Dens-Glass.
      c. National Gypsum Company: Gold Bond eXP.
      d. United States Gypsum Co.: Securock.
   2. Type and thickness: Regular, 1/2 inch (12.7 mm) thick.
   3. Size: Four feet by eight feet (1,220 mm by 2,440 mm) for vertical installation.

2.5 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor Underlayment - DOC PS 1, Exterior, Structural I, C-C Plugged Single Floor Panels:
   1. Span rating: Not less than 20 o.c.
   2. Nominal thickness: Not less than one inch (25 mm).
   3. Edge detail: Tongue and groove.
   4. Surface finish: Fully sanded face.

B. Underlayment: Provide underlayment in nominal thickness not less than 1/4 inch (6.4 mm) over smooth subfloors and not less than 3/8 inch (9.5 mm) over board or uneven subfloors.

C. Sound Deadening Board - Class C Fire Rated, Molded, Recycled Post-Consumer Paper, Cellulose Fiber Structural Panel:
   1. Density: 26 pcf to 28 pcf (416 = 448 kg/cu.m) tested in accordance with ASTM C209.
   2. Tensile strength - when tested in accordance with ASTM C209:
      a. Parallel: 450 - 700 psi (3,100 - 4,830 kPa).
      b. Transverse: 750 - 1--- psi (5.1171 - 6.894 kPa).
   3. Hardness (Janka Ball): 230 pounds (104 kg) tested in accordance with ASTM D1037.
   4. Water absorption by volume, when tested in accordance with ASTMC209:
      a. Two-hour immersion: Maximum seven percent (7%).
   5. Expansion: 50 percent to 90 percent relative humidity, 0.25 percent in accordance with ASTM C209.
   6. Noise reduction coefficient (NCR): 0.20.
   7. Flame spread: Maximum 75 tested in accordance with ASTM E84 Class C.
   8. Thickness: 3/4 inch (19 mm).

2.6 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture. Provide fasteners with hot dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Gypsum Sheathing to Cold Formed Metal Framing:
   1. Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic polymer or corrosion protective coating having salt spray resistance of more than 800 hours according to ASTM B117:
      a. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C1002.

2.7 SHEATHING JOINT AND PENETRATION TREATMENT MATERIALS

A. Sealant for Glass Mat Gypsum Sheathing:
   1. Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass fiber sheathing tape and for covering exposed fasteners:
      a. Sheathing tape: Self-adhering glass fiber tape, minimum two inches (50 mm) wide, ten by ten or ten by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass mat gypsum sheathing and with history of successful in-service use.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 EXECUTION

3.1 INSTALLATION

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three (3) support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint sealant installation so materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions. Fasten gypsum sheathing to cold formed metal framing with screws. Install boards with a 3/8-inch (9.5 mm) gap where non-load bearing construction abuts structural elements. Install boards with a 1/4-inch (6.4 mm) gap where they abut masonry or similar materials that retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation:
   1. Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud:
      a. Space fasteners approximately eight inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

D. Seal sheathing joints according to sheathing manufacturer's written instructions. Apply glass fiber sheathing tape to glass mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal penetrations and openings.

END OF SECTION 06 16 00

SECTION 06 17 00 STRUCTURAL COMPOSITE LUMBER

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide all labor, materials, tools, appliances, facilities and equipment required for the fabrication, delivery and erection of all Structural Composite Lumber (SCL) as shown on the drawing, herein specified and necessary to complete the work.
   1. All blocking, bridging, etc., for the installation of members.
   2. Clips, angles, straps, hangers, etc., incidental to installation of joists.
   3. Nails, bolts, washers and other fasteners used for erecting and securing members.

B. Related Sections:
   1. Section 05 50 00: Metal Fabrications.
   2. Section 06 10 00: Rough Carpentry.
   3. Section 06 17 10: Prefabricated Wood “I” Joists.

1.3 REFERENCES

A. Comply with applicable provisions of the following standards and references: 2019 California Building Code (CBC).

1.4 SUBMITTALS

A. Comply with the provisions of Section 01 33 00: Submittal Procedures

B. Submit shop drawings of materials to be furnished under this section. Shop drawings shall include, but not be limited to;
   1. Erection plans, sizes, types, location and specific designation of SCL members.
   2. Installation instructions.
   3. Details of member connections.

C. Drawings shall also indicate sizes and location of blocking, hangers, etc., with sufficient detailing to ensure correct installation.

1.5 QUALITY ASSURANCE

A. Refer to Section 01 45 00: Quality Requirements.

B. The fabricator shall have been engaged in the continuous manufacturing of SCL members for a minimum of five years.

C. Manufacturer Requirements:
   1. Manufacturing facility shall be approved by an independent ICC approved inspection agency.
   2. All members shall bear a stamp indicating the grade, plant number, independent inspection agency, logo and report number.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01 66 00: Product Storage and Handling.

B. Deliver members tagged, unload carefully and handle only as recommended by the manufacturer; protect from adverse environmental conditions until members are installed and protected by permanent means.

C. If members must be stored prior to erection, they shall be stored in a vertical position off the ground, covered and protected from light weather.

1.7 WARRANTY

A. Refer to Section 01 77 00: Project Closeout, Section 01 78 36: Warranties and Bonds and Section 01 78 39 and 01 78 38: Guarantees.

B. The products delivered will be free from any manufacturing errors or defects in workmanship and material. The design of members shall be adequate to carry the loads specified by the purchaser for the normal and expected life of specified project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Single source responsibility, specified items shall be from one manufacturer. Manufacturer shall be subject for compliance with all requirements of the documents (both Drawings and Specifications), provide products from one of the following Acceptable manufacturers.
   1. WEYERHAUSER, www.iLevel.com P.O. Box 8449, Boise, Idaho 83706, Area Code 208/429-3715.
   2. BOISE CASCADE WOOD PRODUCTS, LLC www.bc.com/wood/eqp P.O. Box 2400 White city, Oregon 97503-0400 (541) 826-0200
   3. RedBUILT, 200 East Mallard Dr., Boise, Idaho 83706, Tel: 1-866-859-6757.
   4. Reviewed Equivalent by Architect.
   5. Substitutions and Deviations shall require Engineer's approval and shall be given in letter form.
   6. Refer to specifications Section 01 33 00: Submittals.
   7. Proposed alternate products must be equal in terms of chemical composition, color, finish, configuration, performance standards, etc.
   8. Specified materials indicated are as manufactured by "Weyerhauser", and shall be installed according to current listed specification requirements.

2.2 MATERIALS

A. General:
   1. SCL joists and types indicated on Drawings and specified here are as herein listed. Other manufacturers' joists complying with these Specifications and having equivalent properties and dimensions shall be subject to Architect's and Structural Engineer's review upon submission of substantiating data, and may be used only if equivalent, in Architect's and Structural Engineer's opinion, to the SCL joists specified. Structural capacities shall be evaluated by ASTM D2559 and independent structural testing.
   2. Lumber
      a. LVL: Versa lam, manufactured in accordance with ICC Report No. ER-1040. Species shall be Douglas Fir, Southern Pine or Western Hemlock. Minimum grade shall be 2.0 E unless noted otherwise on the structural drawings.

b. PSL: Parallam, manufactured in accordance with ICC Report No. ER-1387. Species shall be Douglas Fir, Southern Pine or Western Hemlock. Minimum grade shall be 2.0 E unless noted otherwise on the structural drawings.
c. LSL: Timberstrand, manufactured in accordance with ICC Report No. ER-1387. Multiple species may be used. Minimum grade shall be 1.5 E unless noted otherwise on the structural drawings.
d. Various SCL products shall only be used where specifically indicated on the drawings. No substitutions shall be made without written approval.

3. Adhesive: Exterior type in conformance with ASTM D2559.
4. Types:
   a. Sizes, properties and additional information as shown on the drawings.
   b. Accessories to be furnished and installed as indicated on the Drawings are as follows:
      1) Blocking, diaphragm blocking, miscellaneous blocking required by penetrations.
      2) Hangers, brackets, straps, ties, etc., shown on Drawings.
      3) Miscellaneous accessories incidental to erection and installation of members.

2.3 FABRICATION

A. Fabrication shall be in compliance with specified standard and industry specifications and requirements of the reports indicated.
   1. Fabrication shall be in accordance with best practices with adequate plant and equipment and under supervision of properly qualified personnel.
   2. Moisture content of components at time of gluing shall not be less than 7 percent nor more than 16 percent.

PART 3 EXECUTION

3.1 ERECTION AND HANDLING

A. Structural Composite Lumber (SCL) is to be erected and installed in accordance with plans, manufacturer's drawings and installation suggestions.
   1. Temporary construction loads which cause stresses beyond design limits are not permitted.
   2. Holes, cuts or notches not previously approved by manufacturer's engineering shall not be permitted.
   3. General Contractor is to give notification before enclosing members to provide opportunity for inspection of the installation.
   4. Use equipment and methods that avoid damages that may impair strength of SCL members. Sharp instruments and unprotected wire rope, chain slings and the like shall not be permitted.

3.2 INSTALLATION

A. Members are to be erected and installed in accordance with the drawings and manufacturers recommendations. Comply with all manufacturers' recommendations concerning temporary construction loads and erection bracing.

3.3 PROTECTION AND CLEANING

A. Refer to Section 01 71 33: Protection of Adjacent Construction.
   1. Keep areas of work free from debris as work progresses.
   2. Subcontractor will keep the work areas in a clean and safe condition so his rubbish, waste and debris do not interfere with the work of others.

3. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.
4. Clean adjacent surfaces free of caulking or sealant with mechanical action or solvent as necessary, avoiding damage to other materials.
5. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no cost to the District.
6. After completion of work remove tools, appliances, surplus materials, waste materials, rubbish, debris and accessory items used in or resulting from said work, and legally dispose of off the site.
7. Provide Guarantee / Warranties and Bonds as required in this specification section and as listed in Section 01 78 36: Warranties.
8. Provide record drawings in accordance with Section 01 78 39: Project Record Documents.

END OF SECTION 06 17 00#

SECTION 06 20 00 FINISH CARPENTRY AND MILLWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Providing all finish carpentry items including, but not limited to:
      a. Finish carpentry.
      b. Millwork and cabinetry.
      c. Plastic laminate.
      d. Casework hardware.
      e. Miscellaneous millwork.
   2. Installation of:
      a. Finish hardware.
      b. Plastic laminate faced wood doors.

B. Related Sections:
   1. Section 06 10 00: Rough Carpentry.
   2. Section 09 21 16: Gypsum Board Assemblies.

C. Reference Standards:
   1. Codes and references:
      a. 2019 California Building Code Section 11B-309.
      b. American Disabilities Act Design Guidelines (ADADG).
   2. American National Standards Institute:
      a. ANSI A156.9 Cabinet Hardware.
      b. ANSI A161.1 Woodwork Testing Standards.
      c. ANSI A208.1 Mat-Formed Wood Particleboard.
   3. Woodwork Institute:
      a. WI North American Architectural Woodwork Standards (current edition).
   4. National Electrical Manufacturers Association:
      a. NEMA LD 3 High Pressure Decorative Laminates.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s preprinted product information for all hardware proposed on the Project.
   3. Manufacturer’s preprinted maintenance instructions for the casework hardware.

B. Shop Drawings:
   1. Indicate size, material, and finish.
   2. Show locations and installation procedures, including hardware, sinks, service fixtures, trim, and other pertinent data for each unit.

C. Certification: Provide manufacturer’s certification that casework has been fabricated and

installed according to WI “Custom” Grade guidelines or better.

D. Samples: Two (2) each, six-inch by six-inch by 3/4-inch (6” x 6” x 3/4”) sample of specified particleboard core with grade stamp for use as verification of installed product.

E. Closeout:
1. Record drawings: Indicate revisions to original Drawings and shop drawings.
2. Manufacturer contact names, addresses, and phone numbers.
3. Finish material schedule: Names and color numbers of laminates and stains.
4. Keys: Provide additional master key for each room and additional locksets totaling one percent (1%) of total Project for attic stock.

1.4 PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated, perform work in accordance with WI “Architectural Woodwork Standards,” Custom Grade, except where specification exceeds those standards the more stringent shall govern.

B. Fabricate millwork and cabinetry in accordance with ANSI A161.1, NEMA LD3, and general static load testing performed and certified by an independent testing agency covering the following areas of product performance, with these minimum results:
1. Base cabinet construction/racking test: 800 pounds.
2. Cabinet front joint loading test: 425 pounds.
3. Wall cabinet static load test: 2,000 pounds.
4. Drawer front joint loading test: 600 pounds.
5. Drawer construction/static load test: 750pounds.
6. Cabinet adjustable shelf support device/static load test: 300 pounds.

C. Shelf Loading: Comply with loading/deflection standards of the Composite Panel Association.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program.

B. Installer Qualifications: Licensee of WI's Certified Compliance Program.

C. Quality Standard:
1. Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements:
   a. Before delivery to jobsite, millwork supplier:
      1) Licensees of WI shall issue a certified compliance certificate indicating millwork products being furnished for this Project, and certifying that these products and their installation, will fully meet requirements of grade or grades specified.
      2) Non-licensees of WI shall provide evidence that they have arranged for inspection by WI inspector after completion of fabrication and installation. If conditions are found to be compliant, inspector will issue Compliance Certificate indicating millwork products being furnished for this Project and certifying that these products and their installation will fully meet requirements of grade or grades specified.
   b. Each elevation of casework and each countertop shall bear certified compliance

label.
c. Cabinet Design Series (CDS): CDS numbers on Drawings indicate typical designs.

D. Certified Seismic Installation Program (CSIP):
1. Before wood or metal stud walls are closed up, provide a written Woodwork Institute CSIP report confirming that acceptable backing is provided in all locations required for casework installation or identifying those locations where backing is missing or improperly located:
a. Backing shall consist of a minimum of either three by six (3 x 6) flat Douglas Fir or 16-gage 50 KSI sheet metal.
2. On completion of installation, provide a Woodwork Institute CSIP Certificate identifying the work covered and certifying that installation meets the requirements of the WI CSIP attachment details and schedules.
3. All fees charged by the Woodwork Institute for their CSIP are the responsibility of the millwork installer and shall be included in their bid.

E. Pre-Installation Conference:
1. See Section 01 31 00: Project Management and Coordination.

1.6 WARRANTY

A. Warranty the work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include but not be limited to the following:
1. Rough or difficult operation, or loose or missing parts.
2. Delamination of surfaces.
3. Noticeable deterioration of finish.
4. Warped or misaligned surfaces or telegraphing of subsurface imperfections.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed. Store in ventilated place, protected from the weather, with relative humidity range of 20 to 50 percent.

B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

PART 2 PRODUCTS

2.1 MILLWORK MANUFACTURERS

A. Woodwork Institute listed Accredited Millwork Companies, current roster and shall not preclude Contractor from using other manufacturers, provided they produce equivalent products of the type specified for the scope and size of the Project. Other manufacturers must have experience manufacturing products meeting or exceeding the specifications and must comply with the criteria specified inn Part 1 of this Section and with Division 01 requirements regarding substitutions.

2.2 MILLWORK MATERIALS

A. Plastic Laminate:

1. High-pressure decorative laminate complying with NEMA LD3, and the following requirements:
   a. Exterior color selection available:
      1) Architect to select from minimum of 250 selections available, including wood grain patterns and solid colors.
      2) Provide five (5) different colors available per project.
      3) If laminate has wood grain, direction of grain shall be vertical on door, end panels, fascia panels, and exposed backs; horizontal on drawer faces, aprons, and top rails.
2. Laminate grades:
   a. Exposed doors, finished end panels, and other vertical surfaces: GP28 (0.028 inch thick nominal)
   b. Horizontal surfaces other than top: GP28 (0.028 inch thick nominal)
   c. Cabinet liner: CL20 (0.020-inch nominal), white.
   d. Work surfaces and countertops: GP50 (0.050-inch thick nominal) with BK20 (0.20-inch thick) backer sheet.
   e. Backsplash: PH42 (0.042 inch nominal) with nominally balanced backer sheet.
3. Adhesive: PVA water resistant adhesive. Contact adhesives not permitted.
4. Pressure fused laminate:
   a. NEMA LD3 VGL, and NEMA LD3 CLS, melamine resin impregnated, 120-gram PSM minimum, thermofused to core under pressure.
   b. Color:
      1) Closed interiors, underside of wall cabinets: White.
      2) Exposed and semi-exposed open cabinets: Match exterior.
   c. Provide balanced construction with same thermofused melamine. Unsurfaced coreboard or simple backers not allowed.

B. Core Material:
1. Particleboard: ANSI 208.1, Grade M-2-Exterior Glue.
2. Medium-density fiberboard: ANSI A208.2, Grade MD.
3. Plywood: Shop sanded, exterior grade veneer cored, hardwood faced, any species, with no defects affecting strength or utility. Overlay plywood not permitted. Plywood allowed at countertops and toe-base only.
4. Water resistant treated plywood shall have 24-hour thickness swell factor of five percent (5%) or less and 24-hour water absorption factor of ten percent (10%) or less; P.S. 51, Type II or better.
5. Cabinet components shall be of the following minimum core thicknesses:
   a. Cabinet backs, drawer body, and drawer bottoms: 1/2-inch particleboard.
   b. Door and drawer face, base, wall, and tall cabinet tops and bottoms, cabinet sides, drawer spreaders, cabinet back rear hangstrips, structural dividers, and exposed cabinet backs: 3/4-inch particleboard.
   c. Work surfaces and countertops: Minimum one-inch (1”) particleboard or plywood, except use water resistant treated plywood core at counters with sinks.
   d. Shelves: 3/4-inch particleboard core for 30 inches long or less, one-inch (1”) thick particleboard core for more than 30 inches long; 14-inch deep, unless otherwise noted. Provide vertical dividers for shelves over 36 inches long.
   e. Cabinet toe-base: 3/4-inch plywood. No particleboard within four inches (4”) of floor.

C. Countertops and Backsplashes:
1. Countertops: Provide countertops with PVC edge in as long as practical continuous lengths. Provide field glued splines at joints. No joints closer than 24 inches either side of sink cutout.
2. Backsplash: Integral to countertop, four inches (4”) high unless otherwise shown. Fabricate with single continuous sheet of laminate from front counter to top of splash with no joints from horizontal to vertical application. No joints shall occur at sink

openings.
3. At exposed countertop end corners, provide one-inch (1") radius, or similar safety treatment.

D. Toe Spaces: Leave toe spaces unfinished for installation of resilient base, unless otherwise shown.

E. End Panels and Filler Strips: Match adjacent case-piece.

F. Edging:
1. Provide the following in accordance with "Edging Locations:"
   a. Flat edge PVC: 0.020 inch. Solid, high-impact, purified, color-thru, acid resistant, machine-applied with hot melt adhesives.
   b. Three-millimeter (3 mm) PVC: Solid, high-impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives, and machine profiled to 1/8-inch radius.
2. Edging locations:
   a. Cabinet body edge, including door/drawer front spacer rail: Flat edge PVC, color matched to door/drawer face or as selected.
   b. Forward edge of interior body components, interior dividers, shelf, and top edges of drawer body: Flat edge PVC to match cabinet interior surface color.
   c. Door/drawer-front edging: Three-millimeter (3 mm) PVC, color matched to standard laminates.

2.3 CABINET HARDWARE

A. All hardware shall meet ANSI A156.9 and shall be subject to approval by the Architect. All keying shall match existing master key system and be approved by the Owner:
1. Acceptable manufacturers:
   a. Knape & Vogt.
   b. As specified herein, provide specified product, or Architect approved equal.

B. Hinges:
1. Heavy duty, five-knuckle 2-3/4-inch institutional type hinge shall meet ANSI/BHMA A156.9 Grade 1 requirements. Mill ground, hospital tip, Teflon coated tight pin feature with all edges eased. Hinge shall be full wrap around type of tempered steel 0.095 inch thick. Each hinge shall have minimum of nine (9) screws, #7, 5/8-inch FHMS to assure positive door attachment.
2. One (1) pair per door to 48 inches height. 1-1/2 pair over 48 inches in height. Hinge shall accommodate 13/16 thick laminated door and allow 270-degree swing.
3. Finish: US26D.

C. Pulls: Wire design, four inches (4"), chrome, US26D finish.

D. Sliding Door Hardware:
1. Frameless 1/4-inch glass sliding doors; double track rolling door assembly.
2. Framed 13/16-inch thick stile and rail sliding doors; top mounted track with dual roller hangers. Vertical adjustment for accurate alignment.

E. Drawer Slides:
1. Standard drawers: 3/4 extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 100-pound dynamic load rating at full extension.
2. File drawers: Full extension, three-part progressive opening slide, precision steel ball bearing, minimum 100-pound dynamic load rating at full extension, zinc plated or

epoxy coated at manufacturer's option.

3. Provide body mounted molded rails for hanging file system for legal or letter size as indicated by manufacturer's model number. Cutting or machining of drawer body/face not permitted.
4. Paper storage drawers: Full extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 150-pound dynamic load rating at full extension.

F. Catches:
   1. Provide opening resistance in compliance with the Americans with Disabilities Act:
      a. Provide top-mounted magnetic catch for base and wall cabinet door.
      b. Provide two (2) at each tall cabinet door. Catch housing shall be molded in White.

G. Adjustable Shelf Supports:
   1. Dual-pin design with anti-tip-up shelf restraints for both 3/4-inch and one-inch (1") shelves.
   2. Include keel to retard shelf slide-off, and slot for mechanical attachment of shelf to clip.
   3. Load rating shall be minimum 300 pounds each support without failure.

H. Wardrobe Rod: 1-1/6 inch diameter plated steel rod, with captive sockets.

I. Coat Hooks: Single and double prong, wall mount - satin aluminum.

J. Locks: Five-disk tumbler cam-style with strike. Locks on cabinets in same room keyed alike. Provide two (2) keys per room where doors and drawers are scheduled to receive locks. Dull chrome finish. Lock core shall be removable with a control key, permitting Owner to change lock arrangements without tools.

2.4 SPECIALTY ITEMS

A. Grommets:
   1. Approved Product/Manufacturer: Model No. EDP3 manufactured by Doug Mockett & Company, Inc. (basis of design), Manhattan Beach, CA; (800) 523-1269, or Architect approved equal.
   2. Size: 2-1/2 inches diameter with "Flip-Top"™ tab in cap.
   3. Colors: As selected by Architect from manufacturer's available colors.
   4. Number/location: Where electrical, telephone, and computer data wiring need to pass through tops whether shown or not.

B. Keyboard Drawers (at all knee spaces):
   1. Approved product/manufacturer: No. SD-1 as manufactured by Knape & Vogt; or Architect approved equal.

C. Molded Personal Pencil Drawer: High-impact 100 Polystyrene with in-stop, out-stop, and self-closing features. Provide under top mounted 100-pound self-closing slides. Twelve (12) compartment drawer body, and slides, black. Provide where indicated on plans.

D. Mailbox Label Holder: Brass, card size 1/2-inch by 2-3/16 inches. Provide one (1) at each opening.

2.5 SOLID STOCK

A. Moisture Content: Percent of moisture in relation to over-dry weight shall be between eight percent (8%) and 13 percent at time of installation.

B. Natural Finish Hardwood:
   1. Occasional knot permitted provided it is tight and smooth.
   2. Grain pattern: Rift-cut.
   3. Species: WI "Premium" Grade, white oak.

C. Paint Grade Hardwood: Any species, including Parana Pine, except do not use oak, elm, or similar species that have coarse grain.

2.6 MISCELLANEOUS

A. Utility Shelving: WI "Economy" grade.

B. Clothes Rod: 1-1/2 inch diameter smooth wooden dowel by length required, with end supports and fasteners of type recommended to suit application.

C. Telephone/MDF/IDF Board: Provide minimum four foot by eight foot by 3/4 inch (4’ x 8’ x 3/4”) thick plywood for telephone/data punch down blocks and video equipment in accordance with Section 06 10 00: Rough Carpentry. Paint in accordance with Section 09 90 00: Painting and Coating.

2.7 MILLWORK FABRICATION

A. Fabricate casework, countertops, and related products to dimensions, profiles, and details shown on Drawings. Fabricate casework square, plumb, and true.

B. Detailed Requirements for Cabinet Construction:
   1. Toe-base:
      a. Continuous, ladder type platform with concealed fastening to cabinet bottom, level and secured to floor.
      b. Toe-base at exposed cabinet end panels shall be recessed 1/4 inch from face of finished end for flush installation of finished base material.
      c. No cabinet sides-to-floor will be allowed.
   2. Cabinet top and bottom:
      a. Solid sub-top shall be furnished for all base and tall cabinets.
      b. At cabinets over 36 inches, bottoms and tops shall be mechanically joined by a fixed divider.
      c. Assembly devices shall be concealed on bottom side of wall cabinets.
   3. Cabinet sides:
      a. Doweled, and glued under pressure, or attached with fully concealed interlocking mechanical fasteners to sub-top and bottom.
      b. Drill holes for adjustable shelves 1-1/4 inch on center.
   4. Cabinet backs:
      a. Side bound, captured in grooves, recessed from cabinet rear, and securely fastened at top and bottom.
      b. Hang rails shall be located at rear of cabinet back and fastened to cabinet sides. Provide minimum of two (2) at base, two (2) at wall, and three (3) at tall cabinets as instructed by casework manufacturer.
      c. Provide removable back panels and closure panels for plumbing access at all sink cabinets, and where shown on Drawings.
   5. Exposed end corner and face frame attachment:
      a. Butt joint, glued and finish nailed; or attached with fully concealed interlocked mechanical fasteners.
   6. Door and drawer fronts:
      a. Drawer fronts and hinged doors shall overlay the cabinet body. Maintain a maximum 1/8-inch reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.

b. Where indicated, provide stile and rail doors with full 1/4-inch plate glass, hinged or sliding. Exposed lite-opening edges shall be trimmed and glazed with extruded glazing bead.
c. Where indicated, frameless sliding glass doors shall be 1/4-inch thick plate glass with ground and polished edges. Fit with anodized aluminum shoes and nylon rollers.

C. Drawers:
1. Drawer fronts: Apply to separate drawer body component sub-front.
2. Drawer sides: Doweled to receive front and back, glued under pressure, machine squared.
3. Drawer bottom: Set into front and sides, 1/4-inch deep groove with minimum 3/8-inch standing shoulder, continuously glued. Reinforce drawer bottoms with 1/2 inch by four-inch (4") front-to-back intermediate underbody stiffeners, mechanically fastened. One (1) at 24 inches, two (2) at 36 inches, and over.
4. Paper storage drawers: Fitted with full width hood at back.
5. Hanging file drawers shall be fabricated to accept letter size hanging folders compatible with Pendaflex system.

D. Vertical and Horizontal Dividers: As required by manufacturer for type and style of component.

E. Door/Drawer Front Rail: As required by manufacturer for type and style of component, and hardware placement.

F. Accessibility Requirements - 2019 California Building Code, Section 11B:
1. The following special requirements shall be met, where specifically indicated on architectural Plans as "accessible" or by general note. Shall be in compliance with California title 24 access:
a. Countertop height: With or without cabinet below, not to exceed a height of 34 inches above finished floor (A.F.F.), at a surface depth of 24 inches.
b. Knee space clearance: Minimum 27 inches A.F.F. at apron, and 30 inches clear span width (11B-306.3).
c. Sink cabinet clearances: In addition to above, upper knee space frontal depth shall be no less than eight inches (8"), and lower toe frontal depth shall be no less than 11 inches, at a point nine inches (9") A.F.F., and as further described in 11B-306.

G. Typical Desk or Counter Height at Knee Space Locations: 30 inches A.F.F.

PART 3 EXECUTION

3.1 JOB CONDITIONS

A. Environmental Requirements:
1. Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least one (1) week:
a. Manufacturer/supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
b. After installation, control temperature and humidity to maintain relative humidity between 25 and 55 percent.

B. Conditions: Do not store or install casework in building until concrete, masonry, and drywall/plaster work is dry.

3.2 COORDINATION

A. Coordinate the work of this Section with plumbing work specified in Division 22. Coordinate sink opening construction with sinks specified in Division 22.

B. Coordinate location of blocking in walls for installation and support of wall cabinets.

3.3 MILLWORK INSTALLATION

A. Positioning: Place approximately level, plumb, and at right angles to adjacent work.

B. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging the products and adjacent work.

C. Anchorage: Attach securely so the products will perform to their maximum ability without damage from inadequate fastenings.

D. Fasten tops to frames with concealed clips, screws, and glue.

E. Install simulated wood trim in locations shown on Drawings and in accordance with manufacturer's instructions.

3.4 EXISTING DOOR LAMINATE RESURFACING

A. Resurfacing procedures shall be in accordance with the recommendations and instructions of the laminate and adhesive manufacturers.

B. Acclimate laminate to the same environment as existing material at least 48 hours. Perform work in well-ventilated area, out of the way of construction dust and traffic to maintain clean adhesion.

C. Clean the substrate with detergent or non-flammable solvent as instructed by laminate manufacturer to remove wax, grease, and polish deposits.

D. Using a belt sander or sander instructed by manufacturer, sand entire surface to remove original finish. Remove sanding dust thoroughly.

E. Coat the sanded surface and back of laminate with a uniform coating of contact adhesive. Allow to dry thoroughly prior to assembling. Assembling wet adhesive lines will trap solvent and may result in poor bonding. Follow the adhesive manufacturer's instructions.

F. Index the laminate with the substrate. Make initial contact by smoothing with palms. Apply pressure using a "J" roller or rotary press. Allow to set as instructed by adhesive manufacturer to achieve full adhesion to maintain warranty. Trim with recommended tools.

G. Apply laminate to door faces and exposed vertical edges. Apply edges before face. Paint top and bottom edges to color match facing.

H. Coordinate hardware and vision lite cutouts with work of other Sections.

3.5 FINISH HARDWARE INSTALLATION

A. The supplier will mark each item of hardware for location. Protect the markings until each item is installed. If any item is delivered to the job not properly marked, return it to the supplier for marking before attempting to install it.

B. Check markings on hardware for proper location. Install and make necessary adjustments

for proper working order. Any hardware damaged by improper adjustment or careless abuse will be replaced by Contractor at his expense.

C. Provide clean, properly sized, and accurately placed mortises and drilled holes for all mortise hardware such as locksets and for cylindrical locks where specified only.

D. Fit all surface-applied hardware accurately.

E. After hardware is installed, protect exposed surfaces by use of heavy paper and masking tape and maintain until job completion.

F. Remove all finish hardware except that which is primed for painting before painter's finish is applied. Permanently replace and re-adjust for proper function after painter's finish has dried hard.

G. Millwork contractor shall be responsible for hardware on millwork.

3.6 PLASTIC LAMINATE FACED WOOD DOOR INSTALLATION

A. Protect all doors during handling.

B. Refer to Section 08 71 00: Door Hardware for hardware requirements.

C. Install doors in accordance with manufacturer’s instructions.

D. Install and adjust doors for smooth, quite operation.

END OF SECTION 06 20 00

SECTION 06 40 00 ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Plastic laminate cabinets.
2. Plastic laminate and solid surface countertops.
3. Plastic laminate panels.
4. Standing and running trim.
5. Closet and utility shelving.
6. Shop finishing.
7. Accessories necessary for a complete installation.

B. Related Sections:
1. Section 06 10 00: Rough Carpentry.
2. Section 06 20 00: Finish Carpentry and Millwork.
3. Section 09 90 00: Painting and Coating.
4. Section 12 35 50: Educational/Library Casework.

1.3 DEFINITIONS

A. Architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data:
1. Technical data for each type of product indicated including cabinet hardware and accessories:
a. Include data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:
1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components:
a. Show details full size.
b. Show locations and sizes of furring, blocking, and hanging strips including concealed blocking and reinforcement specified in other Sections.
c. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in architectural woodwork.

C. Samples:
1. Lumber with or for transparent finish, not less than five inches (125 mm) wide by 24 inches (600 mm) long, for each species and cut, finished on one (1) side and one (1) edge.
2. Veneer faced panel products with or for transparent finish, eight inches by ten inches (200 by 250 mm), for each species and cut. Include at least one (1) face veneer seam

and finish as specified.

3. Lumber and panel products with shop applied finish, 50 square inches (300 sq. cm) for lumber and eight inches by ten inches (200 mm by 250 mm) for panels, for each finish system and color, with 1/2 of exposed surface finished.
4. Plastic laminates, eight inches by ten inches (200 mm by 250 mm), for each type, color, pattern, and surface finish and specified edge material applied to one (1) edge.
5. Quartz surfacing materials, six inches (6") square.
6. Corner pieces:
   a. Cabinet front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by six inches (150 mm) deep.
7. Exposed cabinet hardware and accessories, one (1) unit for each type and finish.

D. Qualification Data: For fabricator/installer.

E. Woodwork Quality Standard Compliance Certificates: Woodwork Institute (WI) Quality Certification Program certificates (CCP).

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building code: Comply with applicable requirements of CBC Chapter 8 for Interior Finishes.
   2. Accessibility:
      a. 2019 California Building Code; Section 11B-309 for Casework, Section 11B-404 Doors and Hardware and Section 11B-703 for Signage (where applicable).
      b. ADA Accessibility Guidelines (ADAAG) for Buildings and Facilities; final guidelines and revisions.
   3. Quality standard: Unless otherwise indicated, comply with WI for premium grade architectural woodwork indicated for construction, finishes, installation, and requirements. Provide certified compliance labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.
   4. Fire test response characteristics: Where fire retardant materials or products are indicated, provide materials and products with specified fire test response characteristics determined by testing identical products per test method indicated by UL. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

B. Fabricator Qualifications: Shop having minimum five (5) years' documented experience who employs skilled workers who custom fabricate products similar to those required and who is a participating member of WI.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence matched wood veneers and transparent finished wood doors that are required to be of same species as woodwork.

D. Quality Standard: Unless otherwise indicated, comply with North American Architectural Woodwork Standards, meeting or exceeding ANSI A161.1, for grades of architectural woodwork indicated for construction, finishes, installation, and requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork is completed in installation areas. If woodwork must be stored in other than installation

areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide materials that comply with requirements of WI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products:
1. Hardboard: AHA A135.4.
2. Medium density fiberboard:
   a. ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde; minimum 48 pcf density except that minimum for screw holding capacity on face shall be 300 pounds; minimum 3/4 inches (19 mm) thick, edged and faced as specified:
      1) Arauco; Trupan MDF, VESTA Technology.
      2) Roseburg Forest Products, Inc.; Roseburg MDF products.
      3) Approved equal.
3. Particleboard: Unless otherwise noted by District, particleboard is not to be used.
4. Softwood plywood: DOC PS 1, medium density overlay.

C. Lumber:
1. Comply with applicable provisions for grading and workmanship of WI Quality Standards, and requirements specified. Provide lumber surfaced 4 sides (S4S) and fabricated to profiles shown. Kiln dry lumber to 19 percent moisture content:
   a. Furring, blocking, and shims: No. 1 Common; Southern Pine.
   b. Solid hardwood for opaque finish: Plain sawn Yellow Poplar, free from checks, splits, and sound knots.

D. Thermoset Decorative Panels:
1. Particleboard or medium density fiberboard finished with thermally fused, melamine impregnated decorative paper complying with LMA SAT-1:
   a. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed edges.

E. High Pressure Decorative Laminate - NEMA LD 3, grade indicated or as required by woodwork quality standard:
1. Manufacturer is subject to compliance with requirements; provide high pressure decorative laminates by one of the following:
   a. Abet Laminati, Inc.
   b. Formica Corporation.
   c. Panolam Surface Systems by Panolam Industries International Incorporated.
   d. Wilsonart LLC.

2.2 FIRE RETARDANT TREATED MATERIALS

A. Where fire retardant treated materials are indicated, use materials complying with requirements acceptable to authorities having jurisdiction, and with fire test response characteristics specified:
1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or defective.
2. Use fire retardant treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from

untreated materials.

3. Identify fire retardant treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire Retardant Particleboard:
   1. Panels complying with requirements, made from softwood particles and fire retardant chemicals mixed together at time of panel manufacture to achieve flame spread index of 25 or less and smoke developed index of 50 or less per ASTM E84:
      a. For panels 3/4 inch (19 mm) thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: Modulus of rupture, 1,600 psi 11 MPa; modulus of elasticity, 300,000 psi 2,070 MPa; internal bond, 80 psi 550 kPa; and screw-holding capacity on face and edge, 250 and 225 lbf 1,100 and 1,000 N, respectively.
      b. For panels 13/16 inch to 1-1/4 inches (20 to 32 mm) thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: Modulus of rupture, 1,300 psi 9 MPa; modulus of elasticity, 250,000 psi 1,720 MPa; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf 1,100 and 780 N, respectively.
      c. Product: Subject to compliance with requirements, provide Duraflake FR by Arauco.

C. Fire Retardant Fiberboard: Medium density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire retardant chemicals mixed together at time of panel manufacture to achieve flame spread index of 25 or less and smoke developed index of 200 or less in accordance with ASTM E84.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers of items referenced to this standard. Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Frameless Concealed Hinges (European Type) - BHMA A156.9, B01602, Self-Closing:
   1. Provide 170-degree minimum opening capabilities. For end doors perpendicular to walls, provide 90-degree type.
   2. For doors 32 inches high or less, provide two (2) pairs of hinges, add 1/2 pair for every additional 20 inches.
   3. Products are subject to compliance with requirements; provide from one of the following:
      a. Hafele North America Co.
      b. Julius Blum, Inc.
      c. Mepla-Alfit, Inc.

C. Wire Pulls: Back mounted, solid metal, five inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter.

D. Catches - Magnetic, Complying with BHMA A156.9 and B03161:
   1. Rockwood 901 by Assa Abloy.
   2. Comparable product.

E. Cabinet Shelf Rests - Nickel plated, 7 mm diameter shelf support pegs in brass sockets, complying with BHMA A156.9, B04013:
   1. Hafele 282.01.701 x 282.50.704 or comparable product.

F. Closet Rods and Flanges: 1-1/2-inch diameter, satin finished chrome plated steel or satin finished stainless steel with matching end flanges.

G. Adjustable Shelf Standards and Brackets for Wall Hung Open Shelving - BHMA A156.9, B04071; With Shelf Rests, B04081:
   1. Standards: Model No. 87ANO Super Duty 87/186/187 Steel Series; lengths as indicated, by Knape & Vogt or comparable product.
   2. Brackets: Model No. 187 LL ANO 12 to 24 for 12-inch to 24-inch (300 mm to 600 mm) deep shelves by Knape & Vogt or comparable product.
   3. Shelf rests: Model No. 210 ANO End Rest and Model No. 211 ANO Center Rest with Model No. 129 RUB Rubber Cushions or comparable product.

H. Shelf Rests: BHMA A156.9, B04013; metal, two pin type with shelf hold down clip.

I. Silencers:
   1. Provide rubber silencers on jamb and/or head and sill strike areas of all cabinet doors and drawers, two (2) for paired doors, and three (3) for single doors:
      a. Size: Approximately 1/4-inch (6.4 mm) diameter.
      b. Color: Compatible with adjacent finish.

J. Drawer Slides - BHMA A156.9, B05091:
   1. Provide positive stop, self-closing side mounted, full extension, zinc plated steel drawer slides with steel ball bearings:
      a. Pencil drawer slides: Grade 1; for drawers not more than three inches (75 mm) high and 24 inches (600 mm) wide; Accuride 2006 having 3/4 extension carburized steel ball bearing, side mounting, 45-pound capacity medium duty load rating, cold rolled steel slide members and ball retainers, bright electro zinc plate finish.
      b. Box drawers (less than eight inches [8”] deep): Grade 1HD-100; for drawers not more than six inches (150 mm) high and 24 inches (600 mm) wide. Provide Accuride 4034; up to 24 inches wide, full extension carburized steel ball bearing, side mounting, 150-pound capacity medium duty load rating, cold rolled steel slide members and ball retainers, cushioned in and out stops, detent-in, progressive action, positive stop, clear zinc finish.
      c. Pedestal drawers (greater than eight inches [8”] deep): Accuride 4032; up to 24 inches wide, full extension carburized steel ball bearing, rail mounting, minimum 150-pound capacity heavy duty load rating, cold rolled steel slide members and ball retainers, cushioned in and out stops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
      d. Lateral file drawer slides: For drawers more than six inches (150 mm) high or 24 inches (600 mm) wide; heavy-duty, up to 42 inches wide, 3640A by Accuride.
      e. Keyboard slide: Model No. 2109, color black, by Accuride, Inc.
      f. Refuse cabinets: Accuride C3600-201D, full extension carburized steel ball bearing, bracket mounting, heavy-duty, cold rolled steel slide members and ball retainers, cushioned in and out stops, progressive action, positive stop, clear zinc plate finish.

K. Door and Drawer Locks:
   1. Provide locks for each cabinet door and drawer as indicated on Drawings. Finish exposed portions of locks to match cabinet pull finish. Furnish two (2) keys with each lock and key locks inside one room alike and provide master key for locks in Project. Selections to meet BHMA A156.11 and E07041 (for drawers) or E07121 (for doors):
      a. Cam lock similar to Hafele 235.20.20x, chrome plated, with offset cam 219.13.9xx, sized to fit opening.
      b. Cam lock similar to Hafele 235.20.20x, chrome plated, with surface mounted strike 251.60.703.
      c. Pairs of doors:

1) Inactive leaf: Furniture bolt similar to Hafele 252.02.644, polished chrome, with strike 251.60.703.
2) Active leaf: Single door lock assembly.

L. Grommets for Cable Passage through Countertops:
1. Two-inch (51 mm), black, molded plastic grommets and matching plastic caps with slot for wire passage:
a. Product: Subject to compliance with requirements, provide TG series by Doug Mockett & Company, Inc.

M. Trash Grommet Through Countertop: TM1B, six-inch by two-inch (6” x 2”) polished stainless-steel grommet by Doug Mockett and Co., Inc.

N. Exposed Hardware Finishes:
1. For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated:
a. Satin chromium plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

O. Concealed Hardware: Provide finish complying with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire retardant treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot dip galvanized anchors and inserts on inside face of exterior walls and as required for corrosion resistance. Provide toothed steel or lead expansion sleeves for drilled in place anchors.

C. Hanging (Zee Clip) Strips: Extruded aluminum zee type interlocking clips; type, size and quantity for the condition of use.

D. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

E. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

F. Blind Splines: Specialty devices, as required for tight butt joining, types and size as recommended by woodwork fabricator.

G. Covercaps: Where mortises of fastener heads or drawdowns are exposed (blind holes) in finished work, provide black plastic covercaps.

H. Adhesive for Bonding Plastic Laminate:
1. Resorcinol:
a. Adhesive for bonding edges: Hot melt adhesive.

I. Stone Seam Adhesive:
1. Two-part, epoxy resin stone adhesive with an initial set time of not more than two (2) hours at 70 degrees F (21 degrees C), and with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Color: Clear.
b. Products: Subject to compliance with requirements, provide Bonstone Materials Corporation - Duproxi or Akemi North America - Akepox.

J. Stone Sealer:
1. Colorless, nonstaining, single component, neutral curing silicone sealant that does not affect color or physical properties of stone surfaces, recommended by stone producer for application indicated. Subject to compliance with requirements, provide products by one of the following:
a. Bostik, Inc.
b. Custom Building Products.
c. Hillyard, Inc.

K. Stone Cleaner: Cleaner specifically formulated for stone types, finishes, and applications indicated, recommended by stone producer and by sealer manufacturer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

2.5 FABRICATION

A. Woodwork Grade:
1. WI Custom Grade woodwork complying with referenced quality standard:
a. Complete fabrication, including assembly, finishing, and hardware application, before shipment to site to the maximum extent possible. Disassemble components as necessary for shipment and installation. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting. The width of scribe and filler panels shall not exceed 1/2 inch or 1/2-inch clear dimension from adjacent wall to outside face of cabinet door in a 90-degree position, whichever is greater.
b. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify various parts fit as intended and check measurements of assemblies against field measurements indicated on shop drawings before disassembling for shipment.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire retardant treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
1. Corners of cabinets and edges of solid wood (lumber) members 3/4 inch (19 mm) thick or less: 1/16 inch (1.5 mm).
2. Corners of cabinets and edges of solid wood (lumber) members 3/4 inch (19 mm) thick or less: 1-1/2 inch (38 mm).
3. Corners of cabinets and edges of solid wood (lumber) members and rails: 1/16 inch (1.5 mm).

E. Shop cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs:
1. Seal edges of openings in countertops with a coat of varnish.

F. Plastic Laminate Faced Wood Paneling - WS Premium Grade:
1. Plastic laminate - high pressure decorative laminate complying with NEMA LD 3:
   a. Faces: Grade SGF.
   b. Backs: Grade BKH.
   c. Exposed edges: Same as faces.
2. Colors, patterns, and finishes:
   a. Wood grains, matte finish:
      1) Grain direction: Vertical.
3. Panel core - particleboard or medium density fiberboard:
   a. Thickness: 3/4 inch (19 mm).
4. Exposed panel edges:
   a. Applied solid wood banding 11/16 inch (18 mm) thick by depth of panels.
5. Adhesive for bonding edges: Hot melt adhesive or adhesive for faces.
6. Assemble panels by gluing and concealed fastening.

G. Plastic Laminate Cabinets - WS Premium Grade:
1. WI type of cabinet construction: Flush overlay.
2. Materials:
   a. Laminate cladding for exposed surfaces - high pressure decorative laminate:
      1) Horizontal surfaces other than tops: Grade HGS.
      2) Post formed surfaces: Grade HGP.
      3) Vertical surfaces: Grade VGS.
      4) Edges: Grade HGS.
   b. Semi-exposed surfaces:
      1) Surfaces other than drawer bodies - thermoset decorative panels:
         a) Edges of plastic laminate shelves: Grade HGS, matching laminate in color, pattern, and finish.
         b) For semi-exposed backs of panels with exposed plastic laminate surfaces, provide surface of high pressure decorative laminate, Grade VGS.
      2) Drawer sides and backs: Solid hardwood lumber.
      3) Drawer bottoms: Hardwood plywood.
   c. Concealed backs of panels with exposed plastic laminate surfaces: High pressure decorative laminate, Grade BKL.
3. Colors, patterns, and finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces indicated in Finish Schedule.
4. Provide dust panels of 1/4 inch (6.4 mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.
5. Fabrication:
   a. Join case body members using concealed dado or dowel methods utilizing glue and pressure. Reinforce dado method with nailing or screws. Mechanical fasteners are not permitted:
      1) Base cabinet bottoms and subtops: Bottoms, 3/4-inch particleboard with low pressure laminate finish on interior side and phenolic backing sheet on concealed side. Subtops, 3/4-inch particleboard with phenolic backing sheet both sides. Fabricate all base cabinets with subtops.
      2) Wall cabinet tops and bottoms: Tops, one-inch (1”) particleboard with low pressure laminate finish on interior side and phenolic backing sheet on concealed side. Bottoms, one-inch (1”) particleboard with manufacturer's low pressure laminate finish both sides.
      3) Cabinet ends: 3/4-inch particleboard with low pressure laminate finish on interior side and phenolic backing sheet on concealed side. Install high pressure plastic laminate on exposed sides of cabinet ends.
      4) Cabinet backs - 1/4-inch hardboard with low pressure laminate finish for standard unexposed backs:
         a) Fabricate with continuous hot melt glue joint between sides, tops,

bottoms, and back on concealed side.
b) Exposed backs: 3/4-inch particleboard with low pressure laminate finish on interior side and high pressure plastic laminate on exterior, exposed side.

5) Cabinet shelves (adjustable, semi-concealed): 3/4-inch particleboard with low pressure laminate finish on both sides. Provide one-inch (1") particleboard for shelves for unsupported spans over 36 inches.
6) Cabinet doors: 3/4-inch particleboard with high pressure plastic laminate on exterior side and heavy gauge balancing sheet on interior side.
7) Drawer fronts: 3/4-inch particleboard with high pressure plastic laminate on exterior side and heavy gauge balancing sheet on interior side.
8) Drawer construction - 1/2-inch solid hardwood back, sides, and subfront; tongued and dadoed into back and subfront, joints glued and pinned; 1/4-inch hardboard bottom tongued and dadoed in all four sides, back, and subfront. Provide additional support with continuous hot melt glue joint on underside of drawers between sides, back, subfront, and bottom:
   a) Reinforce drawer bottoms as required with spreaders.
   b) Apply drawer front to subfront in accordance with manufacturer's standard procedures.
   c) Dividers: 3/4-inch particleboard with manufacturer's low pressure laminate finish on both sides. Secure to inside of cabinet with manufacturer's standard plastic clips.
   d) Dust panels: Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers except where located directly under tops.
   e) Finish exterior exposed surfaces with high pressure plastic laminate. Laminate plastic to particleboard core with balancing sheet using urea resin formaldehyde glue. Fabricate using cold press method with regulated pressure for minimum eight hours at minimum 70 degrees F.

H. Countertops - WI Premium Grade:
1. Solid surface:
   a. Solid surfacing material thickness: 3/4 inch (19 mm).
   b. Colors, patterns, and finishes: Provide materials and products resulting in colors of solid surfacing material indicated on Drawings.
2. Quartz countertops:
   a. Seams:
      1) Fabricate countertops without seams to the extent possible. When seams are necessary, fabricate countertops in sections indicated for joining in field, with sealant filled seams 1/16 inch (1.5 mm) in width.
   b. Fittings: Drill countertops in shop for fittings and similar items.
   c. Fabricate with four-inch (4") backsplashes. Sand minor scratches and stains with #400 then #600 sandpaper.
3. Fabrication:
   a. Fabricate tops in one piece, unless otherwise indicated. Comply with solid surfacing material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing:
      1) Fabricate tops with shop applied edges of materials and configuration indicated.
      2) Fabricate tops with loose backsplashes for field application.
   b. Drill holes in countertops for plumbing fittings and soap dispensers in shop.
4. Countertop construction tolerances:
   a. Variation from plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches (1.5 mm in 1,200 mm).
   b. Variation from level: Do not exceed 1/8 inch in 96 inches (3 mm in 2,400 mm), 1/4 inch (6 mm) maximum.

c. Variation in joint width: Do not vary joint thickness more than 1/4 of nominal joint width.
d. Variation in plane at joints (lipping): Do not exceed 1/64-inch (0.4 mm) difference between planes of adjacent units.
e. Variation in line of edge at joints (lipping): Do not exceed 1/64-inch (0.4-mm) difference between edges of adjacent units, where edge line continues across joint.

2.6 SHELVING

A. Closet and Utility Shelving:
1. Grade: WI Custom.
2. Shelf material: 3/4 inch (19 mm) medium density fiberboard with solid lumber edge.
3. Cleats: 3/4-inch (19 mm) solid lumber.

2.7 SHOP FINISHING

A. Grade: WI Premium grade.

B. Shop finish architectural woodwork at fabrication shop. Defer final touchup, cleaning, and polishing until installation.

C. Produce finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

D. Preparations for Finishing:
1. Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work:
a. Backpriming: Apply one (1) coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two (2) coats to back of paneling and to end grain surfaces. Concealed surfaces of plastic laminate clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.

E. Exposed Surfaces - WI Premium Grade:
1. Plastic laminate finish: Use hot plate method for gluing of plastic laminate surfacing materials; glued surfaces shall be in close contact throughout. Glue stains are not permitted.
2. Solid surfacing finish: As scheduled.

F. Unexposed Wood Finish: Water based alkyd type primer/sealer.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements:
1. Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work:

a. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on shop drawings.
b. Established dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

3.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork will be supported and installed as indicated.

3.3 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas. Before installing architectural woodwork, examine shop fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.4 INSTALLATION

A. Grade: Install woodwork to comply with requirements for grade specified for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2,400 mm). Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

C. Fire Retardant Treated Wood: Handle, store, and install fire retardant treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails (or finishing screws) for exposed fastening, countersunk, and filled flush with woodwork and matching final finish if transparent finish is indicated.

E. Plastic Laminate Paneling:
1. Install paneling to comply with same grade as paneling to be installed:
a. Install paneling level, plumb, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2,400 mm). Install with no more than 1/16 inch in 96 inches (1.6 mm in 2,400 mm) vertical cup or bow and 1/8 inch in 96 inches (3 mm in 2,400 mm) horizontal variation from a true plane.
b. Anchor paneling to supporting substrate with blind nailing. Do not use face fastening unless covered by trim.

F. Cabinets:
1. Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide

unencumbered operation. Complete installation of hardware and accessory items as indicated:

a. Install cabinets with no more than 1/8 inch in 96 inches (3 mm in 2,400 mm) sag, bow, or variation from a straight line.
b. Maintain veneer sequence matching of cabinets with transparent finish.
c. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer head screws sized for 1 inch (25 mm) penetration into wood framing, blocking, or hanging strips or toggle bolts through metal backing or metal framing behind walls.

G. Countertops:
1. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop:
a. Install countertops with no more than 1/8 inch in 96 inches (93 mm in 2,400 mm) sag, bow, or variation from a straight line.
b. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
c. Caulk space between backsplash and wall with silicone sealant.

H. Solid Surface and Stone Countertop:
1. Install components plumb and level scribed to adjacent finishes. Fabricate with backsplashes. Sand minor scratches and stain:
a. Align adjacent stone and solid surfacing material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
b. Do not cut in field unless otherwise indicated. If countertops or splashes require additional fabrication not specified to be performed at site, return to fabrication shop for adjustment.
c. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
d. Set stone and solid surface materials to comply with requirements indicated on Drawings and shop drawings. Shim and adjust to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances. Install anchors and attachments indicated or necessary to secure countertops in place.
e. Where backsplash is indicated, install backsplash and end splash by adhering to wall with water-cleanable epoxy adhesive and to countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
f. Adhesive top mount sinks/bowls to countertops using manufacturer's recommended adhesives and color matched silicone sealants.
g. Keep components clean during installation. Remove adhesives, sealants, and stains. Replace stained components.
h. Apply sealant to joints and gaps; comply with Section 07 92 00: Joint Sealants. Remove temporary shims before applying sealant.
i. Make plumbing connections to sinks in accordance with plumbing requirements.
j. Protect surfaces from damage. Repair work or replace damaged work that cannot be repaired to Architect's satisfaction.

I. Closet and Utility Shelving:
1. Cut shelf cleats at ends of shelves about 1/2 inch (13 mm) less than width of shelves and sand exposed ends smooth:
a. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners maximum 16 inches (400 mm) o.c.
b. Install shelf brackets according to manufacturer's written instructions, spaced

maximum 36 inches (900 mm) o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

c. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners maximum 12 inches (300 mm) o.c.

d. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced maximum 36 inches (900 mm) o.c. and within six inches (150 mm) of end of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

e. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports:
   1) Fasten shelves to cleats with finish nails or trim screws, set flush.
   2) Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

J. Touch up finishing work. Fill nail holes with matching filler where exposed.

K. Construction Tolerances:
1. Variation from plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches (1.5 mm in 1,200 mm).
2. Variation from level: Do not exceed 1/8 inch in 96 inches (3 mm in 2,400 mm), 1/4-inch (6 mm) maximum.
3. Variation in joint width: Do not vary joint thickness more than 1/4 of nominal joint width.
4. Variation in plane at joints (lipping): Do not exceed 1/64-inch (0.4 mm) difference between planes of adjacent units.
5. Variation in line of edge at joints (lipping): Do not exceed 1/64-inch (0.4 mm) difference between edges of adjacent units, where edge line continues across joint.

3.5 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality: Provide temporary ventilation during work.

B. Waste Management:
1. Comply with requirements of Section 01 74 19: Construction Waste Management and Disposal:
   a. Select wood sizes to minimize waste; reuse scrap to the greatest extent possible. Clearly separate scrap for use on site as accessory components, including shims, bracing, and blocking.
   b. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
   c. Prevent saw dust and wood shavings from entering the storm drainage system.
   d. Do not burn scrap lumber that has been pressure treated.
   e. Do not send lumber treated with pentachlorophenol, CCA, or ACA to cogeneration facilities or waste to energy facilities.

3.6 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop applied finishes to restore damaged or soiled areas.

D. Countertops:
   1. Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately:
      a. In-progress cleaning: Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.
      b. Remove and replace countertops that are:
         1) Broken, chipped, stained, or otherwise damaged. Stone may be repaired if methods and results are approved by Architect. Repair solid surface in accordance with manufacturer recommendations when approved by Architect.
         2) Defective countertops.
         3) Defective joints, including misaligned joints.
      c. Replace complying with requirements and showing no evidence of replacement.

E. Stone: Clean stone countertops not less than six (6) days after completion of sealant installation, using clean water and soft rags. Do not use wire brushes, acid type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.

F. Stone Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

3.7 PROTECTION

A. Provide final protection and maintain conditions, acceptable to manufacturer and installer, ensuring woodwork is without damage or deterioration at time of Substantial Completion.

END OF SECTION 06 40 00

SECTION 07 21 00 THERMAL INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Polyisocyanurate foam plastic board.
   2. Glass fiber blanket.
   3. Acoustical Insulation.
   4. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 06 10 53: Miscellaneous Rough Carpentry.
   2. Section 09 21 16: Gypsum Board Assemblies.

1.3 SUBMITTALS

A. Product Data: Technical data and installation instructions for each type of insulation product specified.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire performance characteristics - Identify products with appropriate markings of applicable testing and inspecting organization:
      a. Surface burning characteristic: ASTM E84.
      b. Flame spread index: Maximum 25.
      c. Smoke developed index: Maximum 450.
      d. Fire resistance ratings: ASTM E119.
      e. Combustion characteristics: ASTM E136.
   2. Underwriter's Laboratories (UL) 723 Tests for Surface Burning Characteristics of Building Materials.
   3. SCAQMD – South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.
   4. Greenguard Children and Schools (http://www.greenguard.org/).

B. Single Source Responsibility for Insulation Products: Obtain each type of building insulation from single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of Work.

C. Environmental Requirements:
   1. Manufacture extruded polystyrene with HCFC or other CFC free blowing agents. Mark insulation boards and packages with manufacturer's name and product designation. Unmarked boards and packages will be rejected:
      a. Wherever possible, provide boards from manufacturers who recycle insulation materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam plastic board insulation:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 PRODUCTS

2.1 POLYISOCYANURATE FOAM PLASTIC BOARD

A. Polyisocyanurate Board, Foil Faced - ASTM C1289, Foil Faced, Type I, Class 1 or 2:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Atlas Roofing Corporation.
      b. Hunter Panels.
      c. DuPont.
      d. Firestone Building Products.
      e. Rmax, Inc.
      f. Approved equal.
   2. Fire propagation characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 GLASS FIBER BLANKET

A. Glass Fiber Blanket, Unfaced - ASTM C665, Type I; with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Johns Manville (Basis of Design).
      b. CertainTeed Corporation.
      c. Guardian Building Products, Inc.
      d. Owens Corning.
      e. Approved equal.

B. Glass Fiber Blanket, Polypropylene Scrim Kraft Faced - ASTM C665, Type II (non-reflective faced), Class A (faced surface with a flame spread index of 25 or less); Category 1 (membrane is a vapor barrier):
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Johns Manville (Basis of Design).
      b. CertainTeed Corporation.
      c. Owens Corning.
      d. Approved equal.

2.3 ACOUSTICAL INSULATION

A. Glass Fiber Noise Reducer Blanket, Kraft-faced - ASTM C665, Type II; with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per ASTM E84;

combustion characteristics. To be installed on interior wood stud framing:

1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a. CertainTeed Corporation (Basis of Design).
   b. Guardian Building Products, Inc.
   c. Johns Manville; a Berkshire Hathaway company.
   d. Owens Corning.
   e. Approved equal.

2.4 INSULATION FASTENERS

A. Adhesively Attached, Spindle Type Anchors:
   1. Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place:
      a. Plate: Perforated, galvanized carbon steel sheet, 0.030-inch (0.762 mm) thick by two inches (50 mm) square.
      b. Spindle: Copper coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.

B. Adhesively Attached, Angle Shaped, and Spindle Type Anchors:
   1. Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place:
      a. Angle: Formed from 0.030-inch (0.762 mm) thick, perforated, galvanized carbon steel sheet with each leg two inches (50 mm) square.
      b. Spindle: Copper coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.

C. Insulation Retaining Washers:
   1. Self-locking washers formed from 0.016-inch (0.41 mm) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter:
      a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
         1) Crawl spaces.
         2) Ceiling plenums.
         3) Attic spaces.

D. Insulation Standoff: Spacer fabricated from galvanized mild steel sheet for fitting over spindle of insulation anchor to maintain air space of two inches (50 mm) between face of insulation and substrate to which anchor is attached.

E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

F. All other materials such as wire supports, fasteners, and retainers not specifically described but required to complete the work shall be as recommended by approved manufacturer, provided and installed by Contractor.

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids:
   1. Glass fiber insulation: ASTM C764, Type II, loose fill; with maximum flame spread and smoke developed indexes of 5, per ASTM E84.
   2. Spray polyurethane foam insulation: ASTM C1029, Type II, closed cell, with maximum flame spread and smoke developed indexes of 75 and 450, respectively, per

ASTM E84, and shall conform to all SCAQMD and EPA air quality regulations.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

B. Sequence work to ensure fireproofing and firestop materials are in place before beginning work.

3.2 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

B. Foam in Place Insulation:
   1. Verify that substrates are clean, dry, and free of substances that are harmful to insulation:
      a. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Board and Batt Insulation:
   1. Install insulation that is undamaged, dry, and unsoiled and has not been exposed to ice, rain, or snow at any time:
      a. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
      b. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

C. Cavity Wall Insulation:
   1. Foam plastic board insulation:
      a. Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both

directions. Press units firmly against inside substrates:
1) Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in.

D. Framed Construction - Blanket Insulation:
1. Install in cavities formed by framing members according to the following requirements:
a. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
b. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
c. Maintain three-inch (76 mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
d. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
e. For metal framed wall cavities where cavity heights exceed 96 inches (2,438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
f. For wood framed construction, install blankets according to ASTM C1320 and as follows:
1) With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
g. Miscellaneous voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1) Glass fiber insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2) Spray polyurethane insulation: Apply according to manufacturer's written instructions.

E. Reflective Insulation:
1. Install sheet reflective insulation according to ASTM C727:
a. Install sheet radiant barriers according to ASTM C1744.
b. Install interior radiation control coating system according to ASTM C1321.

F. Continuous Insulation for Exterior Walls (Polyisocyanurate Board):
1. Install continuous insulation board according to manufacturer's written instructions:
a. Fastener components shall include a minimum two-inch diameter plastic plate/washer and self-taping screws attached directly to stud framing.
b. All joints, penetrations, and flashings shall be taped and/or otherwise sealed with manufacture’s recommended products.

3.4 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 21 16 BATT INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section is related to batt Insulation and includes information regarding the provision of fiberglass batt thermal insulation for exterior envelope assemblies.

B. Reference Standards:
   1. Materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:
      a. American Society for Testing of Materials (ASTM):
         1) ASTM C423 Test Method for Sound Absorption Coefficient by the Reverberation Room Method.
         2) ASTM C518 Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter.
         3) ASTM C665 Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
         4) ASTM C1320 Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
         5) ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.
         6) ASTM E119 Test Methods for Fire Tests of Building Construction and Materials.

1.3 SUBMITTALS

A. Product Data: Submit data on product characteristics, performance criteria, and limitations, including installation instructions.

1.4 QUALITY ASSURANCE

A. Sustainable Design:
   1. Provide products which have received the following certifications:
      a. UL Certified Environmental Product Declaration in accordance with ISO 14025. Applies to EcoTouch® Faced and Unfaced Insulation.
      b. UL Environment EcoLogo CCD-106, applies to EcoTouch® Faced and Unfaced Insulation.
      c. GREENGUARD Indoor Air Quality Certified® and GREENGUARD Children & Schools Certified℠, applies to EcoTouch® Unfaced Batts and EcoTouch® Faced Batts and Rolls.
      d. GREENGUARD Formaldehyde Free, applies to EcoTouch® Unfaced and EcoTouch® Faced Batts and Rolls.
      e. Scientific Certification Systems SCS-MC-01025, SCS Certified minimum 65 percent recycled glass content (with at least 41 percent post-consumer recycled and the balance of pre-consumer recycled glass content), applies to EcoTouch® Unfaced Batts and Rolls.
      f. Scientific Certification Systems SCS-MC-02676, SCS Certified minimum 58

percent recycled glass content (with at least 36 percent post-consumer recycled and the balance of pre-consumer recycled glass content), applies to EcoTouch® Faced Batts and Rolls.

g. USDA Certified Biobased Products: EcoTouch® unfaced – 98 percent; EcoTouch® Kraft-faced – 57 percent; EcoTouch® FSK-faced – 78 percent.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original packaging.

B. Store and protect products in accordance with manufacturer's instructions. Store in a dry indoors location. Protect insulation materials from moisture and soiling.

C. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

D. Do not install insulation that has been damaged or wet; remove it from jobsite:
1. An exception may be allowed in cases where Contractor is able to demonstrate that wet insulation when fully dried out (either before installation or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN

A. Thermal Insulation: EcoTouch® PINK® FIBERGLAS™ Insulation with PureFiber® Technology by Owens-Corning, Toledo, OH 43659; www.owenscorning.com.

2.2 MATERIALS

A. EcoTouch® FS-25 Batt Insulation - ASTM C665, Type II (PSK facing), Class A and Type III (FSK facing), Class A preformed formaldehyde free glass fiber batt, poly/scrim/Kraft (PSK) or foil/scrim/Kraft (FSK) faced on one side:
1. Flame spread less than 25, smoke developed index less than 50 per ASTM E84.
2. ICC building construction classification: All types.
3. Perm rating: 0.02 maximum per ASTM E96.

B. Accessories:
1. Provide accessories per insulating system manufacturer's recommendations, including the following:
a. Tape: Polyethylene self-adhering type for Kraft faced insulation and bright aluminum self-adhering type for foil faced insulation.
b. Insulation fasteners: Impale clip of galvanized steel; type recommended by insulation manufacturer for particular use intended.
c. Mechanical insulation fasteners: FM approved, corrosion resistant, size required to suit application.
d. Wire mesh: Galvanized steel, hexagonal wire mesh.
e. Spindle fasteners: Corrosion-resistant wire spindles.
f. Ventilation baffles: Formed plastic, metal, or cardboard sized to fit full width of rafter spaces.

2.3 PERFORMANCE CRITERIA

A. Wood Frame Construction - Walls, R-Value - Per ASTM C518:
   1. R-21, 5-1/2-inch (139 mm) thickness, 15-inch (381 mm) or 23-inch (584 mm) width, 93-inch (2,362 mm) length at six-inch (6") studs.
   2. R-25, 15-inch (381 mm) or 23-inch (584 mm) width, 93-inch (2,362 mm) length at eight-inch (8") and 10-inch (10") studs.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be installed. Verify that adjacent materials are dry and ready to receive insulation. Verify mechanical and electrical services within walls have been tested and inspected.

B. Provide written report listing conditions detrimental to performance of work in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's installation instructions and ASTM C1320.

B. Friction-fit blanket insulation in place, until the interior finish is applied. Install batts to fill entire stud cavity, with no gaps, voids, or areas of compression. If stud cavity is less than eight feet (8') in height, cut lengths to friction fit against floor and ceiling tracks. Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes, and other irregularities:
   1. Do not install insulation on top of or within three inches (3") of recessed light fixtures unless the fixtures are approved for such use.

C. Within exterior wall framing, install insulation between pipes and backside of sheathing. Cut or split insulation material as required to fit around wiring and plumbing.

D. Where showers and bathtubs are located on exterior walls, install insulation and vapor retarder air barrier between units and exterior.

E. If eave ventilation baffles are required, install ventilation baffles at eaves to hold insulation down from roof sheathing and provide positive ventilation from eave to attic space.

F. Fluff insulation to full thickness for specified R-value before installation. Do not compress insulation in the cavity during installation, creating gaps or voids that could diminish thermal value.

G. Trim insulation neatly to fit spaces. Fill miscellaneous gaps and voids with insulation.

H. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.

I. For unfaced batt insulation, install with friction fit or retain in place with manufacturer's recommended fasteners or mesh.

J. For batt insulation with factory-applied facing, install with vapor retarder membrane facing warm in the winter side of building spaces or as specified by local building code. Lap ends and side flanges of membrane over or between framing members. Tape to seal tears, cuts, or misalignments in membrane.

K. Secure insulation in place using one of the following methods: Friction fit; staple or nail facing flanges in place as needed, tape in place, retain in place with spindle fasteners, retain in place with wire mesh secured to framing members.

3.3 PROTECTION

A. Protect installed insulation from damage due to weather and physical abuse until protected by permanent construction.

END OF SECTION 07 21 16

SECTION 07 22 00 ROOF AND DECK INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes roof insulation over the properly prepared deck substrate.

B. Related Sections:
1. Section 07 52 16: SBS Modified Bitumen Membrane Roofing.
2. Section 07 62 00: Roof Related Sheet Metal.

C. Reference Standards:
1. American Society for Testing and materials (ASTM):
   a. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
   b. ASTM B29 Standard Specification for Refined Lead.
   c. ASTM B32 Standard Specification for Solder Metal.
   d. ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulation.
   e. ASTM C208 Standard Specification for Cellulosic Fiber Insulation Board.
   f. ASTM C209 Standard Test Method for Cellulosic Fiber Insulating Board.
   g. ASTM C272 Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
   h. ASTM C518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   i. ASTM C578 Standard Specification for Perlite Thermal Insulation Board.
   j. ASTM C728 Standard Test Methods for Fire Test of Roof Coverings.
   k. ASTM C1289 Standard Specification for Faced Rigid Polyisocyanurate Thermal Insulation.
   l. ASTM C1396 Standard Specification for Gypsum Wallboard.
   m. ASTM D5 Standard Test Method for Penetration of Bituminous Materials.
   n. ASTM D36 Standard Test Method for Softening Point of Bitumen (Ring and Ball Apparatus).
   o. ASTM D312 Standard Specification for Asphalt Used in Roofing.
   p. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
   q. ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
   r. ASTM D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
   s. ASTM D1863 Standard Specification for Mineral Aggregate Used on Built-Up Roofs.
   t. ASTM D2126 Standard Test Method for Response off Rigid Cellular Plastics to Thermal Humid Aging.
   u. ASTM D2178 Standard Specification for Asphalt Glass Felts used in Roofing and Waterproofing.
   v. ASTM D4601 Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.

w. ASTM D5147 Standard Sampling and Testing Modified Bituminous Sheet Material.
2. Cast Iron Soil Pipe Institute, Washington, D.C. (CISPI).
a. Factory Mutual Research (FM): Roof Assembly Classifications.
3. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
4. Underwriters Laboratories, Inc. (UL): Fire Hazard Classifications.
5. Warnock Hersey (WH): Fire Hazard Classifications.
6. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
7. Steel Deck Institute, St. Louis, Missouri (SDI).
8. Southern Pine Inspection Bureau, Pensacola, Florida (SPIB).
9. Insulation Board, Polyisocyanurate (FS HH-I-1972).
10. Insulation Board, Thermal (Fiberboard) (FS LLL-1-535B).

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's specification data sheets for each product in accordance with Section 01 33 00: Submittal Procedures.

B. Provide approval letters from insulation manufacturer for use of their insulation within this particular roofing system type.

C. Provide a sample of each insulation type.

D. Shop Drawings:
1. Submit manufacturer's shop drawings indicating complete installation details of tapered insulation system, including identification of each insulation block, sequence of installation, layout, drain locations, roof slopes, thicknesses, crickets, and saddles.
2. Shop drawing shall include outline of roof, location of drains, a complete board layout of tapered insulation components, thickness, and the average "R" value for the completed insulation system.

E. Certification:
1. Submit roof manufacturer's certification that insulation fasteners furnished are acceptable to roof manufacturer.
2. Submit roof manufacturer's certification that insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

1.4 QUALITY ASSURANCE

A. Fire Classification, ASTM E108.

B. Manufacturer's Certificate: Certify that roof system furnished is approved by Factory Mutual, Underwriters Laboratories, Warnock Hersey, or approved third party testing facility in accordance with ASTM E108, Class A for external fire, and meets local or nationally recognized building codes.

C. Manufacturer's Certificate: Certify that the roof system is adhered properly to meet or exceed the requirements of FM [1-90].

D. Pre-Installation Meeting: Refer to Division 07 (roofing specifications) for pre-installation meeting requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site with seals and labels intact, in manufacturer's original containers,

dry and undamaged.

B. Store all insulation materials in a manner to protect them from the wind, sun, and moisture damage prior to and during installation. Any insulation that has been exposed to any moisture shall be removed from the Project site.

C. Keep materials enclosed in a watertight, ventilated enclosure (i.e. tarpaulins).

D. Store materials off the ground. Any warped, broken, or wet insulation boards shall be removed from the site.

PART 2 PRODUCTS

2.1 PRODUCTS, GENERAL

A. Refer to Section 01 60 00: Product Requirements.

B. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

C. Substitutions:
1. Products proposed as equal to the products specified in this Section shall be submitted in accordance with bidding requirements and Division 01 provisions:
   a. Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the State of California. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
   b. Include a list of three (3) projects of similar type and extent, located within a 100-mile radius from the location of the Project. In addition, the three (3) projects must be at least five (5) years old and be available for inspection by the Architect, Owner, or Owner's representative.
   c. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.
   d. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2 INSULATION MATERIALS

A. Thermal Insulation Properties and Approved Insulation Boards:
1. Rigid polyisocyanurate roof insulation; ASTM C1289:
   a. Qualities: Rigid, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.
   b. Thickness: Minimum 5.2 inches.
   c. R-Value: Minimum 30.
   d. Compliances: UL, WH, or FM listed under Roofing Systems; Federal Specification HH-I-1972, Class 1.
   e. Acceptable products:
      1) ENRGY-3; Johns Manville.
      2) H-Shield; Hunter.
      3) EnergyGuard; GAF.
      4) Approved equivalent.
2. Tapered polyisocyanurate roof insulation; ASTM C1289:

a. Qualities: Factory tapered, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.
b. Thickness: Minimum as needed for taper crickets for proper slope to drains, tapered design required as part of submittal process.
c. Average R-Value: Minimum varies.
d. Tapered Slope: One inch (1”).
e. Compliances: UL, WH, or FM listed under Roofing Systems; Federal Specification HH-I-1972, Class 1.
f. Acceptable products:
   1) ENRGY 3; Johns Manville.
   2) EnergyGuard; GAF.
   3) H-Shield; Hunter.
   4) Approved equivalent.

3. High density fiberboard roof insulation; ASTM C208:
   a. Qualities: Rigid, composed of interlocking fibers factory blended treated with asphalt on the top side.
   b. Board size: Four feet by eight feet (4’ x 8’).
   c. Thickness: Minimum 1/2 inch.
   d. Compliances: UL, WH, FM listed under Roofing Systems; Federal Specification LLL-I-535-B.
   e. Acceptable manufacturers:
      1) Blue Ridge; Celotex.
      2) Temple Inland.
      3) Georgia-Pacific.
      4) Approved equivalent.
4. Dens-deck prime roof board:
   a. Qualities: Nonstructural glass mat faced, noncombustible, water-resistant treated gypsum core panel.
   b. Board size: Four feet by eight feet (4’x8’).
   c. Thickness: 1/2 inch.
   d. R-Value: .56.
   e. Compliances: UL, WH, or FM listed under Roofing Systems.

2.3 RELATED MATERIALS

A. Fiber Cant and Tapered Edge Strips:
   1. Preformed rigid insulation units of sizes/shapes indicated, matching insulation board or of perlite or organic fiberboard, as per the approved manufacturer:
      a. Acceptable manufacturers:
         1) The Garland Company, Inc.
         2) Celotex.
         3) Johns Manville.
         4) GAF.
         5) Approved Equivalent.

B. Protection Board: Pre-molded semi-rigid asphalt composition board 1/2 inch.

C. Roof Board Joint Tape: Six inches (6”) wide glass fiber mat with adhesive compatible with insulation board facers.

D. Asphalt: ASTM D312, Type III Steep Asphalt.

E. Roof Deck Insulation Adhesive:
   1. Insul-Lock E HR - dual-component, high rise foam adhesive with 45 percent rapidly renewable material content as recommended by insulation manufacturer and approved by FM indicated ratings:

a. Tensile strength (ASTM D412): 250 psi.
b. Density (ASTM D1875): 8.5 lbs./gal.
c. Viscosity (ASTM D2556): 22,000 to 60,000 cP.
d. Peel strength (ASTM D903): 17 lb/in.
e. Flexibility (ASTM D816): Pass at -70 degrees F.

F. Fasteners:
1. Corrosion resistant screw fastener as recommended by roof membrane manufacturer:
a. Factory Mutual tested and approved with three inches (3") coated disc for I-90 rating; length required to penetrate metal deck one inch (1").

PART 3 EXECUTION

3.1 EXECUTION, GENERAL

A. Comply with requirements of Section 01 73 00: Execution.

3.2 INSPECTOR OF SURFACES

A. Roofing contractor shall be responsible for preparing an adequate substrate to receive insulation:
1. Verify that work that penetrates roof deck has been completed.
2. Verify that wood nailers are properly and securely installed.
3. Examine surfaces for defects, rough spots, ridges, depressions, foreign material, moisture, and unevenness.
4. Do not proceed until defects are corrected.
5. Do not apply insulation until substrate is sufficiently dry.
6. Broom clean substrate immediately prior to application.
7. Use additional insulation to fill depressions and low spots that would otherwise cause ponding water.
8. Verify that temporary roof has been completed.

3.3 INSTALLATION

A. Base Layer(s) - Attachment with Mechanical Fasteners:
1. Approved insulation board shall be fully attached to the deck with an approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with manufacturer's recommendation for FM I-90 system. Otherwise, a minimum of one (1) fastener per two (2) square feet shall be installed.
2. Filler pieces of insulation require at least two (2) fasteners per piece if size of insulation is less than four (4) square feet.
3. Spacing pattern of fasteners shall be as per manufacturer's recommendations to meet the FM requirements. Placement of any fastener from edge of insulation board shall be a minimum of three inches (3"), and a maximum of six inches (6").
4. Minimum penetration into deck shall be as recommended by the fastener manufacturer. There is a one inch (1") minimum for metal, wood, and structural concrete decks where not specified by the manufacturer. For gypsum and cement-wood fiber decks, penetration shall be determined from pull-out test results with a minimum penetration of 1-1/2 inches.
5. Gypsum and Cementitious Wood Fiber Decks: Where the roof deck is visible from the building interior, Contractor shall ensure no penetration of fasteners through underside of the deck. Any holes or spalling caused by fastener installation shall be repaired by the roofing contractor. Where the new roof system thickness exceeds an amount so that a minimum of 1-1/2 of penetration cannot be achieved with an Olympic TB Fastener, or approved equivalent, then (and only then) toggle bolts may be used to

secure installation to the deck.
6. Tape joints of insulation as per manufacturer's requirements.

B. Top Layer - Attachment with Insulation Adhesive Approved by FM:
1. Ensure all surfaces are clean, dry, free of dirt, debris, oils, loose or embedded gravel, unadhered coatings, deteriorated membrane, and other contaminants that may inhibit adhesion.
2. Apply insulation adhesive directly to the substrate using a ribbon pattern with 1/4-inch to 1/2-inch wide beads 12 inches o.c., using either the manual applicator or an automatic applicator, at a rate of one (1) gallon per one hundred (150) square feet per cartridge.
3. Immediately place insulation boards into wet adhesive. Do not slide boards into place. Do not allow the adhesive to skin over before installing insulation boards.
4. Briefly step each board into place to ensure contact with the adhesive. Substrates with irregular surfaces may prevent the insulation board from making positive contact with the adhesive. Relief cuts or temporary weights may be required to ensure proper contact.
5. All boards shall be cut and fitted where the roof deck intersects a vertical surface. The boards shall be cut to fit a minimum of 1/4 inch away from the vertical surface.
6. Tape joints of insulation as per manufacturer's requirements.

3.4 CLEANING

A. Remove debris and cartons from roof deck. Leave insulation clean and dry, ready to receive roofing membrane.

3.5 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during installation. Comply with requirements of authorities having jurisdiction.

END OF SECTION 07 22 00

SECTION 07 25 00 WEATHER BARRIERS

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Commercial weather barrier assemblies.
2. Flexible flashing.
3. Weather barrier flashing.
4. Fluid-applied flashing.
5. Weather barrier accessories.
6. Drainage material.

B. Related Sections:
1. Section 04 22 00: Concrete Unit Masonry.
2. Section 07 21 00: Thermal Insulation.
3. Section 09 24 00: Cement Plastering.

1.3 DEFINITIONS

A. Weather Barrier:
1. A combination of materials and accessories that do the following:
a. Prevents the accumulation of water as a water-resistive barrier.
b. Minimizes the air leakage into or out of the building envelope as a continuous air barrier.
c. Provides sufficient water vapor transmission to enable drying as a vapor-permeable membrane.

B. Water-Resistive Barrier: A combination of materials and accessories that prevent the accumulation of water within the wall assembly.

C. Continuous Air Barrier: The combination of interconnected materials, assemblies, and sealed joints and components of the building envelope that minimize air leakage into or out of the building envelope per ASHRAE 90.1 Section 5.4.3.1.

D. Vapor Diffusion: A slow movement of individual water vapor molecules from regions of higher to lower water vapor concentration (higher to lower vapor pressure).

E. Vapor Permeable Membrane: The property of having a water-vapor permeance rating of ten (10) perms (575 ng/Pa x s x sq. m) or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E96. Vapor permeable material permits the passage of moisture vapor through vapor diffusion.

1.4 SUBMITTALS

A. Product Data:
1. Technical data for each type of product:
a. Building wrap: Submit data on air and water-vapor permeance based on testing according to referenced standards.

B. Shop Drawings: Show details of weather barrier at terminations, openings, and penetrations. Show details of flexible flashing applications.

C. Preconstruction Mockup:
1. Owner will engage in a third-party testing program.
2. Test reports: Prepared by a qualified testing agency for each mockup.
3. Record drawings: As-built drawings showing changes as a result of the mockup and illustrated in the CCD approved by DSA if applicable.

D. Manufacturer's Instructions: For installation of each product specified.

E. Sample of manufacturer's warranty.

F. Reports: Field test and inspection reports, as applicable.

G. Installer's weather barrier manufacturer training certificate.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Installer: Company specializing in installing weather barriers with minimum five (5) years' experience and approved by manufacturer.

B. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

C. Pre-Installation Meetings: To be conducted onsite.

PART 2 PRODUCTS

2.1 WEATHER BARRIER

A. Commercial Building Wrap - ASTM E2357 passed, Air Barrier Association of America (ABAA) evaluated air barrier assembly, and assembly water resistance per ASTM E331; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84; UV stabilized for nine (9) month exposure; and acceptable to authorities having jurisdiction:
1. Basis of design product:
a. Subject to compliance with requirements, provide DuPont Safety & Construction E. I. du Pont de Nemours and Company; [Tyvek® [CommercialWrap®] [and] [Tyvek® CommercialWrap® D] or a comparable product by one of the following:
1) VaproShield.
2) Dow Chemical Company.
3) Raven Industries, Inc.
4) Approved equal.
2. Performance characteristics:
a. Air permeance: Not more than 0.001 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.005 L/s x sq. m at 75 Pa) when tested in accordance with ASTM E2178.
b. Water vapor permeance: Not less than 23 perms (1,300 ng/Pa x s x sq. m) per ASTM E96/E96M, Desiccant Method (Procedure A) or not less than 28 perms (1,600 ng/Pa x s x sq. m) per ASTM E96, Water Method (Procedure B).
c. Water penetration resistance: Hydrostatic head resistance greater than 7.7 feet (2.35 m) in accordance with AATTC TM127.
d. Drainability: 98 percent or greater when tested in accordance with ASTM E2273.
e. Weather barrier system to have a VOC content of 30 g/L or less.

2.2 WEATHER BARRIER FLASHING

A. Conformable Weather Barrier Flashing - Composite flashing material composed of micro-creped, polyethylene laminate with a 100 percent butyl-based adhesive layer; AAMA 711 Class A (no primer), Level 3 thermal exposure, 176 degrees F (80 degrees C) for seven (7) days:
   1. Basis of design product:
      a. Subject to compliance with requirements, provide DuPont Safety & Construction FlexWrap™ NF or comparable product by Architect:
         1) Conformability: Able to create a seamless sill pan extending up the jambs without cuts, patches, or fasteners.
         2) ASTM E331 applies to water penetration testing of exterior windows, skylights, doors, and curtain walls.
         3) Water penetration: No leakage at 15 psf (720 Pa) per ASTM E331.
         4) Low temperature adhesion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm) at 25 degrees F (-4 degrees C) as Class A (without primer use).
         5) Adhesion after water immersion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm), after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3, Test B.

B. Strip Flashing - Composite flashing material composed of spunbonded polyethylene laminate with 100 percent butyl-based, dual-sided, adhesive layer; AAMA 711, Class A (no primer), Level 3 thermal exposure, 176 degrees F (80 degrees C) for seven (7) days:
   1. Basis of design product:
      a. Subject to compliance with requirements, provide DuPont Safety & Construction [StraightFlash™] [StraightFlash™ VF] or comparable product approved by Architect:
         1) ASTM E331 applies to water penetration testing of exterior windows, skylights, doors, and curtain walls.
         2) Water penetration: No leakage at 15 psf (720 Pa) per ASTM E331.
         3) Low temperature adhesion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm) at 25 degrees F (-4 degrees C) as Class A without primer use.
         4) Adhesion after water immersion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm), after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3, Test B.

2.3 FLUID-APPLIED FLASHING

A. Fluid-Applied Flashing - Trowel or brush applied, non-water soluble, single component, silyl terminated polyether technology (STPE), vapor permeable, flashing material:
   1. Basis of design product:
      a. Subject to compliance with requirements, provide DuPont Safety & Construction E. I. du Pont de Nemours and Company; Tyvek® Fluid Applied Flashing & Joint Compound+ or comparable product approved by Architect:
         1) VOC content: ASTM C1250, less than two percent (2%) by weight and between 25 to 30 g/L.
         2) Water vapor transmission: ASTM E96, Method B, greater than 20 perms (1,100 ng/Pa x s x sq. m) at 25 mils (0.635 mm) thick.
         3) Minimum tensile strength: ASTM D412, 165 lb/sq. ft. (1,140 kPa).
         4) Minimum elongation at break: ASTM D412; 360 percent.

2.4 WEATHER BARRIER ACCESSORIES

A. Building-Wrap Tape - Pressure-sensitive plastic tape recommended by weather barrier manufacturer for sealing joints and penetrations in commercial building wrap:
   1. Basis of design product: DuPont Safety & Construction E. I. du Pont de Nemours and Company; Tyvek® Tape.

B. Closed-Cell Polyurethane Foam Insulation - Low pressure, low expansion, single component polyurethane foam, with maximum flame-spread and smoke-developed indexes of 15 and 25, respectively, per ASTM E84:
   1. Basis of design product: DuPont Safety & Construction E. I. du Pont de Nemours and Company; DuPont™ Window & Door Foam.
   2. Pressure build-up: 0.0247 psi (0.170 kPa) maximum, AAMA 812.
   3. Deflection: 0.0050 inch (0.127 mm) maximum, AAMA 812.

C. Fasteners with Self-Gasketing Washers - Commercial building wrap manufacturer's recommended pneumatically or hand-applied fasteners with [1-inch (25 mm)] [2-inch (50 mm)] diameter, high-density polyethylene cap washers with UV inhibitors:
   1. Basis of design product: DuPont Safety & Construction E. I. du Pont de Nemours and Company; Tyvek® Wrap Caps.

D. Primer for Flashings - Synthetic rubber-based product; spray applied. Strengthen adhesive bond at low temperature applications between weather products such as self-adhered flashing products, commercial building wraps, and common building sheathing materials:
   1. Basis of design product: DuPont Safety & Construction E. I. du Pont de Nemours and Company, DuPont™ Adhesive Primer.
   2. Peel adhesion test - Passes in accordance with ASTM D3330, Test Method F, for the following:
      a. Peel Angles: 0, 25, 72, and 180 degrees.
      b. Substrates: Concrete masonry units (CMU), exterior gypsum sheathing, oriented strand board (OSB), aluminum, and vinyl.
   3. Chemical compatibility: Pass; AAMA 713.
   4. Flame spread index: 5; ASTM E84.
   5. Smoke development index: 0; ASTM E84.

E. Sealants: Provide sealants that comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions. Refer to Section 07 92 00: Joint Sealants.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with installer present, for compliance with requirements.

B. Verify that substrate and surface conditions are in accordance with commercial weather barrier manufacturer recommendations prior to installation:
   1. Verify that rough sill framing for doors and windows is sloped downwards towards the exterior and is level across width of the opening.

C. Verify that surfaces to receive weather barrier flashing are clean, dry, and free of frost.

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

3.2 PREPARATION

A. Direct water onto an acceptable weather barrier drainage plane with an unobstructed path to exterior of wall:
   1. Provide a drainage path for water intrusion through window and door attachment system that collects at window and door sills and directs water to the exterior or weather barrier.

3.3 COMMERCIAL BUILDING WRAP INSTALLATION

A. General: Comply with weather barrier manufacturer's written instructions and warranty requirements.

B. Cover exposed exterior surface of sheathing with weather barrier securely fastened to framing immediately after sheathing is installed:
   1. Maintain continuity of air and water barrier assemblies.
   2. Start weather barrier installation at a building corner, leaving 12 inches (300 mm) of weather barrier extended beyond corner to overlap.
   3. Install weather barrier horizontally starting at lower portion of wall surface.
   4. Provide minimum six inches (150 mm) overlap at horizontal and vertical wrap seams in a shingle manner to maintain continuous downward drainage plane and air and water barrier.

C. Seams:
   1. Seal seams with building wrap tape per manufacturer's recommended installation instructions:
      a. Shiplap horizontal seams in weather barrier to facilitate proper drainage.

D. Fasteners:
   1. Use weather barrier manufacturer’s recommended fasteners to secure weather barrier and install fasteners according weather barrier manufacturer’s installation guidelines:
      a. Do not use temporary fasteners to permanently attach weather barrier.
      b. Do not place fasteners with gasketing washers where weather barrier flashing will be installed.
      c. Install fasteners with gasketing washers through flashing where recommended by manufacturer.

E. Openings:
   1. Completely cover openings with weather barrier, then cut weather barrier membrane to openings according to weather barrier manufacturer's installation guidelines:
      a. Provide head and jamb flaps and seam overlaps to maintain continuous drainage.
      b. Repair damage to weather barrier using method recommended by weather barrier manufacturer.
      c. Install flashing according to weather barrier manufacturer's installation guidelines.

3.4 WEATHER BARRIER FLASHING INSTALLATION

A. Installation:
   1. Remove wrinkles and bubbles, and reposition weather barrier as necessary to produce a uniform, smooth surface:
      a. Ensure that ambient and substrate surface temperatures are acceptable in accordance with manufacturer instructions and recommendations.
      b. Wipe surfaces to remove moisture, dirt, grease, and other debris that could interfere with adhesion.
      c. Apply weather barrier manufacturer’s recommended primer over concrete, masonry, and glass-mat gypsum wall sheathing substrates to receive weather barrier flashing.
      d. Lap weather barrier flashing a minimum of two inches (50 mm) onto weather barrier.
      e. Apply pressure over entire surface using roller or firm hand pressure.

B. Rough Openings:
   1. Shiplap flashing with weather barrier in a shingle manner to maintain a continuous downward drainage plane and air and water barrier in accordance with manufacturer’s written instructions:
      a. Retain first option below for stud framing that is nominally four inches (100 mm)

thick. Retain second option for stud framing that is nominally six inches (150 mm) thick.

b. Apply [6-inch (150 mm)] (for stud framing that is nominally four inches [4”] thick) [OR] [9-inch (230 mm)] (for stud framing that is nominally six inches [6”] thick) wide conformable weather barrier flashing at door and window sills.
c. Ensure that sill flashing does not slope to the interior.
d. Install backer rod in joint between frame of opening product and flashed rough opening on the interior.
e. Apply sealant or closed-cell polyurethane foam insulation around entire opening/fenestration product to create air seal around interior perimeter of window openings in accordance with weather barrier manufacturer’s instructions.
f. Weather barrier flashing selection and application methods are specific to type of opening product and rough opening configuration. When building envelope design requirements exceed ASTM E1677, 65 mph equivalent structural load, and 15 mph equivalent wind-driven rainwater infiltration resistance, use butyl-based DuPont™ "StraightFlash™" and wrap cap screws in subparagraphs below.
g. Around door and window openings, apply butyl-based flashing to flaps of weather barrier.
h. Use strip flashing with wrap cap screws to secure head flap of the windows.

C. Penetrations:
1. Apply weather barrier manufacturer's recommended weather barrier flashing patches behind fastening plates, such as brick-tie base plates, metal-flashing clips, and metal channels:
a. Seal weather barrier around each penetration with weather barrier manufacturer's recommended self-adhered flashing product or sealant. Integrate products with flanges into the weather barrier.

D. Terminations:
1. Provide minimum two inches (50 mm) overlap using strip flashing on adjoining roof and base of wall systems to maintain continuous downward drainage plane:
a. Secure weather barrier with fasteners and weather barrier flashing.

3.5 FLUID-APPLIED FLASHING INSTALLATION

A. Before installing fluid-applied flashing, do the following:
1. Ensure drainage path is not blocked or disrupted. Do not install on walls that do not feature a continuous path for moisture drainage. Blocked or disrupted paths for drainage can result in excess moisture buildup in wall cavity. Do not install below grade.
2. Remove surface dust, dirt, and loose mortar.
3. Verify that surface is free of grease and other contaminants and that surface is smooth.
4. Fill joints in concrete masonry units, and voids in cast-in-place concrete with trowel-applied fluid-applied flashing to ensure surface is flush and smooth.
5. Allow masonry mortar and cast-in-place concrete a minimum of 24 hours to cure before installing fluid-applied flashing.

B. Fluid-Applied Flashing Installation:
1. Using a trowel or brush, apply fluid-applied flashing around perimeter of window and door openings to a minimum thickness of 25 mils (0.635 mm):
a. Extend flashing a minimum of two inches (50 mm) onto exterior face of adjacent surface.
b. Inspect for gaps and pinholes in fluid-applied flashing and apply additional coats until no gaps and pinholes appear.
c. Joint applications - using a trowel or a brush, fill cracks and voids up to 1/4 inch (6 mm) in width:

1) For joints and cracks between 1/4 inch and 1/2 inch (6 mm and 12 mm) wide, cover first with mesh tape.
2) For joints and cracks between 1/2 inch and 1 inch (12 mm and 24 mm) wide, cover first with butyl-based strip flashing.
3) Apply a bead, then trowel smooth.
4) Seam coverage should be a minimum of two inches (50 mm) wide and 15 to 20 mils (0.38 mm to 0.51 mm) thick.
5) Inspect for gaps and pinholes in fluid-applied flashing and apply additional coats until no gaps and pinholes appear.

3.6 DRAINAGE MATERIAL INSTALLATION

A. Install drainage material with grooves or channels running vertically in compliance with manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to train installers and observe subject test wall areas and installations.

B. Testing Agency: [Owner will engage] [Engage] a qualified third-party testing agency to perform tests and inspections.

C. Test Area: Perform tests on [one (1) bay at least 30 feet (9.15 m), by one story] [representative areas of structural-sealant-glazed curtain walls] [mockups] [insert requirements].

D. Field Quality Control Testing:
1. Perform the following test on [representative areas of structural-sealant-glazed curtain walls] [mockups] [insert requirements]:
   a. Air infiltration whole building: ASTM E779 at not more than [0.40 cfm/sf (2.00 L/s per sq. m)] [0.25 cfm/sf (1.25 L/s per sq. m)] [0.15 cfm/sf (0.75 L/s per sq. m)] at 1.57 lb/sq. ft. (75 Pa), pursuant to local building codes.
   b. Water penetration:
      1) ASTM E105 at a minimum [uniform] [and] [cyclic] static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" article, but not less than [2.86 lbf/sq. ft. (137 Pa)] [6.24 lbf/sq. ft. (300 Pa)] [10.0 lbf/sq. ft. (500 Pa)] [12.5 lbf/sq. ft. (600 Pa)]. No water penetration shall occur as defined in ASTM E1105:
         a) Perform a minimum of [two (2)] [three (3)] [insert number] tests in areas as directed by Architect.
         [OR]
         b) Perform tests in each test area as directed by Architect. Perform at least three (3) tests, prior to [ten (10), 30, and 70 percent completion] [insert requirements].

E. Prepare test and inspection reports.

3.8 CLEANING

A. Immediately remove release paper and scrap from work area and dispose of material in accordance with requirements of Section 01 73 00: Execution, and Section 01 74 19: Construction Waste Management and Disposal.

3.9 PROTECTION

A. Protect installed weather barrier from the following:
   1. Damage from cladding, structure, or a component of the structure (e.g., window, door, or wall system).
   2. Contamination from building site chemicals, premature deterioration of building materials, or nonstandard use or application of products.
   3. Foreign objects or agents, including the use of materials incompatible with weather barrier products.
   4. UV exposure in excess of products' stated limits.

END OF SECTION 07 25 00

07 26 00 UNDER-SLAB VAPOR BARRIER

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Products supplied under this Section:
   1. Vapor barrier for installation under concrete slabs.
   2. Accessories.

B. Related Sections:
   1. Section 03 30 00: Cast-in-Place Concrete.

C. Reference Standards:
   1. American Society for Testing and Materials (ASTM):
      a. ASTM E1643 Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
      b. ASTM E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
   2. Technical Reference - American Concrete Institute (ACI):
      a. ACI 302.1R Guide to Concrete Floor and Slab Construction.
      b. ACI 302.2R Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.3 SUBMITTALS

A. Quality Control/Assurance:
   1. Summary of test results per Paragraph 9.3 of ASTM E1745.
   2. Manufacturer’s samples and literature.
   3. Manufacturer’s installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
   4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

1.4 QUALITY ASSURANCE

A. Pre-Construction Meeting:
   1. Contact vapor barrier manufacturer to coordinate a pre-construction meeting for training on best means and methods and also schedule a review of the vapor barrier installation either by digital review or in person.

PART 2 PRODUCTS

2.1 MATERIALS

A. Vapor barrier shall have all of the following qualities:
   1. Maintain permeance of less than 0.01 Perms (grains/[$ft^2 \cdot hr \cdot inHg$]) as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-

7.1.5).
2. Other performance criteria:
   a. Strength: ASTM E1745 Class A.
   b. Thickness: 15 mils minimum.
3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

B. Vapor Barrier Products:
1. Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com. Basis of design.
2. Griffolyn VAPORguard by Reef Industries, 713-507-4250. www.reefindustries.com.
3. PMPC by W.R. Meadows, 800-342-5976. http://www.wrmeadows.com/pmpc/.

2.2 ACCESSORIES

A. Seams:
1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Sealing Penetrations of Vapor Barrier:
1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
3. Perimeter/edge seal: Stego Crete Claw by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
4. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
5. Stego Tack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
6. Use of one-sided seaming tape to seal the perimeter must be submitted to the architect for pre-approval.

C. Penetration Prevention:
1. Beast Foot by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

D. Vapor Barrier-Safe Screed System:
1. Beast Screed by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by Architect or geotechnical Engineer:
1. Level and compact base material.

3.2 INSTALLATION

A. Install vapor barrier in accordance ASTM E1643:
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab:
   a. Seal vapor barrier to the entire slab perimeter using Stego Crete Claw, per manufacturer's instructions.
   b. Overlap joints six inches (6”) and seal with manufacturer’s seam tape.
3. Apply seam tape/Crete Claw to a clean and dry vapor barrier.
4. Seal all penetrations (including pipes) per manufacturer’s instructions.

5. For interior forming applications, avoid the use of non-permanent stakes driven through the vapor barrier. Use blunt-end and/or threaded nail stakes (screed pad posts) and insert them into Beast Foot. Ensure Beast Foot's peel-and-stick adhesive base is fully adhered to the vapor barrier.
6. If non-permanent stakes must be driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
7. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
8. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
9. For a vapor barrier-safe, fixed-elevation concrete screeding application, install Beast Screed (vapor barrier-safe screed system) per manufacturer's instructions prior to placing concrete.

END OF SECTION 07 26 00

SECTION 07 52 16 SBS MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Modified bituminous membrane roofing.
2. Nails and fasteners.
3. Roofing walkway pads.
4. Coping and flashing: For areas immediately adjacent to roofing membrane.

B. Scope of Work:
1. Deck type:
   a. Metal/ wood/ concrete/ lightweight concrete:
      1) Install insulation per insulation section.
      2) Install as top insulation layer: 1/2-inch DensDeck Prime. Tape all joints.
2. Torch apply SBS-modified torch base sheet, 120 mil – HPR Torch Base Sheet
3. Torch apply SBS-modified torch cap sheet, 135 mil – Stressply IV Mineral.
4. Torch apply SBS-modified flashing ply in all flashing areas -- HPR Torch Base Sheet – extending the flashing base ply six inches (6”) onto the roof field. Torch apply SBS-modified flashing cap sheet in all flashing areas -- Stressply IV Mineral – extending nine inches (9”) onto the roof field.
5. Spray or roll apply Title 24, reflective white coating at two (2) gallons per square – Pyramic. No moisture on roof prior to application. Power wash the roof prior to the coating.
6. Install walk pads leading to equipment from roof hatch.
7. No pitch pockets on roof. Lead flash all penetrations. Roofing contractor to supply and install all lead flashings. Install umbrella cover for all flashings.
8. Flashing details:
   a. All flashing plies to be terminated with a termination bar set in butyl tape and fastened every six inches (6”) o.c. Caulk above the termination bar.
   b. All flashings to be terminated with a termination bar set in butyl tape. Termination bar to be fastened every six inches (6”) o.c. with caulking above the termination bar.
   c. At any metal curb flashings or parapet walls, install 1/2-inch DensDeck Prime board prior to flashing application.
   d. All sheet metal to be installed with ANSI SPRI ES-1 compliant metal.
9. Install new lead flashings at all penetration. Umbrella cover required for the lead flashing. No pitch pockets.
10. Place all conduits, pipes, and any other utility lines on rubber blocks as needed.
11. Raise all units to six-inch to eight-inch (6”-8”) flashing height above top of roof surface. Build new wood curbs as needed.
12. Contractor to be responsible for any ponding water. Contractor to ensure positive drainage.

C. Related Sections:
1. Division 01.
2. Section 05 31 00: Steel Decking.
3. Section 06 10 00: Rough Carpentry.

4. Section 07 21 00: Roofing Insulation.
5. Section 07 62 00: Sheet Metal Flashing and Trim.

D. Reference Standards:
1. American Society of Civil Engineers (ASCE):
   a. ASCE 7 Minimum Design Loads for Buildings and Other Structures.
2. American Society for Testing and Materials (ASTM):
   a. ASTM D451 Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.
   b. ASTM D1079 Standard Terminology Relating, to Roofing, Waterproofing and Bituminous Materials.
   c. ASTM D1227 Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
   d. ASTM D1863 Standard Specification tor Mineral Aggregate Used as a Protective Coating for Roofing.
   e. ASTM D2824 Standard Specification for Aluminum-Pigmented Asphalt Roof Coating.
   f. ASTM D4586 Standard Specification for Asphalt Roof Cement, Asbestos-Free.
   g. ASTM D5147 Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.
   h. ASTM D6162 Standard Specification tor Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
   i. ASTM D6163 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
   j. ASTM E108 Standard Test Methods for Fire Test of Roof Coverings.
3. Factory Mutual Research (FM) Roof Assembly Classifications.
4. National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual.
5. Underwriters Laboratories, Inc. (UL) Fire Hazard Classifications.
6. Warnock Hersey (WH) Fire Hazard Classifications.

1.3 SUBMITTALS

A. Product Data:
1. Submit manufacturer product data for all products necessary for completion of roofing system and as specified including manufacturer's technical product data, installation instructions, and recommendations for each type of roofing product required. Include data substantiating that materials comply with minimum specified requirements.

B. Test Data and Certifications:
1. Submit independent test data according to ASTM D5147 Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material, substantiating that materials comply with specified requirements.
2. Submit independent test data that indicates the cap sheet complies with CRCC and Title 24 requirements.
3. Submit certification that the roof system furnished is approved by Factory Mutual, Underwriters Laboratories, or Warnock Hersey for external fire E-108 Class lA and that the roof system is adhered properly to meet or exceed 1-90.
4. Submit copy of ISO 9001 certified compliance.

C. Calculations:
1. Submit engineered wind-uplift calculations, stamped by a registered California engineer, that membrane manufacturer warranting wind uplift speeds of up to 85 mph for all components of field assembly and perimeter flashing systems.

D. Manufacturer Qualifications:

1. Submit list of facilities where the proposed material has been used in a similar roofing system as that which is specified and within a 100-mile radius from the location of the specified job. Include a minimum of three (3) projects at least three (3) years old and that are available for the District to inspect.
2. Submit manufacturer's inspector qualifications with certification to perform inspections signed by an officer of the company for this specific Project. Also, show evidence that roofing manufacturer has five (5) years of experience performing daily site inspections during construction and preparing daily inspection reports with a full time employee of that manufacturer. Contact information will be required for verification.

E. Installer Qualifications.

F. Samples:
1. Submit samples of each product being proposed for use. Provide a wet sample of the membrane adhesive and provide third party testing for zero VOC membrane adhesive.

G. Warranty:
1. Submit unexecuted manufacturer's 30-year high-performance edge-to-edge no dollar limit (NDL) warranty covering labor and materials for all components of the roofing system required against leaks, edge to edge (perimeter metal) and deck up (all base sheets, flashing components, and insulation. Warranty covers metal coping, counter flashing, and edge metal where applicable, insulation, base ply, cap, coating, lead flashings, and any and all miscellaneous roof flashings.

H. Shop Drawings:
1. Submit manufacturer engineered stamped shop drawings, layouts, and coordinated details.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Roofing system manufacturer shall have a minimum of 30 years' experience in manufacturing bitumen roofing products in the United States and be ISO 9001 certified. Manufacturer must have local references and have five (5) years' experience in daily site inspections and daily inspection reports forwarded to manufacturer.

B. Installer Qualifications: Installer (roofer) shall be specializing in modified bituminous roof application with minimum ten (10) years' experience and who is currently approved (within the last three [3] years) by the roofing system manufacturer as qualified to install manufacturer's roofing materials.

C. Installer's Field Supervision: Require installer to maintain a full-time supervisor/foreman on jobsite during all phases of bituminous sheet roofing work and at any time roofing work is in progress; proper supervision of workmen shall be maintained. In addition, a minimum two (2) hour fire watch is required on each day that torch applied membranes are installed. A copy of the specification shall be in the possession of the supervisor/foremen and on the roof at all times.

D. It shall be the General Contractor/roof contractor's responsibility to respond immediately to correction of roof leakage during construction. If the roof contractor does not respond within 24 hours, District has the right to hire a qualified roof contractor and back charge the original General Contractor/roof contractor.

E. Pre-Application Roofing Conference:
1. Before scheduled commencement of modified bitumen roof system installation and associated work, meet at Project site with installer of each component of associated

work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in the around roofing must precede or follow roofing work (including mechanical work if any), the District, roofing system manufacturer's representative, and other representatives directly concerned with performance of the work, including (where applicable) the District's insurers, test agencies, and governing authorities:

a. Objectives to include:
    1) Review foreseeable methods and procedures related to roofing work.
    2) Tour representative areas of roofing substrates (decks), inspect, accept, or identify any deficiencies of substrate, roof drains, curbs, penetrations and other preparatory work performed by other trades.
    3) Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
    4) Review roofing system requirements (Drawings, Specifications, and other Contract Documents).
    5) Review approved submittals and shop drawings.
    6) Review and finalize construction schedule related to roofing work and verify availability of material, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    7) Review required inspection, testing, certifying, and material usage accounting procedures.
    8) Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not mandatory requirement).
    9) Record (Contractor) discussion of conference including decisions and agreements (or disagreements) reached and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
    10) Review notification procedures for weather or non-working days.

F. Manufacturer's Duties To District:
1. During the installation of the roofing, the manufacturer will provide the following:
    a. Keep District informed as to the progress and quality or the work as observed.
    b. Jobsite inspections a minimum of five (5) days a week. Daily inspection reports sent to the District representatives and Contractor each day.
    c. Report in writing any failure or refusal of Contractor to correct unacceptable practices called to Contractor's attention.
    d. Confirm after completion of the Project that no application procedures are in conflict with the specifications other than those that may have been previously reported and corrected.
    e. A qualified roofing inspector to conduct inspections of the roofing installation on the Project.
2. Upon completion of the Project, the manufacturer will provide the following:
    a. Provide warranty to District at no additional charge.
    b. Provide a minimum of two (2) inspections annually of the roof during the warranty period. Notify the District prior to any inspections. Provide a written report of findings and schedule of work and or repairs, if any should be necessary, within ten (10) days of inspection.
    c. Provide all future necessary work and or repairs at no cost to the District. Manufacturer to acknowledge this requirement with a signed document from an officer of the company.

1.5 WARRANTY

A. Roofing contractor will provide a minimum of a five (5) year no limit warranty to the

membrane manufacturer with a copy directly to District.

B. Manufacturer will provide manufacturer's 30-year high-performance edge-to-edge no dollar limit (NDL) warranty covering 100 percent labor and materials for all components installed by roofing contractor.

C. Membrane manufacture will provide a minimum of two (2) inspections annually for the roof for the entire warranty period and will provide all work necessary for warranty at no cost to the District.

D. Single source warranty from the manufacturer covering all membranes, coatings, and specified perimeter roof flashings in other sections that meet ANSI SPRI ES I code requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry, and undamaged. Any damaged material to be noted at delivery and returned at no cost to the District.

B. Store and handle roofing sheets in a dry, well-ventilated, weather-tight place to ensure no possibility of significant moisture exposure. Store rolls of felt and other sheet materials on pallets or other raised surface. Stand all roll materials on end. Cover roll goods with a canvas tarpaulin or other breathable material (not polyethylene).

C. Do not leave unused materials on the roof overnight or when roofing work is not in progress unless protected from weather and other moisture sources.

PART 2 PRODUCTS

2.1 GENERAL

A. The design is based upon roofing systems engineered and manufactured by The Garland Company or approved equal:
   1. The Garland Company
      3800 East 91st Street
      Cleveland, Ohio 44105
      Miles Taylor
      310-367-7655

B. Basis of Design:
   1. Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section:
      a. Substitutions: Refer to General Conditions.

2.2 DESCRIPTION

A. Modified bituminous roofing materials:
   1. Torch grade base sheet – high performance roofing (HPR) torch base sheet fully adhered to approved torchable substrate with roofer's torches.
   2. All flashings will include one (1) ply of SBS torch grade base sheet – HPR Torch Base sheet and one (1) ply of SBS torch modified membrane.
   3. The modified membrane cap sheet.
   4. Flashing bond - mastic

2.3 SHEET MATERIALS - PERFORMANCE CHARACTERISTICS

A. Styrene-Butadiene-Styrene (SBS) Roofing Membrane:
   1. ASTM D6163 Type III Grade G.
   2. Tensile strength (ASTM D5147):
      a. 2 in/min.@ 73.41+/- 3.6°F MD 310 lbf/in CMD 310 lbf/in.
      b. 50 mm/min. @ 23 +/- 3°C MD 54.25 kNm CMD 54.25 kNm.
   3. Tear strength (ASTM D5147):
      a. 2 in/min.@ 73.41+/- 3.6°F MD510lbf CMD 510 lbf.
      b. 50 mm/min. @ 23 +/- 3°C MD 2269N CMD 22269 N.
   4. Elongation at maximum tensile (ASTM D5147):
      a. 2 in/min. @ 73.4+/- 3.6°F MD 6.0% CMD 6.0%.
      b. 50 mm/min. @ 23 +/- 3°C.
   5. Low temperature flexibility (ASTM D5147): Passes -40 degrees F (-23 degrees C).

B. High Performance Roofing (HPR) Torch Base Sheet:
   1. Tensile strength (ASTM D5147):
      a. 2 in/min. @ 73.4+/- 3.6°F MD 210 lbf/in.
   2. Tear strength (ASTM D5147):
      a. 2 in/mn. @ 73.4+/- 3.6°F MD 250 lbf.
   3. Elongation at maximum tensile (ASTM D5147):
      a. 2 in/min.@ 73.4+/- 3.6°F MD 4.0%.

2.4 SURFACINGS

A. White water based acrylic, low VOC, reflective roof coating applied at two (2) gallons per square:
   1. Elongation: 250% min.
   2. Emittance: 94%.
   3. SRI: 101.

2.5 RELATED MATERIALS

A. Nails and Fasteners: Non-ferrous metal or galvanized steel, except that hard copper nails shall be used with copper; aluminum or stainless steel nails shall be used with aluminum; and stainless steel nails shall be used with stainless steel, r addition plates should be used. Fasteners shall be self-clinching type of penetrating type as recommended by the manufacturer of the deck material. Nails and fasteners shall be flush-driven through flat metal discs of not less than one-inch (1") diameter. Omit metal discs when one-piece composite nails or fasteners with heads not less than one-inch (1") diameter are used.

B. Walkway Pads: As recommended and furnished by the membrane manufacturer set in approved adhesive to control foot traffic on rooftop surface and give a durable system compliant non-slip walkway.

C. Walkway Pad Adhesive: Adhesive used to adhere approved walk way pads as recommended and furnished by the membrane manufacturer.

D. Coping Cap Metal: 22-gauge, galvanized, Kynar coated coping cap sheet metal. Must meet ANSI SPRI ES I code requirement and be manufactured and warranted by membrane manufacturer.

E. Butyl Tape: 100 percent solids, asbestos free and compressive tape designed to seal as recommended and furnished by the membrane manufacturer.

F. Four (4) pound lead Jacks with umbrella covers for flashing penetrations.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Weather Condition Limitations: Do not apply roofing membrane during inclement weather or when a 40 percent change of precipitation is expected.

B. Do not apply roofing insulation or membrane to damp deck surface.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

D. Proceed with roofing work only when existing and forecasted weather conditions will permit unit of work to be installed in accordance with manufacturer's recommendations and warranty requirements.

E. All slopes greater than 2:12 require back-nailing to prevent slippage of the ply sheets. Use ring or spiral-shank one-inch (1”) cap nails, or screws and plates at a rate of one (1) fastener per ply (including the membrane) at each insulation stop. When slope exceeds 2:12, install all plies parallel to the slope (strapping) to facilitate back nailing. Install four (4) additional fasteners at the upper edge of the membrane when strapping the plies.

3.2 SEQUENCING AND SCHEDULING

A. Sequence installation of modified bituminous sheet roofing with related units of work specified in other Sections to ensure that roof assemblies including roof accessories, flashing, trim, and joint sealers are protected against damage from effects of weather, corrosion, and adjacent construction activity.

B. All work must be fully completed on each day. Phased construction will not be acceptable.

3.3 EXAMINATION

A. Examine substrate surfaces to receive modified bitumen sheet roofing system and associated work and conditions under which roofing will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to roof system manufacturer and installer.

3.4 GENERAL INSTALLATION REQUIREMENTS

A. Cooperate with manufacturer, inspection, and test agencies engaged or required to perform services in connection with installing the roof system.

B. Insurance/Code Compliance: Where required, install and test the roofing system to comply with governing regulation and specified insurance requirements.

C. Protect other work from spillage of roofing materials and prevent materials from entering or clogging drains and conductors. Replace or restore other work damaged by installations of the modified bituminous roofing system work.

D. Coordinate installing roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight. Provide cut-offs at end of each day's work to cover exposed ply sheets and insulation with two (2) plies of #15 organic roofing felt

with joints and edges sealed with roofing cement and other jointly agreed upon tie-in detail. Remove cut-offs immediately before resuming work.

E. Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components.

F. Apply roofing materials as specified herein unless recommended otherwise by manufacturer's instructions. Keep roofing materials dry before and during application. Do not permit phased construction. Complete application of roofing plies, modified sheet and flashing in a continuous operation. Begin and apply only as much roofing in one day as can be completed that same day.

G. Cut-Offs: At end of each day's roofing installation, protect exposed edge of incomplete work, including ply sheets and insulation. Provide temporary covering of two (2) one-ply torch smooth roofing membrane with joints and edges sealed or other jointly agreed upon tie-in detail.

H. A minimum two (2) hour fire watch to remain daily after installation of last torch applied membrane for each day that torch-applied membranes are installed.

I. Keep an ABC rated fire extinguisher in a location per OSHA requirements where all workers are aware of its location and how to operate it properly.

3.5 MEMBRANE INSTALLATION

A. Torch System:
1. Install one (1) layer of SBS Torch Base sheet to a properly prepared substrate. Shingle in proper direction to shed water on each area of roofing.
2. Using a roofing torch, heat the surface of the coiled portion until the burn-off backer melts away. At this point, the material is hot enough to lay into the substrate. Progressively unroll the sheet, while heating and press down with your foot to insure a proper bond.
3. After the major portion of the roll is bonded, re-roll the first six feet (6’) and bond it in a similar fashion.
4. Repeat this operation with subsequent rolls with side laps or four inches (4”) and end laps of eight inches (8”).
5. Give each lap a finishing touch by passing the torch along the joint and spreading the melted bitumen evenly with a rounded trowel to insure a smooth, tight seal.
6. Extend underlayment two inches (2”) beyond top edges of cants at wall and projection bases.
7. Install base flashing ply to all perimeter and projections details.

3.6 FLASHING MEMBRANE INSTALLATION (GENERAL)

A. Torch System:
1. All curb, wall, and parapet flashings shall be sealed on a daily basis. No condition should exist that will permit moisture entering behind, around, or under the roof or flashing membrane.
2. Prepare all walls, penetrations, and expansion joints to be flashed with asphalt primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
3. All flashing plies will be adhered with a roofer's torch. The modified membrane will be used as the flashing and will be nailed off eight inches (8") o.c. at all vertical surfaces.
4. The entire sheet of flashing membrane must be solidly adhered to the substrate.
5. Seal all vertical laps of flashing membrane with a three-course application of Flashing Bond and fiberglass mesh.

6. Counter flashing, cap flashings, expansion joints, and similar work to be coordinated with modified bitumen roofing work are specified in other sections.
7. Roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices, to be coordinated with the roofing system work in other Sections.
8. Pitch pockets are not allowed.

3.7 APPLICATION OF SURFACING

A. Prior to installation of surface, obtain approval from manufacturer as to work completed. Roof besides mastic can be coated immediately upon approval of punch list items.

B. Coat roof field and flashing with Title 24, white coating at two (2) gallons per square. Apply the coating in two (2) passes. Each coat applied at one (1) gallon per square cross directionally.

3.8 CLEANING

A. Remove drippage of bitumen from all walls, windows, floors, ladders, and finished surfaces.

B. In areas where finished surfaces are soiled by asphalt or any other sources of soiling caused by work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.

3.9 FINAL INSPECTION

A. At completion of roofing installation and associated work, meet with installer, installer of associated work, District, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.

B. Inspect roof surface areas of the building, inspect perimeter building edges, as well as flashing of roof penetrations, walls, curbs, and other equipment. List all items requiring correction or completion and furnish copy of list to each parting attending.

C. The District reserves the right to request a thermographic scan of the roof during final inspection to determine if any damp or wet materials have been installed. The thermographic scan shall be provided by Contractor at no additional cost to the District.

D. If core cuts verify the presence of damp or wet materials, Contractor shall be required to replace the damaged areas at his own expense.

E. Repair or replace (as required) deteriorated or defective work found at time of above inspection to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

F. Contractor is to notify the District upon completion of corrections.

G. Following the final inspection, acceptance will be made in writing by the material manufacturer.

END OF SECTION 07 52 16

SECTION 07 62 00 SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. It is the intent of this Section that the work shall:
   1. Conform to all applicable DSA and building code requirements.
   2. Include all shop and field formed sheet metal work shown on Drawings, specified, or required, including, but not limited to:
      a. Roof penetration sleeves, collars, hood, and umbrella counterflashing.
      b. Metal counterflashing.
      c. Expansion joint.
      d. Metal perimeter edge.
      e. Gutters, downspouts, splash blocks and splash pans.
      f. One-way roof moisture relief vents.
      g. Metal gravity vents.
      h. Metal heat exhaust vents.
      i. Sanitary vent pipes.
      j. Pipe box.
      k. Copings, trim, and miscellaneous sheet metal accessories.

B. Related Sections:
   1. Section 05 50 00: Metal Fabrications.
   2. Section 07 72 00: Roof Accessories.
   3. Section 07 92 00: Joint Sealants.
   4. Division 22: Plumbing.
   5. Division 23: Heating, Ventilating & Air Conditioning (HVAC).

C. Reference Standards:
   1. ASTM International (ASTM):
      a. A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
      b. B32 Standard Specification for Solder Metal.
      c. C1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
   2. National Association of Architectural Metal Manufacturers (NAAMM).
   3. National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual.
   4. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Architectural Sheet Metal Manual.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s installation instructions.

B. Shop Drawings: Indicating sizes, configurations, and details of attachment to related and

adjacent work, materials, and finishes.

C. Samples:
1. Full range of finish colors for Architect's selection.
2. 12-inch long sample of each specified item with approved finish.
3. Provide full size mockup of all shop built assemblies.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Fabricator and installer of roof related flashing and accessories shall be the same as the membrane roof installer.

B. Comply with governing codes and regulations of authorities having jurisdiction.

C. Installation Conference:
1. Refer to Section 01 31 00: Project Management and Coordination.

1.5 WARRANTY

A. Manufacturer's Product Warranty:
1. Manufacturer's standard 20-year Kynar 500 or Hylar 5000 finish warranty signed by the manufacturer, with guarantee covering any failure of the fluoropolymer finish during the warranty period.
2. Failure is defined to include, but is not limited to, deterioration of finish, such as fading, discoloring, peeling, cracking, corroding, etc.
3. Correction may include repair or replacement of failed product.

B. Roofing Contractor’s Warranty:
1. Contractor shall warrant the sheet metal work and related work to be free from defects in workmanship and materials, and that the metal flashings will be and remain watertight, for a period of five (5) years from date of Substantial Completion.
2. Defects shall include, but not be limited to:
a. Leaking water or bitumen within building or construction.
b. Becoming loose from substrate.
c. Loose or missing parts.
d. Finish failure as defined above.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Handle and store materials and equipment in such a manner as to avoid damage.

C. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form. Do not place materials or equipment in such a manner as to overload structure.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Manufacturers named within specification are approved for use on the Project providing:
1. Their products meet or exceed the specifications.
2. Company has a minimum of five (5) years’ experience manufacturing products of the type specified.

3. Products have been tested in conjunction with roofing membrane system as an assembly and as such has obtained the same approval and rating as the roofing membrane system.
4. Products are approved for use by the roofing membrane manufacturer.

B. Substitutions shall be in accordance with Division 01 requirements regarding substitutions.

2.2 SHEET METAL MATERIALS

A. General Requirements: Roofing sheet metal system shall have been tested in conjunction with roofing membrane system as an assembly and have the same approval and rating as the roofing membrane system.

B. Prefinished Aluminum Sheet:
1. Precoated type, aluminum conforming to Fed. Spec. QQ-A-250, ASTM B209.
2. Finish: Kynar 500, color as selected by Architect from manufacturer's standard colors.
3. Thickness: Minimum 0.040 inch, except as otherwise indicated.

C. Sheet Lead: Four (4) pound minimum for use at roof drains and soil stacks.

D. Stainless Steel: Type 302/304 Soft Temper, No. 2D finish. Minimum thickness 24 gauge, except as otherwise noted.

2.3 FASTENERS

A. Same metal as flashing/sheet metal or other noncorrosive metal or as noted below.

B. Exposed fasteners shall be self-sealing and gasketed for weathertight installation (ZAC type).

C. Match finish of exposed heads with material being fastened.

D. Mechanical Fasteners:
1. Nails: Stainless steel ring shank, minimum 1-1/2 inch in length with 1/2-inch diameter head.
2. Washers: Steel washers with bonded rubber sealing gasket.
3. Screws: Self-tapping sheet metal type of stainless steel or compatible with material being fastened, with hooded integral EPDM washers (ZAC type).
4. Rivets: Stainless steel and cadmium plated material, closed end type of sizes recommended by sheet metal manufacturer to suit application.

E. Clips: Continuous cleat (coping/fascia). Minimum 20-gauge, G-90 galvanized, stainless steel, or aluminum. Match material of coping/fascia and provide one (1) gauge heavier.

2.4 RELATED MATERIALS

A. Solder: ASTM B32, alloy grade 58, 50 percent tin, 50 percent lead.

B. Flux:
1. Phosphoric acid type, manufacturer’s standard:
   a. For use with steel or copper: Rosin flux.
   b. For use with stainless steel: Acid-chloride type flux, except use rosin flux over tinned surfaces.

C. Underlayment:

1. 48 mil minimum, non-reinforced, homogeneous, waterproof, impermeable elastomeric sheeting manufactured by Nervastral, Inc. or Lexus Co.

D. Adhesives: Type recommended by flashing sheet manufacturer seaming and adhesive application of flashing sheet to ensure adhesion and watertightness.

E. Metal Accessories: Sheet metal clips, straps, anchoring devices, clamps, and similar accessories required for the complete installation of work, matching or compatible with material being installed, non-corrosive, and size and gauge recommended by installer to suit application and performance.

F. Sealant:
1. Type A:
   a. Type: One-part, non-sag, moisture-curing polyurethane sealant.
   b. Approved products/manufacturers:
      1) Chem-Calk 900, manufactured by Bostik Construction Products Division.
      2) Vulkem 921, manufactured by Mameco International, Inc.
      3) Dynatrol I, manufactured by Pecora Corporation.
      4) NP 1, manufactured by Sonneborn Building Products.
      5) Approved equal.
2. Type B:
   a. Type: One-part, neutral-curing, medium-modulus silicone sealant for sealing metal to metal surfaces, i.e. metal edge, cover plates, etc.
   b. Approved products/manufacturers:
      1) Chem-Calk 1200, manufactured by Bostik Construction Products Division.
      2) 795 Silicone Building Sealant, manufactured by Dow Corning Corporation.
      3) 895 Silicone, manufactured by Pecora Corporation.
      4) Omniseal, manufactured by Sonneborn Building Products
      5) Spectrem 2, manufactured by Tremco Incorporated.
      6) Approved equal.

G. Grout - Pitch Pans:
1. Type: Quick-setting, non-shrink, non-metallic, high strength formula complying with ASTM C1107.
2. Approved products/manufacturers:
   a. Sure Grip High Performance Grout, manufactured by Dayton Superior Corporation.
   b. Premier Quick-Trim, manufactured by L & M Construction Chemicals, Inc.
   c. Masterflow, manufactured by Master Builders, Inc.
   d. Sonnogrout 10K, manufactured by Sonneborn Building Products.
   e. Approved equal.

H. Pitch Pan Filler:
1. Type: Pourable polyurethane sealer, approved by roofing system manufacturer.
2. Approved products/manufacturers:
   a. Quick Pitch Sealer, manufactured by U.S. Intec.
   b. SPM Pourable Sealer, manufactured by Johns Manville.
   c. Approved equal.

I. Termination Bar:
1. Material: Extruded aluminum bar with flat profile.
2. Size: 1/8-inch thick by one-inch (1”) wide with factory punched 1/4-inch by 3/8-inch oval holes spaced six inches (6”) on center.
3. Approved product/manufacturer:
   a. TB 125, manufactured by TruFast Corp.
   b. Approved equal.

J. Pipe Hangers and Supports: Refer to Section 07 72 00: Roof Accessories.

K. Splash Blocks: Concrete type, of size and profiles indicated; minimum 3,000 psi compressive strength at 28 days, with minimum five percent (5%) air entrainment. Use at locations where roof drainage dumps on ground.

L. Splash Pans: 22-gauge stainless steel, of size and profiles indicated. Use at locations where roof drainage discharges over adjoining, lower roof level(s).

M. One-Way Moisture Relief Vents: Shall be fabricated from spun aluminum as recommended by roofing manufacturer.

2.5 FABRICATION

A. Except as otherwise indicated, fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and reviewed shop drawings. Form all flashings, receivers, and counterflashings in accordance with standards set forth in the NRCA roofing manual and SMACNA.

B. Comply with manufacturer's installation instructions and recommendations.

C. Unless noted otherwise, fabricate perimeter edge/fascia, scuppers, gutters, downspouts, copings, counterflashings, wind clips, and trim from pre-finished aluminum sheet steel.

D. Shop fabricate work to greatest extent possible. Fabricate inside and outside corners for metal edges, counterflashing, and coping caps of equal length – minimum two-foot (2’) lengths.

E. Fabricate items to size and dimensions as indicated on the Drawings. Limit single-piece lengths to ten feet (10’).

F. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work sufficient to permanently prevent leakage, damage, or deterioration of the work.

G. Integrate flashing in a manner consistent with detailing. Form work to fit substrates.

H. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling or fullness in metal after installation.

I. Fabricate items with straight lines, sharp angles, smooth curves, and true levels. Avoid tool marks, buckling, and oil canning.

J. Fold back edges on concealed side of exposed edge to form hem.

K. Unless noted otherwise, lap joints minimum one inch (1”). Rivet and solder joints on parts that are to be permanently and rigidly assembled.

L. Seams:
1. Wherever possible, fabricate non-moving seams in sheet metal with flat-lock seams and end joints.
2. Pre-finished galvanized steel: Seal pre-finished metal seams with rivets and silicone sealant.
3. Metal other than aluminum: Tin edges to be seamed, form seams, and solder.

M. On Kynar 500 or Hylar 5000 pre-finished metal, surface sand metal flanges prior to applying any primers. Prime all metal in contact with bituminous material.

N. Back-paint all concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals.

O. Expansion Provisions: Where lapped or bayonet type expansion provisions in work cannot be used or would not be sufficiently waterproof or weatherproof, form expansion joints of intermeshing hooked flanges, not less than one-inch (1") deep filled with mastic sealant concealed within joints.

2.6 FABRICATED ITEMS

A. Metal Flashings (Minimum ten-foot [10'] lengths):
1. Through wall receiver tray: Minimum 24-gauge stainless steel, through wall receivers shall not extend past the face of the exterior veneer more than 3/4 inch.
2. Counterflashing: Minimum 24-gauge stainless steel.

B. Wind Clips: Minimum 24-gauge stainless steel (or match material of counterflashing), one-inch (1") wide by length to engage counterflashing a minimum of 1/2 inch. To be installed at all wall flashings and at curb flashing lengths longer than five feet (5').

C. Roof Penetrations:
1. Umbrella counterflashing: Two-piece construction of minimum 24-gauge stainless steel, fabricated in accordance with Drawings or Project requirements.
2. Pitch pans:
   a. 24-gauge stainless steel.
   b. Fabricate to provide installed minimum clear inside perimeter dimension of two inches (2") on each side of penetrating element.
   c. Fabricate pans to at least six inches (6") above the finished roof membrane and with 1/4-inch hem at top edge and with four-inch (4") flanges. Round all corners of flange.
   d. Fabricate metal bonnets for all pans, no exceptions. Fabricate bonnets with metal compatible with metal to which bonnet is to be attached. On beams and other steel, weld in place bonnets fabricated from 1/4-inch steel plate. Draw band bonnets fabricated from 22-gauge stainless steel may be used on circular projections.

D. Metal Edge:
1. Minimum 0.040-inch thick pre-finished aluminum formed in maximum ten-foot (10') lengths, with six-inch (6") wide cover plates of same profile, four-inch (4") flange, maximum seven-inch (7") fascia, 3/4-inch gravel stop.
2. Provide expansion slip joints at maximum 20 feet on center.
3. Shop fabricate all interior and exterior corners. Fabricate exterior corners with 18-inch minimum to four-foot (4') maximum legs. Lap, rivet, and seal prior to delivery to jobsite.
4. Fabricate to sizes and dimensions as indicated on Drawings with a minimum one-inch (1") coverage past top of wall. Refer to SMACNA Fig. 2-5A.
5. Provide mock-up for Architect's approval prior to fabrication.

E. Continuous Cleats: Continuous strips, same material and profile, minimum one (1) gauge heavier of item to which cleats attach.

F. Vent Hoods, Sleeves, Penetration Flashings, and Accessories: Minimum 24-gauge stainless steel, or as shown or directed otherwise.

G. Angle Termination Bar: Aluminum pressure bar 1/8 inch by one inch (1”).

H. Vent Pipe Flashing: Four (4) pound lead. Provide proper size to fold down inside of pipe a minimum of one inch (1”).

I. Roof Drain Flashing: Four (4) pound lead, minimum 30 inches by 30 inches.

J. Coping:
1. Minimum 0.040-inch thick pre-finished aluminum, with six-inch (6”) wide cover plates of same profile.
2. Fabricate as outlined in SMACNA; Refer to Figure 3-4 A.
3. Provide tapered substrate to slope to one (1) side, and cover with waterproof membrane.
4. Install with continuous cleat one (1) side and fasten other side.

K. Gutters/Downspouts/Collector Heads:
1. Gutters and downspouts: Minimum 0.040-inch thick pre-finished aluminum formed in maximum ten-foot (10’) lengths, with six-inch (6”) wide cover plates. Minimum five-inch by six-inch (5” x 6”) box gutter (verify size meets rainfall data per SMACNA).
2. Gutter/downspout straps: Minimum 0.040-inch thick pre-finished (match color) aluminum. Hem both sides.
3. Gutter supports: Minimum 0.040-inch thick pre-finished (match color) aluminum hemmed around 1/8-inch galvanized bent steel bracket.
4. Gutter screen: Stainless steel 1/4-inch diamond wire screen enclosed in a pre-finished frame.
5. Collector heads: Minimum 0.040-inch thick pre-finished (match color) aluminum. As outlined in SMACNA; Refer to Figure 1-25F and Figure 1-28 with alternate Section A-A.

L. Pipe Box Cover: 24-gauge stainless steel.

M. Heat Exhaust Curbs and Hoods: 22-gauge stainless steel.

N. Expansion Joint Cover: Minimum 24-gauge stainless steel (provide pre-finished metal at perimeter edge end termination.)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrates are smooth and clean to extent required to perform sheet metal work.

B. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set in place.

C. Verify that reglets, nailers, cants, and blocking to receive sheet metal are in place and free of concrete and soil.

D. Do not start work until conditions are satisfactory.

3.2 PREPARATION

A. Field measure site conditions prior to fabrication work.

B. Install starter and edge strips and cleats before starting installation.

3.3 INSTALLATION

A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form 1/4-inch hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Pre-fabricated corners or transitions are required at changes in direction, elevation, or plane and at intersections. Locate field joints not less than 12 inches, nor more than three feet (3') from actual corner. Laps shall be one inch (1"), riveted and soldered at following locations:
   1. Pre-fabricated corners.
   2. Transitions.
   3. Changes in direction, elevation, and plane.
   4. At intersections.

B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners wherever possible; and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight and weatherproof.

C. Install fabricated sheet metal items in accordance with manufacturer's installation instructions and recommendations and with SMACNA Architectural Sheet Metal Manual.

D. Separations: Provide for separation of metal from dissimilar metal or corrosive substrates by coating concealed surfaces with zinc chromate, bituminous coating, or other permanent separation at locations of contact as recommended by manufacturer or fabricator. Do not use materials that are incompatible with roofing system.

E. Continuous Cleat: At exposed edges of perimeter edge, fascias, cap flashings, and where required, attach continuous cleat at six inches (6") on center with appropriate fasteners.

F. Gravel Guard/Fascia:
   1. Install with expansion joints ten feet (10') o.c., 1/2-inch expansion leeway, with cover plate.
   2. Set in asphalt mastic and fasten into nailer at three inches (3") o.c. staggered.
   3. Buff sand Kynar surface of flange and prime.
   4. Strip in flange with specified stripping plies set in hot bitumen extending three inches (3") from outer edge of flange to at least three inches (3") inward towards gravel stop. Provide finish stripping ply of modified bitumen base ply in hot bitumen extending six inches (6") from the outer edge of the flange and butt base of gravel stop.

G. Counterflashing:
   1. Do not use surface mount counterflashing except as noted in Drawings.
   2. Set in through wall with receiver and spring lock counterflashing, as detailed in Drawings and to NRCA roofing manual, SMACNA standards.
   3. Coordinate installation of through-wall flashing with the masonry contractor.
   4. Seal through-wall in conjunction with masonry wall waterproofing.
   5. Install wind clips 30 inches o.c. at all counterflashing over five feet (5') in length.

H. Pitch Pans, Metal Flanges:
   1. Apply mastic under pitch pan or metal flashing flange at least 1/2 pound per linear foot.
   2. Prime all metal flanges with asphalt primer prior to flashing installation.
   3. Clean all projections enclosed in pitch pans in any manner suitable and coated with a rust inhibitive coating as approved by the Architect. Coating shall be allowed to dry prior to pitch pan fill.
   4. Fill base of pitch pans with grout or cementitious binder and allow to cure.
   5. Top Finish Fill: Self-leveling, one-part urethane; at least two inches (2") to top of pitch

pan sides.

6. Strip in pitch pan flanges with two (2) strips of specified stripping plies set in hot bitumen extending three inches (3") from the outer edge of the flange to at least three inches (3") inward toward base of pitch pan. Provide finish stripping ply of SBS modified bitumen membrane in hot bitumen extending six inches (6") from the outer edge of the flange and butt to base of pitch pan.

I. Sanitary Vent Stacks:
   1. Prime top and bottom flanges of lead flashing sleeve. Set flange in uniform troweling of plastic roof cement. Prime top side of flange to receive strip-in membrane.
   2. Fold lead sleeve down inside of pipe a minimum of one inch (1"). Apply a continuous bead of sealant on inside of pipe prior to folding lead sleeve.

J. Roof Drains:
   1. After membrane installation, prime bottom of lead flashing sheet and set in uniform bed of plastic roof cement at specified locations.
   2. Extend lead flashing into drain bowl or pipe a minimum of two inches (2") and over top of piping/bowl connection, if possible. Apply a continuous bead of specified Type A sealant, at intersection of pipe and drain bowl.
   3. If drain bowl and pipe connection is contaminated with bituminous material, strip-in area with three-coursing of plastic roof cement and fabric.
   4. Prime top of lead flashing sheet to receive strip-in membrane.

K. Gutters/Downspouts:
   1. Install gutters as detailed.
   2. Install downspouts plumb and level and attached to columns or wall with straps located at top and bottom of downspout and maximum ten feet (10') on center.
   3. Install splash pad or block under discharge port of downspouts. Install splash pan over a protection (walkway) pad for downspouts located at roof level.
   4. End caps, downspout outlets, gutter and downspout straps, support brackets, and joint fasteners to be manufactured to suit profile and dimension of gutter and downspout.
   5. Install all anchoring devices as outlined in SMACNA.
   6. Expansion joints: Lap or butt type per SMACNA, locate every 50 linear feet.

L. Expansion Joint:
   1. Construct wood curbs as shown on Drawings and as outlined in the NRCA and SMACNA manuals.
   2. Install underlayment, form envelope, and secure underlayment to curb. Fill envelope with compressible insulation.
   3. Securely fasten expansion joint cover to curb with grommetted fasteners spaced six inches (6") on center.
   4. Taper expansion joint down at the metal edge.

M. Coping:
   1. Install wood nailers as shown on Drawings.
   2. Install metal cleats with appropriate fasteners spaced six inches (6") on center.
   3. Install underlayment over the wood substrate. Lap ends minimum of six inches (6") and secure membrane in place. Seal laps with appropriate adhesive.
   4. Install metal coping allowing 1/2-inch spaces between segments. Lock coping onto cleat and install appropriate fasteners through the interior fascia spaced 24 inches on center in enlarged holes.
   5. Install cover plate centered over coping joint in continuous beads of specified Type B sealant, placed approximately one inch (1") from cover edges. Refer to SMACNA for alternate joints as required by length.
   6. Install appropriate fastener through neoprene washer and cover plate between coping segments.

7. Accommodate building wall expansion joints by terminating coping joints and cleats either side of expansion joint. Do not run coping or cleats continuous across joints. Install coping cover plate to span across joint and lap coping on each side of joint a minimum of four inches (4”). Fasten cover plate on one (1) side of joint only (provide wall flashing membrane up and over parapet wall in accordance with manufacturer’s detail).

3.4 CLEANING AND PROTECTION

A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean of stains.

B. Remove scraps and debris and leave work area clean.

C. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes. Paint areas where finish is damaged on pre-finished metal by painting with a compatible paint in color to match undamaged finish.

D. Prime soldered area of phosphatized metal after cleaning to prevent rusting.

E. Paint metal flashings that have been soiled with bitumen with aluminized paint.

F. Clean other work damaged or soiled by work of this Section.

G. Protect finished work from damage.

END OF SECTION 07 62 00

SECTION 07 62 01 COPING SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide all labor, equipment, and materials to and install the specified pre-manufactured coping system as specified: Coping cap at parapets.

B. Related Sections:
   1. Section 06 10 00: Rough Carpentry.

C. Reference Standards:
   1. American Society for Testing and Materials (ASTM):
      a. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (galvanized) or Zinc-Iron Alloy-Coated (galvannealed) by the Hot-Dip Process.
      b. ASTM A792 Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process.
      c. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
      d. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
      e. ASTM D692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
   2. American National Standards Institute/Single Ply Roofing Industry (ANSI/SPRI).
   3. Warnock Hersey International, Inc., Middleton, WI (WH).
   4. Factory Mutual Research Corporation (FMRC).
   5. Underwriters Laboratories (UL).
   6. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Latest Edition Architectural Sheet Metal Manual.
   7. National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual.
   8. American Society of Civil Engineers (ASCE):
      a. ASCE 7 Minimum Design Loads for Buildings and Other Structures.

1.3 SUBMITTALS

A. Product Data:
   1. Provide manufacturer's specification data sheets for each product.
   2. Metal material characteristics and installation recommendations.
   3. Submit color chart prior to material ordering and/or fabrication so that equivalent colors to those specified can be approved.

B. Samples: Submit two (2) samples, illustrating typical metal edge, coping, gutters, and fascia extenders for material and finish.

C. Shop Drawings:
   1. For manufactured and ANSI/SPRI approved shop fabricated gravel stops, fascia, scuppers, and all other sheet metal fabrications.
   2. Indicate material profile, jointing pattern, jointing details, fastening methods, flashing,

terminations, and installation details.
3. Indicate type, gauge, and finish of metal.

D. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the manufacturer and the Owner.

E. Design Loads: Any material submitted as equal to the specified material must be accompanied by a report signed and sealed by a professional engineer licensed in the State of California. This report shall show that the submitted equal meets the wind uplift and perimeter attachment requirements according to ASCE 7. Substitution requests submitted without licensed engineer approval will be rejected for nonconformance.

F. Factory Mutual Research Corporation's (FMRC) wind uplift resistance classification: The roof perimeter flashing shall conform to the requirements as defined by the FMRC Loss Prevention Data Sheet 1-49.

G. A letter from an officer of the manufacturing company certifying that the materials furnished for this Project are the same as represented in tests and supporting data.

H. Mill production reports certifying that the steel thicknesses are within allowable tolerances of the nominal or minimum thickness or gauge specified.

I. Certification of work progress inspection. Refer to Quality Assurance article below.

J. Certifications:
1. Submit roof manufacturer's certification that metal fasteners furnished are acceptable to roof manufacturer.
2. Submit roof manufacturer's certification that metal furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

K. Closeout Submittals:
1. Special project warranty: Provide specified warranty for the Project, executed by the authorized agent of the manufacturer.
2. Roofing maintenance instructions: Provide a manual of manufacturer's recommendations for maintenance of installed roofing systems.
3. Insurance certification: Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

1.4 PERFORMANCE REQUIREMENTS

A. Thermal Expansion and Contraction: Completed metal edge flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors, or fasteners, or reducing performance ability.

1.5 QUALITY ASSURANCE

A. Engage an experienced roofing contractor specializing in sheet metal flashing work with a minimum of five (5) years' experience.

B. Maintain a full-time supervisor/foreman who is on the jobsite at all times during installation. Foreman must have a minimum of five (5) years' experience with the installation of similar system to that specified.

C. Source Limitation: Obtain components from a single manufacturer. Secondary products that cannot be supplied by the specified manufacturer shall be approved in writing by the primary manufacturer prior to bidding.

D. Upon request, fabricator/installer shall submit work experience and evidence of financial responsibility. The Owner's representative reserves the right to inspect fabrication facilities in determining qualifications.

1.6 WARRANTY

A. Owner shall receive one (1) warranty from manufacturer of roofing materials covering all of the following criteria. Multiple warranties are not acceptable:
   1. Pre-finished metal material shall require a written twenty (20) year non-prorated warranty covering fade, chalking, and film integrity. The material shall not show a color change greater than five (5) NBS color units per ASTM D2244 or chalking excess of eight (8) units per ASTM D659. If either occurs, material shall be replaced per warranty at no cost to the Owner.
   2. Changes: Changes or alterations in the edge metal system without prior written consent from the manufacturer shall render the system unacceptable for a warranty.
   3. Warranty shall commence on date of Substantial Completion or final payment, whichever is agreed by contract.
   4. The Contractor shall provide the Owner with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be watertight and secure for a period of three (3) years from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop, and make good any damage to other work or equipment caused by such leaks or the repairs thereof.
   5. Installing roofing contractor shall be responsible for the installation of the edge metal system in general accordance with the membrane manufacturer's recommendations.
   6. Installing contractor shall certify that the edge metal system has been installed per the manufacturer's printed details and specifications.
   7. One manufacturer shall provide a single warranty for all accessory metal for flashings, metal edges, and copings, along with the warranty for metal roof areas, membrane roof areas, and any transitions between two different material types.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.

B. Stack pre-formed and pre-finished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials that may cause discoloration or staining.

PART 2 PRODUCTS

2.1 PRODUCTS, GENERAL

A. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and Contractor/fabricator quality and performance criteria specified in Part 1.

B. Substitutions:

1. Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 01 provisions:
   a. Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the State of California. Substitution requests containing specifications without licensed engineer certification shall be rejected for nonconformance.
   b. Include a list of three (3) projects of similar type and extent, located within a 100-mile radius from the location of the Project. In addition, the three (3) projects must be at least five (5) years old and be available for inspection by the Architect, Owner, or Owner's representative.
   c. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.
   d. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2 ACCEPTABLE MANUFACTURERS

A. The design is based upon roofing systems engineered and manufactured by:
   1. The Garland Company
      3800 East 91st Street
      Cleveland, Ohio 44105
      Telephone: 559-647-1196
      Website: www.garlandco.com
      Local representative: Rich Jones

2.3 MATERIALS

A. General: Product designations for the materials used in this Section shall be based on performance characteristics of the R-MER Edge System manufactured by the Garland Company, Cleveland, OH, and shall form the basis of the Contract Documents.

B. R-Mer Edge Coping:
   1. Minimum gauge of steel or thickness of aluminum to be specified in accordance with Architectural Sheet Metal Manual, Sheet Metal and Air Conditioning Contractor's National Association, Inc. recommendations. [22] gauge, Zinc-coated (galvanized) steel sheet, as per ASTM A653: G90 (Z275) coating designation; structural quality, grade 40 ksi (275 MPa).

C. R-Mer Edge Coping Chairs:
   1. Zinc-coated steel, ASTM A653, coating designation G-90, in thickness of 0.0635 nom./ 16 gauge, 36 inches to 48 inches by coil length, chemically treated, commercial or lock-forming quality.

D. Finishes:
   1. Exposed surfaces for coated panels:
      a. Steel finishes: Fluorocarbon finish. Epoxy primer baked both sides, .2-.25 mils thickness as approved by finish coat manufacturer.
      b. Weathering finish as referred by National Coil Coaters Association (NCCA).

PROPERTY	TEST METHOD	FLUOROCARBON*
Pencil Hardness	ASTM D3363 NCCA II-2	HB-H
Bend	ASTM D-4145	O-T

	NCCA II-19	
Cross-Hatch Adhesion	ASTM D3359	no loss of adhesion
Gloss (60° angle)	ASTM D523	25+/-5%
Reverse Impact	ASTM D2794	no cracking or loss of adhesion
Nominal Thickness	ASTM D1005	
Primer		0.2 mils
Topcoat		0.8 mils
TOTAL		1.0 mils

* Subject to minimum quantity requirements

c. Color shall from standard colors.
d. Exposed and unexposed surfaces for anodized aluminum flashing, fascia, and coping cap, shall be as shipped from mill.

2.4 RELATED MATERIALS AND ACCESSORIES

A. Metal Primer: Zinc chromate type.

B. Plastic Cement: ASTM D4586.

C. Sealant: Tuff Stuff Urethane Caulking.

D. Underlayment: Aqua Block 60.

E. Slip Sheet: Rosin sized building paper.

F. Fasteners:
1. Corrosion resistant screw fastener as recommended by metal manufacturer. Finish exposed fasteners same as flashing metal.
2. Fastening shall conform to Factory Mutual requirements or as stated on section details, whichever is more stringent.

G. Gutter and Downspout Anchorage Devices: Material as specified for system.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for pre-formed metal edge system.

3.2 PROTECTION

A. Isolate metal products from dissimilar metals, masonry, or concrete with bituminous paint, tape, or slip sheet. Use gasketed fasteners where required to prevent corrosive reactions.

3.3 GENERAL

A. Secure fascia to wood nailers at the bottom edge with a continuous cleat.

B. Fastening of metal to walls and wood blocking shall comply with building code standards.

C. All accessories or other items essential to the completeness of sheet metal installation, whether specifically indicated or not, shall be provided and of the same material as item to which applied.

D. Allow sufficient clearances for expansion and contraction of linear metal components. Secure metal using fasteners as required by the system. Exposed face fastening will be rejected.

3.4 INSPECTION

A. Verify that curbs are solidly set and nailing strips located.

B. Perform field measurements prior to fabrication.

C. Coordinate work with work of other trades.

D. Verify that substrate is dry, clean, and free of foreign matter.

E. Commencement of installation shall be considered acceptance of existing conditions.

3.5 MANUFACTURED SHEET METAL SYSTEMS

A. Furnish and install manufactured fascia and coping cap systems in strict accordance with manufacturer's printed instructions.

B. Provide factory-fabricated accessories including, but not limited to, fascia extenders, miters, scuppers, joint covers, etc. Refer to source limitation provision in Part 1.

3.6 SHOP-FABRICATED SHEET METAL

A. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices.

B. Hem exposed edges.

C. Angle bottom edges of exposed vertical surfaces to form drip.

D. Lap corners with adjoining pieces fastened and set in sealant.

E. Form joints for gravel stop fascia system, coping cap with a 3/8-inch opening between sections. Back the opening with an internal drainage plate formed to the profile of fascia piece.

F. Install sheet metal to comply with referenced ANSI/SPRI, SMACNA, and NRCA standards.

3.7 FLASHING MEMBRANE INSTALLATION

A. Snap-On Coping Cap Detail:
   1. Install miters first.
   2. Position base flashing of the built-up and/or modified roofing membrane over the wall edge covering nailers completely, fastening eight inches (8”) on center. Install membrane and cap sheet with proper material and procedure according to manufacturer's recommendations.
   3. Install minimum 16-gauge, 16-inch long by specified width anchor chair at [Contact Garland Representative] feet on center.
   4. Install six-inch (6”) wide splice plate by centering over 16-inch long by specified width anchor chair. Apply two (2) beads of sealant to either side of the splice plate's center, approximately two inches (2”) from the coping cap joint. Install coping cap by hooking outside hem of coping on outside face of anchor chair. Press downward on inside edge of coping until "snap" occurs and hem is engaged on the entire chair.

3.8 CLEANING

A. Clean installed work in accordance with the manufacturer's instructions.

B. Replace damaged work than cannot be restored by normal cleaning methods.

3.9 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated. Comply with requirements of authorities having jurisdiction.

3.10 FINAL INSPECTION

A. At completion of installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.

B. Inspect work and flashing of roof penetrations, walls, curbs, and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.

C. Repair or replace deteriorated or defective work found at time of above inspection as required to produce an installation that is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

D. Notify the Ojai Unified School District upon completion of corrections.

E. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

F. Immediately correct roof leakage during construction. If the Contractor does not respond within 24 hours, the Owner will exercise rights to correct the work under the terms of the conditions of the contract.

3.11 DEMONSTRATION AND TRAINING

A. At a time and date agreed to by the Owner, instruct the Owner's facility manager, or other representative designated by the Owner, on the following procedures:
   1. Troubleshooting procedures.
   2. Notification procedures for reporting leaks or other apparent roofing problems.
   3. Maintenance.
   4. The Owner's obligations for maintaining the warranty in effect and force.

5. The manufacturer's obligations for maintaining the warranty in effect and force.

END OF SECTION 07 62 01

SECTION 07 65 00 FLEXIBLE FLASHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Flexible sheet flashing for windows, doors, parapets, and other openings and where indicated on Drawings.

B. Related Sections:
   1. Section 07 41 13: Metal Roof Panels.
   2. Section 07 42 16: Metal Soffit Panels.
   3. Section 07 62 00: Sheet Metal Flashing and Trim.
   4. Section 07 72 00: Roof Accessories.
   5. Section 07 92 00: Joint Sealants.

C. Reference Standards:
   1. Part 1 2019 California Building Standards Administrative Code, Title 24 C.C.R.
   2. Part 2 2019 California Building Standards Administrative Code, Title 24 C.C.R.
   3. Part 3 2019 California Electrical Code, Title 24 C.C.R.
   4. Part 4 2019 California Mechanical Code, Title 24 C.C.R.
   5. Part 5 2019 California Plumbing Code, Title 24 C.C.R.
   6. Part 6 2019 California Energy Code, Title 24 C.C.R.
   7. Part 8 2019 California Historical Code, Title 24 C.C.R.
   8. Part 9 2019 California Fire Code, Title 24 C.C.R.
   9. Part 10 2019 California Existing Building Code, Title 24 C.C.R.
   10. Part 11 2019 California Green Building Standards Code (CALGreen Code), Title 24 C.C.R.
   11. Part 12 2019 California Referenced Standards Code, Title 24 C.C.R.
   12. NFPA 13 Automatic Sprinkler Systems (California Amended), Current Edition.
   13. NFPA 14 Standpipe Systems (California Amended), Current Edition.
   14. NFPA 17 Dry Chemical Extinguishing Systems, Current Edition.
   15. NFPA 20 Stationary Pumps, Current Edition.
   16. NFPA 24 Private Fire Service Mains (California Amended), Current Edition.
   17. NFPA 72 National Fire Alarm and Signaling Code (California Amended) Current Edition (Note: See UL Standard 1971 for “Visual Devices.”
   18. NFPA 80 Fire Door and Other Opening Protectives, Current Edition.
   19. NFPA 253 Critical Radiant Flux of Flooring Covering Systems, Current Edition.
   20. NFPA 2001 Clean Agent Fire Extinguishing Systems (California Amended), Current Edition.
   21. Americans with Disabilities Act (ADA), Title II, and 2019 CBC Section 11B.

1.3 SUBMITTALS

A. Concurrent Review Requirements: Submit submittals of this Section with doors and windows Sections.

B. Product Data: Include manufacturer’s written instructions for evaluating, preparing, and

treating substrate, technical data, and testing physical and performance properties of flexible sheet flashing.

C. Shop Drawings: Show locations and extent of flexible sheet flashing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

D. Samples - For the Following Products:
1. 12-by-12-inch square of flexible sheet flashing.

E. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

F. Qualification Data: For installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for flexible sheet flashing.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that is acceptable to flexible sheet flashing manufacturer for installation of flexible sheet flashing required for this Project.

B. Source Limitations: Obtain flexible sheet flashing materials through one (1) source from a single manufacturer.

C. Mockups:
1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
   a. Build mockup with doors and windows.

D. Pre-Installation Conference:
1. Conduct conference at Project site. Review methods and procedures related to flexible sheet flashing including, but not limited to the following:
   a. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Review and discuss the flashing to be coordinated with the finishing of doors and windows.
   c. Review, discuss, and coordinate the interrelationship of flexible flashing with other exterior wall components. Include provisions for sealants and fasteners.
   d. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
   e. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.5 WARRANTY

A. Special Warranty:
1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of flexible sheet flashing that fails in materials or workmanship within specified warranty period:
   a. Warranty period: Two (2) years.

B. Installer's Warranty: One (1) year.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by flexible sheet flashing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Flexible Sheet Flashing:
   1. Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified:
      a. WR Grace (basis of design).
      b. FortiFlash by Fortifiber.
      c. FlexWrap and StraightFlash by DuPont.
      d. Or equal.

2.2 FLEXIBLE SHEET FLASHING

A. Product - Vycor Plus by WR Grace or Equal:
   1. Self-Adhered, cross-laminated high-density polyethylene (HDPE) sheet, backed by aggressive pressure-sensitive rubberized asphalt adhesive.
   2. Thickness: 25 mil minimum per ASTM D3767, Method A.
   3. Low temperature flexibility: Unaffected at minus 45 degrees F per ASTM D1970.
   4. Elongation, ultimate failure of rubberized asphalt: 200 percent minimum per ASTM D412.
   5. Cracked cycling 100 cycles: Unaffected at minus 25 degrees F per ASTM C836.
   6. Lap adhesion at minimum application temperature: 60 plf width per ASTM D1876 modified.
   7. Adhesion to concrete at minimum application temperature: 60 plf width per ASTM D903.
   8. Recommended exposure limit: 30 days.
   9. Perm-A-Barrier by Grace is not acceptable.

2.3 AUXILIARY MATERIALS

A. Mastic, Joint Sealant, Adhesives, and Tape:
   1. Liquid mastic and adhesives, and adhesive tapes recommended by flexible sheet flashing manufacturer:
      a. Caulking, sealants, and adhesives applied on the interior of the building envelope shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements and other conditions affecting performance:
   1. Verify that concrete has cured and aged for minimum time period recommended by flexible sheet flashing manufacturer.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install flexible sheet flashing in accordance with the manufacturer's written instructions, AAMA Publication 2400, and the applicable code.

END OF SECTION 07 65 00

SECTION 07 72 00 ROOF ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Roof curbs.
   2. Equipment supports.

B. Related Sections:
   1. Section 05 50 00: Metal Fabrications.
   2. Section 06 10 00: Rough Carpentry.
   3. Section 07 62 00: Sheet Metal Flashing and Trim.

1.3 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

C. Coordination Drawings:
   1. Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
      a. Size and location of roof accessories specified in this Section.
      b. Method of attaching roof accessories to roof or building structure.
      c. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

D. Warranty: Provide manufacturer’s standard warranty.

1.4 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's Architectural Sheet Metal Manual details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

B. Mockups: Refer to Section 07 62 00: Sheet Metal Flashing and Trim.

C. All work must conform to California Building Code.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A653/A653M, G90 (Z275) coated.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, AZ50 (AZM150) coated.

C. Aluminum Sheet: ASTM B209, alloy and temper recommended by manufacturer for type of use and mill finish.

D. Aluminum Extrusions and Tubes: ASTM B221, alloy and temper recommended by manufacturer for type of use, mill finished.

E. Stainless-Steel Shapes or Sheet: ASTM A240/A240M or ASTM A666, Type 304 or Type 316, No. 2D finish.

F. Steel Shapes: ASTM A36/A36M, hot-dip galvanized to comply with ASTM A123/A123M, unless otherwise indicated.

G. Steel Tube: ASTM A500, round tube, baked-enamel finished.

H. Galvanized Steel Tube: ASTM A500, round tube, hot-dip galvanized to comply with ASTM A123/A123M.

I. Galvanized Steel Pipe: ASTM A53/A53M.

2.3 MISCELLANEOUS MATERIALS

A. Glass-Fiber Board Insulation: ASTM C726, one inch (25 mm) thick.

B. Polyisocyanurate Board Insulation: ASTM C1289, one inch (25 mm) thick.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, not less than 1-1/2 inch (38 mm) thick.

D. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

E. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

H. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.

I. Roofing Cement: ASTM D4586, non-asbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.4 ROOF CURBS

A. Roof Curbs:
1. Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with an integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or shop drawings of equipment to be supported:
   a. Manufacturers (Butler IF Curb):
      1) Colony Custom Curbs.
      2) Commodity Products Company, Inc.
      3) Conn-Fab Sales, Inc.
      4) Curbs Plus Inc.
      5) Custom Curb, Inc.
      6) LM Curbs.
      7) Loren Cook Company.
      8) Metallic Products Corporation.
      9) Pate Company (The).
      10) Roof Products & Systems Corporation.
      11) Roof Products, Inc.
      12) Thaler Metal Industries Ltd.
      13) ThyCurb; Div. of Thybar Corporation.
      14) Uni-Curb, Inc.
      15) Vent Products Company, Inc.
   b. Material: Galvanized or aluminum-zinc alloy-coated steel sheet, 0.052 inch (1.32 mm) thick.
   c. Liner: Same material as curb, of manufacturer's standard thickness and finish.
   d. Factory install wood nailers at tops of curbs.
   e. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   f. Factory insulate curbs with manufacturer’s standard rigid or semi-rigid insulation:
      1) Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 16 inches (400 mm), unless otherwise indicated.
      2) Sloping roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.5 EQUIPMENT SUPPORTS

A. Equipment Supports:
1. Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with an integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or shop drawings of equipment to be supported:
   a. Manufacturers:
      1) Colony Custom Curbs.

2) Commodity Products Company, Inc.
3) Conn-Fab Sales, Inc.
4) Curbs Plus Inc.
5) Custom Curb, Inc.
6) LM Curbs.
7) Loren Cook Company.
8) Metallic Products Corporation.
9) Pate Company (The).
10) Roof Products & Systems Corporation.
11) Roof Products, Inc.
12) Thaler Metal Industries Ltd.
13) ThyCurb; Div. of Thybar Corporation.
14) Uni-Curb, Inc.
15) Vent Products Company, Inc.

b. Indicate load requirements on Drawings or insert below.
c. Material: Galvanized or aluminum-zinc alloy-coated steel sheet, 0.052 inch (1.32 mm) thick.
d. Factory install continuous wood nailers 3-1/2 inches (90 mm) wide at tops of equipment supports.
e. Metal counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
f. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
g. Equipment support height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer.
h. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.
i. Sloping roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on shop drawings.

3.2 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

3.3 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, to verify actual locations, dimensions, and other conditions affecting performance of work:
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, is securely anchored, and is ready to receive roof accessories.
2. Verify dimensions of roof openings for roof accessories.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection:
   1. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer:
      a. Coat concealed side of uncoated aluminum and stainless steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
      b. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
      c. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Curb Installation: Set roof curb so top surface of roof curb is level.

F. Equipment Support Installation: Set equipment support so top surface of equipment support is level.

G. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.5 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Section 09 90 00: Painting and Coating.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

3.6 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 07 72 00

SECTION 07 92 00 JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Control and expansion joints on exposed interior and exterior surfaces.
2. Perimeter joints between wall surfaces and frames of interior and exterior doors and openings.
3. Joints between plumbing fixtures and adjoining walls, floors, and counters.
4. Joints indicated or as necessary.
5. Accessories necessary for a complete installation.

B. Related Sections:
1. Section 03 30 00: Cast-In-Place Concrete
2. Section 05 50 00: Metal Fabrications.
3. Section 07 84 00: Firestopping.
4. Section 08 11 13: Hollow Metal Doors and Frames.
5. Section 08 14 16: Flush Wood Doors.
6. Section 08 80 00: Glazing.
7. Section 09 90 00: Painting and Coating.

1.3 SUBMITTALS

A. Product Data:
1. Technical data for each joint sealant product. Data to indicate elasticity and durability of each joint sealant product. Submit written certification from manufacturers of sealants attesting products are suitable for use indicated, verified through in-house testing laboratory:
   a. Written certification from manufacturers of joint sealants attesting that products comply with specification requirements and suitable for use indicated verified through manufacturers testing laboratory within the past 36 months or since most recent reformulation, whichever is most recent:
      1) Complete instructions for handling, storage, mixing, priming, installation, curing, and protection of each type of sealant.
      2) Manufacturer's letter, clearly indicating proposed lot numbers of each sealant supplied and expiration date sequence.
2. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and postconsumer recycled content per unit of product.
   b. Indicate relative dollar value of recycled content product to total dollar value of product included in Project.
   c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
   d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
3. Local/regional materials:
   a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery;

indicate distance between extraction, harvesting, and recovery and the Project site.
b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the Project site.
c. Product value: Indicate dollar value of product containing local/regional materials; include materials cost only.
d. Product component(s) value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

4. VOC data: Submit manufacturer's product data for sealants. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.
5. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

B. Samples:
1. Provide color samples from full manufacturer's full range for each type of sealant specified for Architect's review.

C. Certificates and Reports:
1. Product Certificates: Manufacturer's product certificate for each kind of joint sealant and accessory.
2. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
3. Product test reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
4. Preconstruction compatibility and adhesion test reports:
a. From sealant manufacturer, indicating the following:
1) Materials forming joint substrates and sealant backings have been tested for compatibility and adhesion with sealants.
2) Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
5. Preconstruction field adhesion test reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified.
6. Field adhesion test reports: For each sealant application tested.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
1. Firm having minimum five (5) years' documented experience and specializes in the installation of sealants:
a. Exposed sealant work (sealants used for air and weatherseals external at perimeter, metal panel to panel joints) shall be performed by a single (i.e. one) firm specializing in the installation of sealants who has successfully produced work comparable to Project.
b. Concealed sealant work (sealants that are internal to skylights and providing an air seal) shall be the responsibility of the subcontractor providing erection of the respective system.

B. Source Limitations: Obtain each type of joint sealant from a single manufacturer.

C. Product Testing:
1. Test joint sealants using a qualified testing agency:
a. Testing agency qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
b. Test according to SWRI Sealant Validation Program for compliance with

requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion in peel, and indentation hardness.

D. Environmental Requirements:
   1. Toxicity/IEQ:
      a. Comply with applicable regulations regarding toxic and hazardous materials:
         1) VOC content of interior sealants - sealants and sealant primers complying with limits for VOC content for SCAQMD when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
            a) Sealants: 250 g/L.
            b) Sealant primers for nonporous substrates: 250 g/L.
            c) Sealant primers for porous substrates: 775 g/L.
      b. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.

1.5 WARRANTY

A. Written warranty, signed by installer agreeing to repair or replace elastomeric joint sealant work that has failed to provide a weathertight system within specified warranty period:
   1. Warranty period: Five (5) years from date of Substantial Completion.

B. Written warranties (weatherseal and stain resistance), signed by sealant manufacturer agreeing to furnish joint sealants to repair or replace those that fail to provide airtight and watertight joints, or fail in adhesion, cohesion, abrasion resistance, stain resistance, weather resistance, durability, or appear to deteriorate in manner not specified in the manufacturer's data as an inherent quality of the material within specified warranty period:
   1. Warranty period: Five (5) years from date of Substantial Completion.

C. Warranties specified exclude deterioration or failure of sealants from:
   1. 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.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer’s written instructions to prevent deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

PART 2 PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backings, and related materials compatible with one another and with joint substrates under conditions of service and application, as stated by sealant manufacturer’s published data, and as substantiated by the manufacturer for each

application through testing.

B. Liquid Applied Sealants: Comply with ASTM C920 and requirements indicated for each liquid applied sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Stain Test Response Characteristics: For sealants in contact with porous substrates, provide nonstaining products that have undergone testing according to ASTM C1248 and do not stain porous joint substrates.

D. 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.

E. Colors: For fully concealed joints, provide standard color of sealant that has the best overall performance characteristics for the application shown. For exposed joints, submit color samples to Architect for approval, from manufacturer's full line of standard colors.

F. Manufacturer's Representative: Use sealant produced by manufacturer who agrees to send a qualified technical representative to site upon request for the purpose of rendering advice concerning the recommended installation of manufacturer's materials.

G. Sealants: Self-leveling compounds for horizontal joints in pavements and non-sag compounds elsewhere except as shown or specified.

H. Silicone Sealant:
1. Comply with ASTM C920, Type M, Grade NS, Class 25; use NT, M, A and O:
    a. Use: Typical joints between masonry, metals, glass, and plastics (two-part silicone sealants).
    b. Properties:
        1) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates. The minimum pli value after seven (7) day immersion shall not be less than 13 when tested in strict accordance with ASTM C794 Adhesion and Peel.
        2) Cure system and oil content: Neutral cure system specifically manufactured with controlled oil content to eliminate oil migration into sealed substrates and residue rundown over and onto adjacent substrates.
    c. Product and manufacturer: Dow Corning; 756 Silicone Building Sealant - HP with Additive.

I. Silicone Sealant:
1. ASTM C920, Type S, Grade NS, Class 50, for Use NT:
    a. Use: Typical joints between masonry, metals, glass, and plastics (single component sealants).
    b. Properties:
        1) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates.
        2) Cure system and oil content: Neutral cure system specifically manufactured with controlled oil content to eliminate oil migration into sealed substrates and residue rundown over and onto adjacent substrates.
    c. Product and manufacturer:
        1) BASF Building Systems; Omniseal 50.
        2) Dow Corning Corporation; 756 SMS, 791, 795, 995 as applicable.
        3) GE Advanced Materials, Silicones; SilGlaze II SCS2800, SilPruf NB SCS9000, SilPruf SCS2000, or UltraPruf II SCS2900 as applicable.
        4) Pecora Corporation, as applicable.

5) Sika Corporation, Construction Products Division; SikaSil-C995.
6) Tremco, as applicable.
7) Comparable product.

J. Polyurethane Sealants:
1. ASTM C920, Type M, Grade NS, Class 25; use NT, M, A and O:
   a. Use: Typical Wall and floor joints (two-part polyurethane sealants). Use at concrete joints.
   b. Properties:
      1) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates.
   c. Products and manufacturers:
      1) BASF Building Systems; Sonolastic NP-2.
      2) Pecora Corporation; Dynatred.
      3) Sika Corporation, Construction Products Division; Sikaflex 2c NS or Sikaflex 2c NS TG as applicable.
      4) Tremco, as applicable.
      5) Comparable product.

K. Two-Part Polyurethane Sealants:
1. ASTM C920, Type M, Grade NS, Class 50; use NT, M, A and O:
   a. Use: Typical Wall and floor joints (two-part polyurethane sealants).
   b. Properties:
      1) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates. The minimum pli value after seven (7) day immersion shall not be less than 13 when tested in strict accordance with ASTM C794 Adhesion in Peel.
   c. Products and manufacturers:
      1) BASF Construction Chemicals; NP 2.
      2) Pecora Corporation, as applicable.
      3) Schnee-Morehead, Inc.; Permathane SM 7200.
      4) Sika Corporation, Inc.; Sikaflex - 2c NS TG.
      5) Tremco, as applicable.
      6) Comparable product.

L. Mildew Resistant Silicone Sealant:
1. ASTM C920, Type S, Grade NS, Class 25, Use NT, Substrate uses G, A, and O; and containing fungicide for mildew resistance; acid curing:
   a. Use: One-part mildew-resistant silicone, formulated with fungicide for sealing interior joints of nonporous substrates around ceramic tile, plumbing fixtures, and showers.
   b. Products - provide one of the following:
      1) BASF Building Systems; Omniplus.
      2) Dow Corning; 786 Mildew Resistant Silicone Sealant.
      3) GE Silicones; Sanitary SCS 1700.
      4) Pecora Corporation, as applicable.
      5) Sika Corporation, Inc., as applicable.
      6) Tremco, as applicable.
      7) Comparable product.

M. Latex Sealant:
1. Non-elastomeric, one-part, non-sag, paintable latex sealant that is recommended for exposed applications on the interior. Complying with ASTM C834, Type OP (opaque sealants):
   a. Products are subject to compliance with requirements; provide one of the following:
      1) BASF; Sonolastic Sonolac.

2) Pecora Corporation; AC-20 + Silicone.
3) Sika Corporation, Inc., as applicable.
4) Tremco, as applicable.
5) Comparable product.

N. Acoustical Joint Sealant:
1. Non-sag, paintable, non-staining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90:
   a. Products are subject to compliance with requirements; provide one of the following:
      1) BASF, as applicable.
      2) Pecora Corporation; AC-20 FTR or AIS-919.
      3) Sika Corporation, Inc., as applicable.
      4) Tremco, as applicable.
      5) USG Corporation; SHEETROCK Acoustical Sealant.
      6) Comparable product.

O. Sealant Backing:
1. Provide sealant backings that are non-staining, compatible with joint substrates, sealants, primers, and joint fillers, and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing:
   a. Cylindrical sealant backings: Preformed, compressible, resilient, non-staining, non-waxing, non-extruding backings of flexible plastic foam complying with ASTM C1330, and of type indicated below. Select shape and density of cylindrical sealant backings in consultation with the manufacturer for proper performance in specific condition of use in each case.
   b. Type C - closed cell polyethylene foam material with surface skin, nonabsorbent to liquid water and gas, non-outgassing in unruptured state; provide one of the following:
      1) BASF, as applicable.
      2) HBR Closed Cell Backer Rod; Nomaco, Inc.
      3) Pecora Corporation, as applicable.
      4) Sonolastic Closed-Cell Backer-Rod; BASF Construction Chemicals.
      5) Tremco, as applicable.
      6) Comparable product.

P. Window Glazing:
1. Product Description: Ready to use glazing compound that may be used for face glazing wood or metal sash on existing windows. It is a knife-grade consistency allows for smooth, easy applications. Stick tightly to glass and sash and resists sagging, shrinking and cracking. Follow manufacturers suggested uses.
2. This product is NOT to be used on plastic windowpanes, porcelainized steel insulating panels or any insulated glass units with organic seals, stained or leaded glass. Any window pain over 48 inches in any direction.
3. Listed manufacturer:
   a. Dap 33 Glazing compound.
   b. Approved equal.

Q. Miscellaneous Materials:
1. Primer: Material recommended, as verified through compatibility and adhesion testing, by joint sealant manufacturer for the substrates indicated to be sealed.
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 with joint substrates.

3. Masking tape: Non-staining, non-absorbent material compatible with joint sealants and that will not stain nor mar the finish of surface adjacent to joints to which it is applied.
4. Cork joint filler: Resilient and non-extruding, ASTM D1752, Type II.
5. Bond breaker tape: Polyethylene, TFE fluorocarbon, or plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations:
   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 degrees F (4.4 degrees C).
      b. When joint substrates are wet. Should joints or backing materials become wet, remove and replace backing material with new.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

3.2 EXAMINATION

A. Examine joints indicated to receive joint sealants for compliance with requirements for joint configuration, installation tolerances, and conditions affecting sealant performance. Proceed with installation after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Surface Cleaning of Joints:
   1. Clean out joints immediately before installing joint sealants to comply with the recommendations of joint sealant manufacturer and requirements:
      a. Remove foreign material from joint substrates interfering with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), existing joint sealants, oil, grease, water, surface dirt, and frost.
      b. Clean concrete, masonry, unglazed surfaces of tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil free compressed air.
      c. Remove laitance and form-release agents from concrete.
      d. Clean metal, glass, porcelain enamel, glazed surfaces of tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming (Elastomeric Sealants Only): Prime joint substrates where recommended in writing by joint sealant manufacturer, based on prior testing and experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.4 INSTALLATION

A. Silicone Glazing Sealants: Refer to Section 08 80 00: Glazing.

B. Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

C. Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants applicable to materials, applications, and conditions indicated.

D. Sealant Backings:
1. Install sealant backings to support sealants during application and at position necessary 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. Trim for tight fit around obstructions or elements penetrating the joint.
    b. Do not stretch, twist, puncture, or tear sealant backings.
    c. Remove absorbent sealant backings that become wet before sealant application and replace with dry sealant backings.
    d. Install bond breaker tape behind sealants where backings are not used between sealants and back of joints.

E. Weeps and Vents: Install weeps and vents into joints at the same time sealants are being installed. Locate weeps and vents spaced recommended by sealant manufacturer and the window and curtain wall fabricator and erector. Do not install weeps and vents at outside building corners. Do not install vents at horizontal joints immediately below shelf angles, sills, and through wall flashings.

F. Sealants:
1. Install sealants by proven techniques resulting in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at same time sealant backings are installed:
    a. Apply sealants in depth in accordance with manufacturer's recommendations and recommended general proportions and limitations.
    b. Apply elastomeric sealants, in joints not subject to traffic or abrasion, to a depth equal to 50 percent of the joint width, but not less than 1/4 inch (6 mm) and not more than 1/2 inch (13 mm).
    c. Apply non-elastomeric sealants to a depth approximately equal to the joint width.

G. Tooling of Non-Sag Sealants:
1. Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform, beads to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces. Tool exposed surfaces of sealants to the profile shown, or if none is shown, tool slightly concave:
    a. Use masking tape to protect adjacent surfaces of recessed tooled joints.
    b. Provide a slight wash on horizontal joints where horizontal and vertical surfaces meet.

c. Against rough surfaces or in joints of uneven widths avoid the appearance of excess sealant or compound by locating the compound or sealant well back into joint wherever possible.

H. Installation of Preformed Silicone Sealant System:
1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. 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.
3. 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.
4. 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.

I. 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.

J. 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 C919 and with manufacturer written recommendations.

3.5 FIELD QUALITY CONTROL

A. Field Adhesion Testing:
1. Field test exterior wall joint sealant adhesion to joint substrates:
   a. Extent of testing - test completed and cured sealant joints:
      1) Perform ten (10) tests for the first 1,000 feet (300 m) of joint length for each kind of sealant and joint substrate.
      2) Perform one (1) test for each 1,000 feet (300 m) of joint length thereafter or one (1) test per each floor per elevation.
2. Test method: Test joint sealants according to Method A, Field Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521. 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.
3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. 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 field adhesion hand pull test criteria.
4. 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.
5. Repair sealants pulled from test area by applying new sealants following same

procedures used originally to seal joints. Ensure original sealant surfaces are clean and new sealant contacts original sealant.

B. Evaluation of Field Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with 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.

3.6 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality: Provide temporary ventilation during work. Coordinate interior application of sealants with interior finishes schedule.

3.7 CLEANING AND PROTECTION

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

B. Protect joint sealants during and after curing from contact with contaminating substances and from damage so sealants are without deterioration or damage at time of Substantial Completion. If, despite protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 07 92 00

SECTION 07 95 00 EXPANSION CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Expansion joint cover assemblies.
   2. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 05 50 00: Metal Fabrications
   2. Section 07 62 00: Sheet Metal Flashing and Trim.
   3. Section 09 21 16: Gypsum Board Assemblies.
   4. Section 09 24 00: Cement Plastering.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of product including construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

B. Shop Drawings:
   1. Submit for each expansion joint cover assembly:
      a. Include plans, elevations, sections, details, splices, block out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
      b. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Expansion Joint Cover Assembly Schedule:
   1. Prepared by or under the supervision of the supplier. Include the following information in tabular form:
      a. Manufacturer and model number for each expansion joint cover assembly.
      b. Expansion joint cover assembly location cross-referenced to Drawings.
      c. Nominal, minimum, and maximum joint width.
      d. Movement direction.
      e. Materials, colors, and finishes.
      f. Product options.
      g. Fire resistance ratings.

D. Product Test Reports: For each fire resistance rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 PERFORMANCE REQUIREMENTS

A. Expansion Joint Design Criteria:
   1. Type of movement: Thermal and wind sway.
   2. Refer to Drawings for placement in wall types and location of expansion joints.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire resistance ratings:
      a. Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency:
         1) Hose stream test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate. Apply protective coating on aluminum surfaces in contact with cementitious materials.

B. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

D. Moisture Barrier: Flexible elastomeric material. Continuous, waterproof membrane within joint and attached to substrate on sides of joint. Provide where indicated on Drawings.

E. Nonmetallic, Shrinkage Resistant Grout: ASTM C1107/C1107M, factory packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

F. Fasteners: Recommended attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.2 FLOOR EXPANSION JOINT COVERS

A. Metal Plate Floor Joint Cover:
   1. Metal cover plate fixed on one side of joint gap and free to slide on other:
      a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
         1) Architectural Art Manufacturing Inc. (basis of design), a division of Pittcon Architectural Metals, LLC.
         2) Construction Specialties, Inc.
         3) InPro Corporation (IPC).
         4) MM Systems Corporation.
         5) Watson Bowman Acme Corp.
         6) Balco.
      b. Application: Floor to wall.
      c. Installation: Surface mounted.
      d. Load capacity:
         1) Uniform load: 50 lb/sq. ft. (244 kg/sq. m).
         2) Concentrated load: 300 lb (136 kg).
         3) Maximum deflection: 0.0625 inch (1.6 mm).

e. Fire resistance rating: Not less than indicated on Drawings and adjacent construction.
f. Cover plate design: Plain.
g. Exposed metal: Aluminum, clear anodic, Class I.

B. Elastomeric Seal Floor Joint Cover:
1. Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.
a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
1) Architectural Art Manufacturing Inc.
2) Construction Specialties, Inc.
3) EMSEAL Joint Systems, Ltd.
4) InPro Corporation (IPC).
5) MM Systems Corporation.
6) Watson Bowman Acme Corp.
7) Balco.
b. Application: Floor to floor.
c. Installation: Indicated on Drawings.
d. Load capacity:
1) Uniform load: 50 lb/sq. ft. (244 kg/sq. m).
2) Concentrated load: 300 lb (136 kg).
3) Maximum deflection: 0.0625 inch (1.6 mm).
e. Fire resistance rating: Not less than that indicated on Drawings and adjacent construction.
f. Exposed metal: Aluminum, clear anodic, Class I.
g. Seal: Preformed elastomeric membrane or extrusion.

2.3 WALL EXPANSION JOINT COVERS

A. Metal Plate Wall Joint Cover:
1. Metal cover plate fixed on one side of joint gap and free to slide on other:
a. Manufacturers are subject to compliance with requirements, provide products by one of the following:
1) Architectural Art Manufacturing Inc., a division of Pittcon Architectural Metals, LLC.
2) Construction Specialties, Inc.
3) InPro Corporation (IPC).
4) MM Systems Corporation.
5) Watson Bowman Acme Corp.
6) Balco.
b. Application: Wall to wall.
c. Fire resistance rating: Not less than indicated on Drawings and adjacent construction.
d. Exposed metal: Aluminum, clear anodic, Class I.

2.4 CEILING EXPANSION JOINT COVERS

A. Metal Plate Ceiling Joint Cover:
1. Metal cover plate fixed on one side of joint gap and free to slide on other:
a. Manufacturers are subject to compliance with requirements, provide products by one of the following:
1) Architectural Art Manufacturing Inc.
2) Construction Specialties, Inc.
3) InPro Corporation (IPC).
4) MM Systems Corporation.
5) Balco.

b. Application: Wall to ceiling.
c. Fire resistance rating: Not less than indicated on Drawings and adjacent construction.
d. Exposed metal: Aluminum, Clear anodic, Class I.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

C. Furnish units in longest practicable lengths to minimize field splicing.

D. Include factory fabricated closure materials and transition pieces, T joints, corners, curbs, cross connections, and other accessories as required to provide continuous expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames:
1. Perform cutting, drilling, and fitting required to install expansion joint cover assemblies:
   a. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage resistant grout.
   b. Install frames in continuous contact with adjacent surfaces.
   c. Shimming is not permitted.
   d. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   e. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
   f. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.

g. Locate anchors at interval recommended by manufacturer, but not less than three inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

C. Seals:
1. Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints:
a. Provide in continuous lengths for straight sections.
b. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
c. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure sensitive tape as recommended by manufacturer.

D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Terminate exposed ends of expansion joint cover assemblies with field or factory fabricated termination devices.

F. Fire Resistance Rated Assemblies:
1. Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements:
a. Fire barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

G. Moisture Barrier Drainage: If indicated, provide drainage fittings and connect to drains.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 07 95 00

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide items shown on the Drawings and specified, including, but not limited to the following:
   1. Standard and fire rated steel doors.
   2. Steel frames for doors, sidelites, transoms, and windows.
   3. Louvers and vision lites in steel doors, if shown or required.
   4. Sound rated steel doors.
   5. Thermally rated steel doors.

B. Related Sections:
   1. Section 05 40 00: Cold-Formed Metal Framing.
   2. Section 07 92 00: Joint Sealants.
   3. Section 08 80 00: Glazing.
   4. Section 09 21 16: Gypsum Board Assemblies.
   5. Section 09 24 00: Cement Plastering.
   6. Section 09 90 00: Painting and Coating.

C. Reference Standards:
   1. ASTM International (ASTM):
      a. A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      b. A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
      c. A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
      d. A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
      e. C1363 Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
      f. E283 Standard Test Method for Determining the rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
      g. E413 Standard Classification for Rating Sound Insulation.
   2. Hollow Metal Manufacturers Association (HMMA):
      a. HMMA 802 Manufacturing of Hollow Metal Doors and Frames.
      b. HMMA 810 Hollow Metal Doors.
      c. HMMA 830 Hardware Preparation and Locations for Hollow Metal Doors and Frames.
      d. HMMA 840 Installation and Storage of Hollow Metal Doors and Frames.
      e. HMMA 850 Fire Rated Hollow Metal Doors & Frames.
      f. HMMA 890 Technical Summary of Hollow Metal by HMMA.
   3. National Fire Protection Association (NFPA):
      a. 80 Fire Doors and Fire Windows.
      b. 252 Fire Tests of Door Assemblies.

4. Steel Door Institute – Current Standards: Technical Data Series.
5. Underwriters Laboratories Inc. (UL):
   a. Building Materials Directory.
   b. Listing and Labeling.
   c. 10B and 10C Fire Tests of Door Assemblies.
   d. 1784 Air Leakage Tests of Door Assemblies.
6. Intertek Testing, Services (Warnock Hersey, Inc. (WHI): Listing and Labeling.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's standard details and catalog data demonstrating compliance with specifications and referenced standards.
   2. Manufacturer's installation instructions.

B. Shop Drawings:
   1. Indicate complete schedule in detail for each steel door and frame using the same reference number for details and openings as those on the contract Drawings. If any door is not by the steel door manufacturer, only the door opening number should be shown along with the type of door (wood, plastic laminate faced, etc.):
      a. Show details of construction, installation, connections, anchors, hardware reinforcement, hardware preparation, louvers, and floor and threshold clearances.

C. Samples are required from non-Steel Door Institute members:
   1. 12-inch by 12-inch sample of a fire-rated and non-rated door, cut from corner of door, showing door construction.
   2. 12-inch by 12-inch sample of each type of door louver specified or required, showing louver construction.
   3. Six-inch (6”) long sample of a fire-rated, non-rated frame, and each type of glass stop specified or required, showing corner and construction.

D. Certificates: Manufacturer’s certification that oversized openings are in compliance with specifications.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: If other than a manufacturer listed under Paragraph 2.1 is proposed for use on the Project, it shall be a company specializing in the manufacturer of steel doors and frames of the type specified for this Project with a minimum of five (5) years’ experience.

B. All steel doors and frames shall be by a single manufacturer, shop drawings to be submitted with manufacturer’s insignia, which is being supplied.

C. Furnish steel doors and frames to meet current ANSI/Steel Door Standards.

D. ANSI A250.13 Testing and Rating of Sever Windstorm Resistant Components for Swing Door Assemblies.

E. ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

F. Comply with ASTM E283 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

G. Regulatory Requirements:
   1. Fire-Rated Assemblies:
      a. Fire-rated door, panel, frame, and fire window construction shall conform to NFPA 252, or UL 10B, as applicable, and acceptable to the code of authorities having jurisdiction.
      b. Fire-rated door construction:
         1) Notwithstanding any other requirements of this Section, provide gauge of metal, method of construction, hardware preparation, reinforcement, and placement, glass opening size, and other specifics required to obtain the specified or required label. The label shall contain the fire resistance rating (20-minute, 45-minute, 1-hour, 1-1/2-hour, 3-hour, etc.) and the designation (A, B, C, D, or E); doors with B Label shall be 1-1/2 hour.
         2) Fire-rated doors used in a stairway enclosure, shall be so constructed so that the maximum transmitted temperature shall not exceed 450 degrees F above ambient temperature at the end of 30 minutes of the Standard Fire Exposure Test and shall be so noted on the label.
      c. Fire-rated openings:
         1) Conform to NFPA 80 for fire-rated class shown or required by code of authorities having jurisdiction:
            a) Units shall be identical to assemblies whose fire resistance characteristics have been determined in accordance with requirements specified above, and shall be labeled and listed by UL, WHI, or other inspection and testing agency acceptable to the code of authorities having jurisdiction.
            b) Fire-rated steel doors, panels, frames, and fire windows shall bear permanent labels attesting to fire resistance. At stairway enclosures, provide units listed for 450 degree F maximum temperature rise rating for 30 minutes of exposure.
            c) Oversized openings shall be constructed in accordance with all applicable requirements for labeled door construction.
            d) Fire rated door assemblies with gaps in excess of 1/8 inch between door and frame will not comply with NFPA 80.
            e) Locate label on hinge side of doors and frames so that when door is closed, label is not visible.
            f) Caution shall be taken to ensure that labels are not removed, damaged, or painted over.
            g) Glass panes shall not exceed sizes allowed whether indicated or not on the Drawings.

H. Wind Loads: Provide hollow metal and door hardware assemblies approved by DSA, including anchorage, capable of withstanding wind load design pressures that are calculated for this Project by a registered Architect or Engineer and is part of the construction documents per CBC.

I. Hurricane-Resistance Test Performance:
   1. Provide hollow metal and door hardware approved assemblies that pass large missile-impact tests, as required by authorities having jurisdiction:
      a. Impact resistance: Hollow metal with approved door hardware assemblies must satisfy Division of the State Architect and CBC for protection from windborne debris. The assemblies must have passed the large missile impact test, which equates to Missile Level D specified in ASTM E1996. The assemblies may be installed at any height on the structure as long as the design pressure rating for the assemblies is not exceeded. These assemblies will and do not need to be protected with an impact protective system when installed in areas where windborne debris protection is required.

J. Accessibility Requirements:
1. Comply with applicable requirements:
   a. Americans with Disability Act of 1990, as amended: 2010 ADA Standards.
   b. CBC 2019 California Building Code. CCR Title 24, Part 2, as adopted and amended by DSA.

K. Pre-Installation Conference: Refer to Section 01 31 00: Project Management and Coordination.

1.5 WARRANTY

A. Warrant the work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship.

B. Defects shall include, but not be limited to:
1. Use of incorrect materials in opening.
2. Incorrect labeled components installed within opening.
3. Noisy, rough, or difficult operation.
4. Failure to meet specified quality assurance requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in accordance with manufacturer's instructions, and as follows:
1. In manufacturer's original, clearly labeled, undamaged containers or wrappers.
2. Containers or wrappers shall list the name of the manufacturer and product.

B. Deliver materials to allow for minimum storage time at the Project site. Coordinate delivery with the scheduled time of installation.

C. Protect products from moisture, construction traffic, and damage:
1. Store under cover in a clean, dry place, protected from weather and abuse.
2. Store in a manner that will prevent rust or damage.
3. Store doors in a vertical position, spaced with blocking to permit air circulation.
4. Do not use non-vented plastic or canvas shelters.
5. Should containers or wrappers become wet, remove immediately.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Manufacturers listed below whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must comply with Manufacturer Qualifications, must manufacture equivalent products to those specified, and comply with requirements of Section 01 25 00: Substitution Procedures and Form, regarding substitutions to be considered:
1. CECO Door Products, Brentwood, TN; (615) 661-5030.
2. Curries Company, Mason City, IA; (515) 423-1334.
3. Pioneer Industries, Inc., Kewanee, IL; (309) 856-6000.
4. Republic Builders Products Company, McKenzie, TN; (800) 733-3667.
5. Steelcraft Mfg. Co., Cincinnati, OH; (513) 745-6400.
6. Approved equal.

2.2 MATERIALS, GENERAL

A. Steel requirements, all frames to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM A1008 general requirements. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM A1011. Exterior frames and interior frames where shown on Drawings or required in damp, moist, humid, and wet areas, i.e., toilets, locker rooms, showers, etc., to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel and galvannealed to A-60 minimum coating weight standard per ASTM A653 and A924, with coating weight of not less than 0.60 ounce per square foot (0.30 ounce per square foot per side).

2.3 FRAME FABRICATION

A. Minimum Gauges:
   1. Interior openings:
      a. Less than four feet (4') width: 16 gauge.
      b. Four feet (4') in width and greater: 14 gauge.
   2. Exterior openings: 14 gauge

B. Design and Construction:
   1. Frames shall be custom made, welded units with integral trim of sizes and shapes shown on approved shop drawings. Hinge jambs that butt adjacent 90-degree walls shall have at least four-inch (4") wide frame face to assure the door trim will not strike the wall prior to the door opening at least 90 degrees. Frame profile shall match wall thickness where practical, i.e., 4-3/4-inch at four-inch (4") CMU, 6-3/4-inch at six-inch (6") CMU, and 8-3/4-inch at eight-inch (8") CMU. At masonry wall openings, fabricate frames to suite masonry opening with two-inch (2") head member.
   2. Frames shall be strong and rigid, neat in appearance, square, true, and free of defects, warp, and buckle. Molded members shall be clean cut, straight, and of uniform profile throughout their length.
   3. Jamb depths, trim, profile, and backbends shall be as shown on approved shop drawings.
   4. Corner joints, including face and inside corners, shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops butted. The use of gussets shall not be permitted. Face of frame shall be ground smooth. Knockdown (KD) frames are not permitted.
   5. Minimum depth of stops shall be 5/8 inch, except at fire windows where minimum depth of stops shall be 3/4 inch.
   6. Frames for multiple openings shall have mullion and rail members that are closed tubular shapes having no visible seams or joints. Joints between faces of abutting members shall be securely welded and finished smooth. Mullions shall be key locked removable type. Keys shall be master keyed to Owner's Best system.
   7. High frequency hinge reinforcement: Provide high frequency hinge reinforcements at door openings 48-inch and wider with mortise/butt type hinges only at top hinge location to deter against hinge reinforcement sag.
   8. Continuous hinge reinforcement: Provide welded continuous 12-gage strap for continuous hinges specified in hardware sets in Division 08 Openings.
   9. Provide countersunk flat or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops; provide security head screws at exterior locations.
   10. Provide A60 galvannealed coating at frames in restrooms and locker rooms with showers/Jacuzzi, clean areas such as kitchen rooms.
   11. Electrical knock out boxes:
      a. Factory weld 18-gage electrical knock out boxes to frame for electrical hardware preps; included but not limited to electric thru wire hinges, electrical raceways, door position switches, electric strikes, jamb mount card readers, and magnetic licks as noted in door hardware sets in Division 08 Openings:
         1) Electrical knock out boxes are required at door position switches, electric

strikes, card readers, and middle hinge locations.
2) Provide electrical knock out boxes with 3/4-inch knockouts.
3) Conduit to be coordinated and installed in field from middle hinge box and strike box to door position box.
4) Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Openings.
5) Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
6) Provide field installed conduit per Division 28: Electronic Safety & Security Section for standardized plug connectors to accommodate up to twelve (12) wires as required for electrified door hardware specified in hardware sets in Division 08 Openings. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.

12. Hardware reinforcements:
    a. Frames shall be mortised, reinforced, drilled, and tapped at factory for fully template mortised hardware in accordance with approved hardware schedule and templates provided by Section 08 71 00: Door Hardware. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only.
    b. Minimum thickness of hardware reinforcing plates shall be as follows:
        1) Hinge and pivot reinforcements (1-1/4-inch x 10-inch minimum size): Seven (7) gauge.
        2) Strike reinforcements: 12-gauge stiffeners.
        3) Flush bolt reinforcements: 12-gauge.
        4) Closer reinforcements: 12-gauge.
        5) Reinforcements for surface-mounted hardware, hold-open arms, and surface panic devices: 12-gauge.
13. Floor anchors: Minimum 14-gauge, securely welded inside each jamb, with holes for floor anchorage.
14. Jamb anchors:
    a. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the T-strap type. Anchors shall be not less than 16-gauge steel. The number of anchors provided at each jamb shall be as follows:
        1) Frames up to seven-feet-six-inches (7’-6”) in height: Three (3) anchors.
        2) Frames seven-feet-six-inches (7’-6”) to eight feet (8’) in height: Four (4) anchors.
        3) Frames over eight feet (8’) in height: One (1) anchor for each two feet (2’) or fraction thereof in height.
    b. Frames for installation in wood or metal stud partitions shall be provided with steel anchors of suitable approved design, not less than 16-gauge thickness, securely welded inside each jamb as follows:
        1) Frames up to seven feet six inches (7’-6”) in height: Four (4) anchors.
        2) Frames seven feet six inches (7’-6”) to eight feet (8’) in height: Five (5) anchors.
        3) Frames over eight feet (8’) in height: Four (4) anchors plus one (1) additional for each two feet (2’) or fraction thereof over eight feet (8’).
    c. Frames to be anchored to previously placed concrete, masonry, or structural steel shall be provided with anchors of suitable design as shown on approved shop drawings.
15. Dust cover boxes: Shall be of not less than 26-gauge steel and shall be provided at all mortised hardware items. Eight-inch (8”) CMU walls with face brick shall have dual offset jamb anchors.
16. Steel spreader: Shall be provided on all frames, temporarily attached to bottoms of both jambs for bracing during shipping and handling.
17. Loose glazing stops: Shall be of cold rolled steel, not less than 20 gauge, butted at

corner joints and secured to the frame with countersunk cadmium or zinc-plated screws. Loose stops at exterior frames shall be placed on the interior side of the frames.

18. At sound rated door openings and at masonry openings, coat inside of frame profile with corrosion resistant coating to minimum thickness of 1/16 inch.

C. Frame Color: Field painted under Section 09 90 00: Painting and Coating to match face of door.

2.4 DOOR FABRICATION

A. Minimum Gauges:
1. Interior doors: 0.047 inch or 18 gauge (16 gauge for high frequency doors).
3. Exterior doors: 0.059 inch or 16 gauge (14 gauge for windstorm rated doors).

B. Design and Construction:
1. Types: Doors shall be custom fabricated, of types and sizes shown on approved shop drawings, and shall be seamless face construction with no visible seams or joints on vertical edges with fully welded seams free from blemishes and defects. Thickness shall be 1-3/4 inch, unless specifically noted or shown otherwise.
4. Exterior doors: Provide doors with 22-gage steel z-channels placed at six inches (6”) apart with foamed in place polyurethane core, with a thermal insulation calculated R factor of 11.01 per ASTM C518 Standards.
5. Fabrication:
   a. Doors shall be strong, rigid, and neat in appearance, free from warpage and buckle.
   b. Corner bends shall be true and straight and of minimum radius for gage of metal used.
   c. Provide stiffeners with polystyrene core spaced maximum six inches (6”) on center and extending full height of door.
   d. Fill interior with noncombustible fiberglass insulation. Use mineral board filler as required for labeled doors.
   e. Faces shall be joined at vertical edges of door by a continuous weld extending full height of door. Welds shall be ground, filled, and dressed smooth to provide a smooth flush surface.
   f. Top and bottom edges of doors shall be closed with a continuous recessed steel channel not less than 16 gauge, extending full width of door and spot weld to both faces. Exterior doors shall have an additional flush closing channel at top and bottom edges. Openings shall be provided in the bottom closure channel at top and bottom edges. Openings shall be provided in the bottom closure of exterior doors to permit the escape of entrapped moisture.
   g. Continuous hinge reinforcement: Provide welded continuous 12-gage strap for continuous hinges specified in hardware sets in Division 08: Openings.
   h. Electrical raceways: Provide raceways for standardized plug connectors to accommodate up to 12 wires as required for electrified door hardware specified in hardware sets in Division 08: Openings. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.
   i. Doors in wet or humid areas shall have a top cap and solid foam interior core to prevent internal moisture accumulation and galvannealed.
   j. Edge profile shall be provided on both vertical edges of door as follows:
      1) Single-acting swing doors: Beveled 1/8 inch in two inches (2”).
   k. Hardware reinforcements:
      1) Doors shall be mortised, reinforced, drilled, and tapped at factory for fully template hardware, in accordance with the approved hardware schedule and templates provided by Section 08 71 00: Door Hardware. Where surface-

mounted hardware is to be applied, doors shall have reinforcing plates only.
2) Minimum gauges for hardware reinforcing plates shall be as follows:
a) Hinge and pivot reinforcements: Seven (7) gauge.
b) Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge.

6. Glass moldings and stops: Loose stops shall be not less than 20-gauge steel, with butt corner joints, secured to frame opening by countersunk screws. Snap-on attachments will not be acceptable.
7. Louvers: Shall be inverted "V" blade, sight-proof type, unless noted otherwise.
8. Edge clearances:
a. Between door and frame at head and jambs: 1/8 inch.
b. At doorsills with no threshold: 5/8-inch to 3/4-inch above finished floor.
c. At doorsills with threshold: As required to suit threshold.
d. Between meeting edges of double doors: 1/8 inch.

C. Finish:
1. Shop paint steel (whether galvanized or ungalvanized) stops and accessories as follows:
a. Clean surfaces free of mill scale, rust, oil, grease, dirt, and other foreign matter.
b. Chemically treat surfaces and apply one (1) coat of an approved baked-on rust-inhibitive primer paint to provide a minimum 0.5 mil dry film thickness.
2. Field painted under Section 09 90 00: Painting and Coating.

D. Sound Rated Door: STC of 32, measured in accordance with ASTM E413.

E. Thermal Insulated Door: Total insulation R-Value of 44 measured in accordance with ASTM C1363, unless otherwise noted on Drawings.

2.5 LABELED DOORS AND FRAMES

A. Labeled doors and frames shall be provided for openings requiring fire protection ratings as scheduled and to comply with NFPA 80. Such doors and frames shall be constructed as tested and approved by UL, WHI, or other nationally recognized testing agency having a factory inspection service and approved by code authorities having jurisdiction and shall bear the appropriate permanent label.

B. If any door or frame scheduled to be fire-rated cannot qualify for appropriate labeling because of its size, design, hardware, or other reason, the Architect shall be so advised before fabrication work on that item is started. Indicate and highlight on shop drawing.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate the work of this Section.

B. Coordinate hardware installation with opening construction. Finish hardware is specified in Section 08 71 00: Door Hardware.

C. Coordinate doors, frames, and windows with glazing specified in Section 08 80 00: Glazing.

D. Coordinate doors and frames with painting specified in Section 09 90 00: Painting and Coating.

3.2 INSTALLATION

A. Separate dissimilar metals. Protect against galvanic action.

B. Frames:
1. Anchorage and connections: Secure to adjacent construction. Where practical, interior door frames shall be flush with the pull side wall to minimize or eliminate the reveal and allow full 180-degree door swing.
2. Install frames in accordance with manufacturer's instructions and install labeled frames in accordance with NFPA 80.
3. Frame spreader bars: Leave intact until frames are set perfectly square and plumb and anchors are securely attached.
4. Remove hardware, with the exception of prime-coated items, tag box, and reinstall after finish paint work is completed. Do not remove or paint over labels on labeled frames.

C. Doors:
1. Install hardware in accordance with hardware manufacturer's templates and instructions.
2. Install doors in accordance with manufacturer's instructions and install labeled doors in accordance with NFPA 80.
3. Adjust operable parts for correct function.
4. Remove hardware, with the exception of prime-coated items, tag, box, and reinstall after finish paint Work is completed. Do not remove or paint over labels on labeled doors.

3.3 ADJUST AND CLEAN

A. Adjust doors for proper operation, free from binding or other defects.

B. Clean and restore soiled surfaces.

C. Remove scraps and debris, and leave site in clean condition.

END OF SECTION 08 11 13

SECTION 08 14 16 FLUSH WOOD DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. WI Certified, fire-rated and non-rated, flush panel wood doors.
2. Solid core doors with MDF and plastic laminate faces.
3. Integration of a security system.
4. Factory fitting flush wood doors to frames and factory machining for hardware.
5. Accessories necessary for a complete installation.

B. Related Sections:
1. Section 05 50 00: Metal Fabrications.
2. Section 07 92 00: Joint Sealants.
3. Section 08 11 13: Hollow Metal Doors and Frames.
4. Section 08 80 00: Glazing.
5. Section 09 21 16: Gypsum Board Assemblies.
6. Section 09 24 00: Cement Plastering.

1.3 SUBMITTALS

A. Product Data:
1. Technical data for each type of door indicated:
a. Include details of core and edge construction, louvers, and trim for openings.
b. Include factory finishing specifications.
c. Include laboratory test report results of hinge loading, cycle/slam, stile edge screw withdrawals, and stile edge split resistance for fire rated doors.

B. Shop Drawings:
1. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
a. Dimensions and locations of blocking.
b. Dimensions and locations of mortises and holes for hardware.
c. Dimensions and locations of cutouts.
d. Undercuts.
e. Requirements for veneer matching.
f. Doors to be factory finished and finish requirements.
g. Fire-protection ratings for fire rated doors.

C. Certificate of Compliance for Fire Rated Doors: Provide copies of Certificate of Compliance for fire rated door assemblies and smoke and draft control door assemblies.

D. Certificate of Compliance regarding WI construction grade.

E. Certificate of Compliance regarding WI installation requirements.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire rated wood doors - NFPA 80 listed and labeled by UL for fire protection ratings indicated, based on testing at positive pressure according to UL 10C:
      a. Oversize fire rated door assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
      b. Temperature rise limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 degrees F (250 degrees C) above ambient after 30 minutes of standard fire-test exposure.
   2. Smoke and draft control door assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
   3. Accessibility requirements - comply with applicable requirements:
      a. Americans with Disabilities Act of 1990, as amended:
         1) ADA Title II Regulations & the 2016 ADA Standards for Accessible Design.
      b. CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA:
         2) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
   4. Quality standard: In addition to requirements specified, comply with Woodwork Institute WI Manual of Millwork
   5. Maintain at least one copy of WI Manual for reference at jobsite throughout installation period.

B. Source Limitations: Obtain flush wood doors through one (1) source from a single manufacturer.

C. Pre-Installation Conference: Conduct conference at site.

1.5 WARRANTY

A. Warranty:
   1. Written warranty signed by manufacturer, installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship. A representative of the door manufacturer shall inspect the installed doors and shall note on the warranty that no provisions of the warranty have been nullified in the manufacture and/or installation:
      a. Failures include, but are not limited to, the following:
         1) Warping (bow, cup, or twist) more than 1/4-inch (6.4 mm) in a 42-inch by 84-inch (1,067 mm by 2,134 mm) section.
         2) Telegraphing of core construction in face veneers exceeding 0.01-inch in a three-inch (0.25 mm in a 76.2 mm) span.
      b. Warranty include installation and finishing that may be required due to repair or replacement of defective doors.
      c. Warranty period for solid core exterior doors: Five (5) years from date of Substantial Completion.
      d. Warranty period for solid core interior doors: Life of installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Store wood doors on a flat level surface in a dry, well ventilated, place. Keep wood doors a minimum of 3-1/2 inches (85 mm) off floor surface and protected by a protective covering under the bottom door and over the top door. Covering should protect wood doors from dirt, water, and abuse but allow for air circulation under and around the

stack. Do not store wood doors in direct sunlight. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in heavy duty cardboard cartons prior to shipment from factory. Mark each door on top and bottom rail with opening number used on shop drawings using temporary, removable, or concealed markings.

C. Handle wood doors with clean gloves. Lift and carry wood doors when moving them around the site; do not drag wood doors across one another.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers are subject to compliance with requirements; provide flush wood door products by one of the following:
1. Haley Brothers, Inc.
2. Oshkosh Door Company.
3. Oregon Door.
4. Weyerhaeuser.
5. Approved equal.

B. Manufacturers are subject to compliance with requirements; provide high pressure laminate products by one of the following:
1. Formica Corp.
2. Panolam Surface Systems.
3. Wilsonart LLC.
4. Approved equal.

C. Fire Rated Wood Doors - Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C:
1. Cores: Provide core specified or mineral core as necessary to provide fire protection rating indicated.
2. Edge construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
3. Pairs: Provide fire retardant stiles listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
4. Pairs:
    a. Provide formed steel edges and astragals with intumescent seals:
        1) Finish steel edges and astragals with baked enamel same color as doors.
        2) Finish steel edges and astragals to match door hardware (locksets or exit devices).

D. Smoke and Draft Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

E. Particleboard Core Doors:
1. Blocking:
    a. Provide wood blocking in particleboard core doors as necessary to eliminate through-bolting hardware:
        1) Five-inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
        2) Five-inch (125 mm) bottom rail blocking, in exterior doors and doors

indicated to have protection plates.
3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
4) 4-1/2-inch by ten-inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.

2. Provide doors with glued wood stave or structural composite lumber cores instead of particleboard cores for doors indicated to receive exit devices.

F. Fire Rated Wood Doors with Plastic Laminate Face - Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C:
1. Core: Noncombustible mineral product complying with requirements and testing and inspecting agency for fire protection rating indicated.
2. Blocking:
a. Provide composite blocking with improved screw-holding capability approved for use in doors of fire protection ratings indicated as follows:
1) Five-inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
2) Five-inch (125 mm) bottom rail blocking, in doors indicated to have protection plates.
3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
4) 4-1/2 inch by 10 inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.
3. Edge Construction:
a. Provide fire rated door edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges:
1) At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance:
a) Screw holding capability: 550 lbf (2440 N) per WDMA T.M.-10.
2) Pairs:
a) Provide fire retardant stiles listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges. Where required, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.
4. Smoke and draft control door assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

2.2 PLASTIC-LAMINATE-FACED DOORS

A. Particleboard Core Doors with Plastic Laminate Face:
1. Grade and construction: WI custom grade, PC-5; 1-3/4 inch unless otherwise indicated.
2. Core - ANSI A208.1, particleboard or MDF, made with binder containing no urea formaldehyde resin: Provide doors with glued block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.
3. Blocking:
a. Provide wood blocking in particleboard core doors necessary to eliminate through bolting hardware:
1) Five-inch (125 mm) top rail blocking. in all doors, whether or not closers are scheduled.
2) Five-inch (125 mm) bottom rail blocking in doors indicated to have protection plates.
3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
4) 4-1/2-inch by ten-inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.

4. Exposed vertical and horizontal edges - impact resistant polymer edging, applied after faces:
   a. Polymer edging color: Match face color.
5. Construction: Five (5) plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press**.**
6. Crossbanding: Minimum 1/16-inch thick, low density hardwood, composite, or high density hardboard.
7. Face: 3-ply AWI PC-HPDL-3 High Pressure Decorative Laminate (HPDL).

2.3 PAINTED DOORS (OPAQUE FINISH)

A. Particleboard Core Doors with Painted Finish:
   1. Grade and construction: AWI custom grade, PC-5; 1-3/4 inch unless otherwise indicated.
   2. Core - ANSI A208.1, particleboard or MDF, made with binder containing no urea formaldehyde resin: Provide doors with glued block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.
   3. Blocking:
      a. Provide wood blocking in particleboard core doors necessary to eliminate through bolting hardware:
         1) Five-inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
         2) Five-inch (125 mm) bottom rail blocking in doors indicated to have protection plates.
         3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
         4) 4-1/2-inch by ten-inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.
   4. Exposed vertical and horizontal edges:
      a. Seal all exposed edges with primer and provide opaque finish.
      b. Color: Match face color and finish unless noted otherwise.
      c. Labels: Mask labels prior to field painting where doors are not delivered with factory finish.
   5. Construction: Five (5) plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press.
   6. Crossbanding: Minimum 1/16-inch thick, low density hardwood, composite, or high density hardboard.
   7. Face: Paint grade medium density overlay (MDO).

2.4 LIGHT FRAMES AND LOUVERS

A. Metal Frames for Light Openings: Manufacturer’s standard frame formed of 0.048-inch (1.2 mm) thick, cold-rolled steel sheet; factory primed for paint.

B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch (1.2 mm) thick, cold-rolled steel sheet; factory primed for paint with baked-enamel or powder-coated finish, and approved for use in doors of fire-protection rating indicated.

C. Metal Louvers:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Air Louvers; a Division of the Activar Construction Products Group.
      b. L & L Louvers.

c. McGill Architectural Products.
d. Approved equal.

2. Blade type: Vision-proof, inverted V.
3. Metal and finish: Hot-dip galvanized steel, 0.040-inch (1.0 mm) thick, factory primed for paint with baked-enamel or powder-coated finish.
4. Metal and finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.

D. Louvers for Fire-Rated Doors - Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Air Louvers; a Division of the Activar Construction Products Group.
b. L & L Louvers, Inc.
c. McGill Architectural Products.
d. Approved equal.
2. Metal and finish: Hot-dip galvanized steel, 0.040-inch (1.0 mm) thick, factory primed for paint with baked-enamel or powder-coated finish.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated:
1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame shop drawings, BHMA-156.115-W, and hardware templates:
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels:
1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles:
a. Fabricate door and transom panels with full-width, solid-lumber**,** rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings:
1. Factory cut and trim openings through doors:
a. Light openings: Trim openings with moldings of material and profile indicated.
b. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00: Glazing.
c. Louvers: Factory install louvers in prepared openings.

E. Exterior Doors:
1. Factory treat exterior doors with water repellent after fabrication has been completed but before shop priming or factory finishing:
a. Flash top of out-swinging doors with manufacturer's standard metal flashing.

2.6 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises

with one (1) coat of wood primer specified in Section 09 90 00: Painting and Coating.

B. Doors for Transparent Finish: Shop prime faces and all four edges with stain (if required), other required pretreatments, and first coat of finish as specified in Section 09 90 00: Painting and Coating. Seal edges of cutouts and mortises with first coat of finish.

2.7 FACTORY FINISHING

A. General – For factory finish doors, factory finish doors that are indicated to receive transparent finish, and factory finish doors where indicated in schedules or on Drawings as factory finished:
   a. Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing:
      1) Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Transparent Finish:
   1. Grade: Premium.
   2. Finish: WI's Architectural Woodwork Standards System 9, UV curable, acrylated epoxy, polyester, or urethane; refer to Drawings for finish designation.
   3. Staining: As selected by Architect from manufacturer's full range.
   4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
   5. Sheen: Semigloss.

C. Opaque Finish:
   1. Grade: Premium.
   2. Finish: AWMAC's and WI's Architectural Woodwork Standards System 10, UV curable, water based; refer to Drawings for finish designation.
   3. Color: As selected by Architect from manufacturer's full range.
   4. Sheen: Semigloss.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

3.2 EXAMINATION

A. Examine doors and installed door frames, with installer present, before hanging doors:
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

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

3.3 INSTALLATION

A. Hardware: For installation, see Section 08 71 00: Door Hardware.

B. Installation Instructions:
   1. Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated:
      a. Install fire-rated doors according to NFPA 80.
      b. Install smoke and draft-control doors according to NFPA 105.

C. Job-Fitted Doors:
   1. Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining:
      a. Clearances:
         1) Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 3/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated:
            a) Comply with NFPA 80 for fire-rated doors.
      b. Bevel non-fire-rated doors 1/8 inch in two inches (2”) - 3-1/2 degrees - at lock and hinge edges.
      c. Bevel fire-rated doors 1/8 inch in two inches (2”) - 3-1/2 degrees- at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 41 13 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Exterior and interior storefront framing.
   2. Exterior and interior manual swing entrance doors.
   3. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 05 12 00: Structural Steel Framing.
   2. Section 05 40 00: Cold-Formed Metal Framing.
   3. Section 05 50 00: Metal Fabrications.
   4. Section 07 62 00: Sheet Metal Flashing and Trim.
   5. Section 07 92 00: Joint Sealants.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of product indicated including construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum framed systems.

B. Shop Drawings:
   1. Submit aluminum storefront framing and entrances shop drawings including plans, elevations, sections, full size details, and attachments to other work:
      a. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
      b. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

D. Engineer’s calculations of performance requirements.

E. Maintenance Data: For aluminum framed systems to include in maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

A. Aluminum framed systems shall withstand the effects of specified performance requirements without exceeding performance criteria or fail due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.

2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:
   a. Deflection exceeding specified limits.
   b. Thermal stresses transferring to building structure.
   c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
   d. Noise or vibration created by wind and by thermal and structural movements.
   e. Loosening or weakening of fasteners, attachments, and other components.
   f. Sealant failure.
   g. Failure of operating units.

B. Structural Loads:
   1. Wind loads: Ultimate wind speed gust 115 mph; exposure D.

C. Deflection of Framing Members:
   1. Deflection normal to wall plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
   2. Deflection parallel to glazing plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

D. Structural Test Performance - Provide aluminum framed systems tested according to ASTM E330 as follows:
   1. When tested at positive and negative wind load design pressures, systems do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test durations: As required by design wind velocity, but not fewer than ten (10) seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft.0.03 L/s per sq. m of fixed wall area when tested according to ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa.)

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa.

G. Windborne Debris Impact Resistance:
   1. Pass missile impact and cyclic pressure tests when tested according to ASTM E1886 and testing information in ASTM E1996 for Wind Zone 4:
      a. Large missile test: For glazed openings located within 30 feet (9.1 m) of grade.

H. Thermal Movements:
   1. Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:
      a. Temperature change (range): 120 degrees F (67 degrees C, ambient; 180 degrees F, 100 degrees C, material surfaces.
      b. Interior ambient-air temperature: 75 degrees F (24 degrees C).

I. Condensation Resistance: Provide aluminum framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

J. Thermal Conductance: Provide aluminum framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x degrees F3.23 W/sq. m x K when tested according to AAMA 1503.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Accessibility requirements:
      a. 2019 California Building Code: Section 11B-404.3 accessible route.
      b. 2019 California Building Code: Section 11B-309.4 operable parts interior usage.
      c. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
      d. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.

B. Installer Qualifications: Installer having minimum ten (10) years' documented experience who is an authorized representative of the manufacturer and is trained and approved for installation of units required.

C. Engineering Responsibility: Prepare data for aluminum framed systems, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated.

D. Product Options:
   1. Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in service performance:
      a. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Source Limitations: Obtain aluminum framed entrances from single source from single manufacturer.

F. Pre-Installation Conference: Conduct conference at site.

1.6 WARRANTY

A. Written warranty signed by manufacturer, Contractor, and installer in which manufacturer agrees to repair or replace components of aluminum framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Water leakage through fixed glazing and framing areas.
      d. Failure of operating components.
   2. Warranty period: Two (2) years from date of Substantial Completion.

B. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace

components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering:

1. Warranty period: Ten (10) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Basis of Design:
   1. **Kawneer Trifab 451/451T** (Product Evaluation CWSF-34), And/or the **Trifab 601/601T**, impact resistant system, maximum design pressure +/- 45 psf. Refer to Drawings for frame size and locations. Subject to compliance with requirements, provide comparable storefront system by one of the following:
      a. Tubelite, Inc.
      b. US Aluminum Corporation.
      c. Vistawall.
      d. YKK America AP, Inc.

B. Aluminum:
   1. Alloy and temper recommended by manufacturer for type of use and finish indicated:
      a. Sheet and plate: ASTM B209ASTM B209M.
      b. Extruded bars, rods, profiles, and tubes: ASTM B221ASTM B221M.
      c. Extruded structural pipe and tubes: ASTM B429.

C. Framing Members:
   1. Extruded aluminum framing members of thickness required and reinforced necessary to support imposed loads:
      a. Construction: Nonthermal/thermal.
      b. Glazing system: Retained mechanically with gaskets on four sides.
      c. Glazing plane: Center.

D. Accessories:
   1. Brackets and reinforcements: High strength aluminum with nonstaining, nonferrous shims for aligning system components.
   2. Fasteners and accessories:
      a. Corrosion resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials:
         1) Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
         2) Reinforce members as required to receive fastener threads.
   3. Concrete and masonry inserts: Hot dip galvanized cast iron, malleable iron, or steel inserts, complying with ASTM A123/A123M or ASTM A153/A153M.
   4. Concealed flashing: Corrosion resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
   5. Framing system gaskets and sealants: Recommended by manufacturer for joint type.

E. Glazing:
   1. Refer to Section 08 80 00: Glazing for impact resistant laminated insulating glass with low-e coating on Number 2 surface:
      a. Glazing gaskets: Compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
      b. Spacers and setting blocks: Elastomeric type.

F. Entrance Doors:

1. Glazed entrance doors for manual swing operation:
   a. Door construction: 1-3/4-inch (44.5 mm) overall thickness, with minimum 0.125-inch (3.2 mm) thick, extruded aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
   b. Door design:
      1) Wide stile; 5-1/2-inch (88.9 mm) nominal width:
         a) Accessible doors: Smooth surfaced for width of door in area within ten inches (255 mm) above floor or ground plane.
   c. Glazing stops and gaskets: Square, snap on, extruded aluminum stops and preformed gaskets.

G. Entrance Door Hardware:
1. Refer to Section 08 71 00: Door Hardware for aluminum entrance hardware sets:
   a. Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section:
      1) Opening-force requirements: CBC Section 11B-404.2.9:
         a) Exterior/interior hinged doors, sliding doors, or folding doors: Five (5) pounds square foot maximum.
         b) Required fire doors: The minimum opening force allowable by DSA not to exceed 15 pounds square foot (these forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position).
         c) Accessible interior doors: Maximum five (5) pounds foot to fully open door.
      2) Weather stripping: Standard replaceable components to match existing.
      3) Weather sweeps: Standard exterior door bottom sweep with exposed fasteners on mounting strip to match existing.

H. Accessories:
1. Joint sealants: For installation at perimeter of aluminum framed systems, refer to Section 07 92 00: Joint Sealants.
2. Bituminous paint: Cold applied, asphalt mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil 0.762 mm thickness per coat.

2.2 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Framing Members:
1. Fabricate components that, when assembled, have specified characteristics:
   a. Profiles that are sharp, straight, and free of defects or deformations.
   b. Accurately fitted joints with ends coped or mitered.
   c. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   d. Physical and thermal isolation of glazing from framing members.
   e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   f. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
   g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   h. Provide sill receptors with end dams at all sill conditions.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Storefront Framing: Fabricate components for assembly using screw spline system.

E. Entrance Door Frames:
   1. Reinforce as required to support loads imposed by door operation and for installing entrance door hardware:
      a. At exterior doors, provide weather stripping at fixed stops.
      b. At interior doors, provide weather stripping at stops to prevent metal to metal contact.

F. Entrance Doors:
   1. Reinforce doors as required for installing entrance door hardware:
      a. At pairs of exterior doors, provide compression type weather stripping retained in adjustable strip and mortised into door edge.
      b. At exterior doors, provide weather sweeps applied to door bottoms.

G. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.

2.3 ALUMINUM FINISHES

A. Class I, Clear Anodic Finish (#14): AA-M10C21A41 / AA-M45C22A41, 0.018 mm or thicker.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum framed systems by field measurements before fabrication and indicate measurements on shop drawings.

3.2 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.3 INSTALLATION

A. Comply with aluminum framed storefront manufacturer recommended installation instructions. Coordinate installation with curtain wall work:
   1. Do not install damaged components.
   2. Fit joints to produce hairline joints free of burrs and distortion.
   3. Rigidly secure nonmovement joints.
   4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   5. Seal joints watertight unless otherwise indicated.
   6. Min anchorage #8 with two-inch (2”) minimum embedment; minimum two inches (2”) from edges. Refer to shop drawings.

B. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00: Joint Sealants to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing specified in Section 08 80 00: Glazing.

G. Entrance Doors and Hardware:
1. Install doors to produce smooth operation and tight fit at contact points:
   a. Exterior doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   b. Field installed entrance door hardware: Install surface mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Section 07 92 00: Joint Sealants to produce weathertight installation.

3.4 ERECTION TOLERANCES

A. Install aluminum framed systems to comply with the following maximum erection tolerances:
1. Location and plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:
   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer:
1. For entrance doors accessible to people with disabilities, adjust closers to provide a three (3) second closer sweep period for doors to move from a 70-degree open position to three inches (75 mm) from the latch, measured to the leading door edge.

3.6 MAINTENANCE SERVICE

A. Entrance Door Hardware:
1. Maintenance tools and instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial maintenance service: Beginning at Substantial Completion, provide six (6) months full maintenance by skilled employees of entrance door hardware installer.

Include quarterly preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

END OF SECTION 08 41 13

SECTION 08 42 29.23 – SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:

1. Division 7 Sections for caulking to the extent not specified in this section.
2. [Division 8 Section “Aluminum-Framed Entrances and Storefronts” for entrances furnished separately in Division 8 Section.]
3. [Division 8 Section “Door Hardware” for hardware to the extent not specified in this Section.]
4. Division 8 Section “Glazing” for materials and installation requirements of glazing for automatic entrance doors.
5. Division 26 and 28 Sections for electrical connections including conduit and wiring for automatic entrance door operators and access control devices.

1.2 REFERENCES

A. References: Refer to the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. CUL – Approved for use in Canada.
4. NFPA 70 - National Electrical Code.
5. NFPA 101 - Life Safety Code.

B. American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA).

1. ANSI/BHMA A156.10 American National Standard for Power Operated Pedestrian Doors.
2. ANSI Z97.1 Standards for Safety Glazing Material Used in Buildings.

C. Underwriters Laboratories (UL).

1. UL 325 Standard for Safety for Door, Drapery, Gate, Louver and Window Operators and Systems.

D. American Association of Automatic Door Manufacturers (AAADM).

E. American Society for Testing and Materials (ASTM).

1. ASTM B221 Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
2. ASTM B209 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.

F. American Architectural Manufacturers Association (AAMA).

1. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.

G. National Association of Architectural Metal Manufacturers (NAAMM).

1. Metal Finishes Manual for Architectural Metal Products.

H. International Code Council (ICC).

1. [IBC: International Building Code.]
2. [CBC: California Building Code.]

1.3 DEFINITIONS

A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to activate the operation of the door.

1. Knowing act: Consciously initiating the opening of a power operated door using acceptable methods including wall mounted switches such as push plates and controlled access devices such as keypads, card readers and key switches.

B. Safety Device: A device that detects the presence of an object or person within a zone where contact could occur and provides a signal to stop the movement of the door.

1.4 PERFORMANCE REQUIREMENTS

A. Compliance with the following:

1. ANSI/BHMA A156.10 American National Standard for Power Operated Pedestrian Doors.
2. UL 325 listed.

B. Automatic door equipment accommodates medium to heavy pedestrian traffic.

C. Entrapment Force Requirements:

1. Power Operated Sliding Doors: Not more than 30 lbf (133 N) required to prevent stopped door from closing.
2. Sliding doors provided with a breakaway device shall require no more than 50 lbf (222N) applied 1 inch (25 mm) from the leading edge of the lock stile for the breakout panel to open.

1.5 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, fabrication, operational descriptions and finishes.

B. Shop Drawings: Submit manufacturer’s shop drawings, including elevations, sections and details, indicating dimensions, materials, and fabrication of doors, frames, sidelites, operator, motion /presence sensor control device, anchors, hardware, finish, options and accessories.

C. Samples: Submit manufacturer’s samples of aluminum finish.

D. Informational Submittals: Manufacturer's product information and applicable sustainability program credits that are available to contribute towards a LEED rated project certification.

1. Credit MR 4.1 and 4.2: Manufacturer's or fabricator's certificate indicating percentage of post-consumer recycled content by weight and pre-consumer recycled content by weight for each Product specified under this Section.

E. Manufacturers Field Reports: Submit manufacturer’s field reports from AAADM certified technician of inspection and approval of doors for compliance with ANSI/BHMA A156.10 after completion of installation.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door opening installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the entrance and their nearest service representatives. The final copies delivered after completion of the installation test to include spare parts list.

G. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.6 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 10 years of documented experience in manufacturing of doors and equipment of similar to that indicated for this Project and that have a proven record of successful in-service performance. Manufacturer to have a company certificate issued by AAADM.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing and maintenance of units similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Certified Inspector Qualifications: Certified by AAADM.

D. Source Limitations for Automatic Entrances: Obtain each type of door, frame, operator and sensor components specified in this Section from a single source, same manufacturer unless otherwise indicated.

E. Power-Operated Pedestrian Door Standard: ANSI/BHMA A156.10 (current version).

F. Emergency Exit door requirements: Comply with requirements of authorities having jurisdiction for automatic entrance doors serving as a required means of egress.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings to receive automatic entrances by field measurements before fabrication and indicate on shop drawings.

1.8 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed tracks and thresholds if applicable. Concrete work is specified in Division 03.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies and access control system as applicable.

1.9 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Automatic Entrance Doors shall be free of defects in material and workmanship for a period of One (1) year from the date of substantial completion.

C. During the warranty period a factory-trained technician shall perform service and affect repairs. An inspection shall be performed after each adjustment or repair.

D. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal business hours.

E. Manufacturer shall have in place a dispatch procedure that shall be available 24 hours a Day, 7 Days a week for emergency call back service.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: ASSA ABLOY Entrance Systems, 1900 Airport Road, Monroe, NC 28110. Toll Free (877) SPEC-123. Fax (704) 290- 5555 Website www.assaabloyentrance.us contact: specdesk.na.entrance@assaabloy.com

B. Substitutions: Requests for substitution and product approval in compliance with the specifications must be submitted in writing and in accordance with the procedures outlined in Division 1, Section “Substitution Procedures”. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 SLIDING AUTOMATIC ENTRANCES

A. Sliding automatic entrance system including the following:

1. Sliding panels, sidelites and aluminum frame.
2. Overhead concealed, electro-mechanical operator.
3. Operator housing, guide system and carrier assemblies.
4. Controls and accessories as required for a complete installation.

B. Besam SL500 (Basis of Design) Automatic Sliding Entrance with Stile and Rail Panels:

1. [Single slide, full breakout, door system.]
   a. Configuration: Single slide, two equal panel unit with one operable leaf and one sidelite.
   b. Traffic Pattern: [Two-way.]
   c. Emergency Breakaway Capability: Sliding leaf and sidelite.
   d. Mounting: Overhead header installed between jambs.
   e. Emergency Breakaway Capability: Sliding leaf.
   f. Mounting: Overhead header installed between jambs.

2.3 ENTRANCE COMPONENTS

A. Stile and Rail Sliding Panels and Sidelites:

1. Material: Extruded Aluminum, Alloy 6063-T5.
2. Door panels shall have a minimum .125 inch (3.2 mm) structural wall thickness including adjoining horizontal members and perimeter frames where applicable.
3. Door Construction shall be by means of an integrated corner block with 3/8 inch all-thread through bolt from each stile.

4. Glass stops shall be .062 inch (15.8 mm) wall thickness and shall provide security function as a standard by means of a fixed non-removable exterior section with glazing to be performed from the interior only.
5. Full breakout sliding entrances shall include two interlocks per moving panel securing the leading stile of the sidelite and the butt stile of the sliding door panel together.
6. Vertical Stiles shall be narrow stile 2-1/8 inch (54 mm).
7. Bottom Rails shall be 10 inch (254 mm).
8. 4 inch (102 mm).
9. Weather-Stripping: Slide-in type, replaceable pile mohair seals retained by the aluminum extrusions. The following types of weather-stripping are required: complementing weather-stripping on the joining vertical stiles of the sidelite and sliding door panels, complementing weather-stripping on the lead edge of the lock stiles of bi-parting doors, single pile weather-stripping between the carrier and the header, single pile weather-stripping on the lead edge stile of single slide door panels, dual pile weather-stripping on the pivot stile of breakout sidelite panels, and dual pile weather-stripping on the butt stile of fixed sidelite panels. Bottom rails shall be provided with an adjustable nylon sweep.

Glass: Glazing shall comply with ANSI Z97.1, thickness as indicated.

a. Glazing Sliding Panels and Sidelite Panels: 5/8” (16 mm) clear insulated glass
b. Glazing Installation: See Division 8 Section “Glazing” for requirements.

B. Door Carriers: Manufacturer’s standard carrier assembly that allows vertical adjustment.

1. Carriage Assembly: Carriage bar with two wheel assemblies. Each assembly shall have tandem roller wheels.
2. Roller Wheels: Two heavy duty Delrin roller wheels per wheel assembly, for a total of four (4) roller wheels, 1-7/16 inch (36.51 mm) diameter, per active door leaf for operation over a replaceable aluminum track. Single journal with sealed oil impregnated bearings.
3. Two (2) heavy duty self-aligning anti-risers per leaf.

C. Framing Members: Provide automatic entrances as complete assemblies. Manufacturer’s standard extruded aluminum framing reinforced as required to support loads.

1. Vertical Jambs: 4-1/2 inches (114.3 mm)

D. Header: Manufacturer’s standard extruded aluminum header with a replaceable aluminum track extending full width of entrance unit. Header to conceal door operators, carrier assemblies, and roller track; complete with hinged access panel for service of door operator, and controls.

1. Header Span: Maximum 16’-0” (4.9 m) without intermediate supports when entrance glazed with 1/4-inch glass.
   a. Capacity: Capable of supporting active breakout leafs up to maximum of 300 lb (136 kg) per leaf when header is supported per manufacturer’s recommendations.
2. Header Size: 4-1/2 inches (114.3 mm) wide by 7 inches (177.8 mm) high.
3. Header height including the sensor plate cap which spans the clear door opening width is 8 inches (203.2 mm) high.
4. Header Access: Continuous hinge at top of header allows cover to swing and allow complete access to operator and internal electronic and mechanical assemblies.
5. Design: Closed header when doors in closed position.

2.4 HARDWARE

A. Hardware: Provide manufacturer’s standard hardware as required for operation indicated.

1. Breakaway arms and bottom pivot assemblies shall be supplied by the manufacturer and shall be adjustable to comply with applicable codes.
2. Magnetic catch(s) to retain breakout door and sidelite panels in the closed position.

NOTE: The optional door closers control and close the breakout panels when in breakout mode - Magnetic catches are optional with door closer and will automatically relatch breakout panels after panels are returned to the closed position

NOTE: The optional hydraulic dampeners only control the doors in the breakout mode. Consult SpecDesk for use.

3. [Hydraulic closer(s) to return breakout door and sidelite panels to the closed position.]
   a. [Magnetic catch(s) to retain breakout door and sidelite panels in the closed position.]
4. [Wind resistant hydraulic damper to control movement of breakout panels.]
5. [Bottom ball detent on breakout sidelite panels to provide additional wind resistance.]
6. Locking hardware shall be provided as indicated.
   a. Electrified slide lock shall automatically lock the sliding function of all sliding door panels within the entrance when the door panels are in the closed position.
      1) Fail secure operation: Slide lock shall lock the sliding function of the door panels upon loss of power.
      2) Fail safe operation: Slide lock shall unlock the sliding function of the door panels upon loss of power.
   b. Exit devices shall lock the breakout function while allowing emergency egress at all times. Exit devices in combination with the automatic slide locking hardware to be provided on secured doors. Automatic locking for the sliding door when the door control switch is in the closed position.

B. Guide Track/Threshold: Manufacturer's threshold as indicated.

1. Full Breakout Entrance Threshold: 1/2 inch (12.7 mm) high continuous aluminum threshold with integral track shall span the width of the sliding door header and fit between the vertical framing members. Threshold design shall allow for optional extruded ramps to securely interlock to flat section to meet ADA requirements.
   a. Recessed mounted threshold.

DOOR OPERATORS AND CONTROLS

C. Door Operator and Controller:

1. Electro-mechanical controlled unit utilizing a high-efficiency, energy efficient, DC motor requiring a maximum of 3 amp current draw, allowing 5 operators on one 20 amp circuit. The supplied system shall have the capability to operate at full performance well beyond a brown out and high line voltage conditions (85V – 265V) sensing changes and adjusting automatically. The operator shall allow an adjustable hold open time delay of 0 to 60 seconds and have internal software to incorporate a self-diagnostic system.
2. Operating Temperature Range: -31° F to 130° F (-35° C to 54.44° C).

D. Microprocessor Control Box:

1. Modular control unit to allow for changing technology. Factory-adjusted configuration with opening and closing speeds set to comply with ANSI/BHMA A156.10 requirements and electronic dampening to reduce wear on drive train. Should the drive train operations deviate from design criteria ranges, Watchdog Control Circuit Monitoring will assume command of the system and shut down the automatic function allowing a secondary

supervisory circuit to perform as a backup. Control unit shall allow the following functions:

a. Diagnostics with the ability to produce application data.

2. Mode Selector Control:

NOTE: The standard mode selector control is the rotary knob switch

a. [Multi-position [rotary knob] [keyed cylinder] mode selector control shall allow selection of the indicated functions to be engaged when switch is turned to the appropriate setting.]

NOTE: The standard mounting location is jamb mounted

b. Mode Selector Control Mounting: Control shall be mounted as indicated:
   1) Jamb mounted.

c. Mode selector control to allow the following functions:
   1) "Off"
   2) "Exit Only" one way traffic with automatic operation from the interior.
   3) "Two Way Traffic" allowing automatic operation from exterior and interior.
   4) "Partial Opening" energy saving door position allows door to automatically adjust opening width based on amount of usage, that is, full open during high use and partial open during low use. The control for this setting is programmable allowing adjustment to both the usage setting and the opening width.
   5) "Hold Open" doors activated and held in the full open position.

2.5 ACTIVATION AND SAFETY CONTROL DEVICES

A. General: Provide the types of activation and safety devices specified in accordance with ANSI/BHMA standards, for the condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

B. Combination Activation Motion Sensor/Safety Presence Sensor:

1. Shall be a sliding door sensor utilizing K-band microwave technology to detect motion and focused active infrared technology to detect presence, combined in a single housing surface mounted on each side of the header.
   a. Presence sensor shall remain active at all times.
   b. The sensor shall communicate with the automatic door operator through a self-monitoring connection that allows the door to go into a fail-safe mode preventing the door from closing in the event of a sensor failure.
2. Motion/presence detecting sensors to be field installed and adjusted.

2.6 ELECTRICAL

A. High-Efficiency DC Motor: Maximum of 3 amp current draw, allowing 5 operators to run on one 20 Amp circuit.

B. Power: Self-detecting line voltage capable control. 120 VAC through 240 VAC, 50/60 Hz, 3 amp minimum incoming power with solid earth ground connection for each door system.

C. Key Impulse Input: Input for card readers or remote activation with independent adjustable hold open delay.

D. Wiring: Separate internal channel raceway free from moving parts.

E. Brown out / high voltage capability: System has capability to operate at full performance well beyond brown out and high voltage line conditions (85 V – 265 V) sensing changes and adjusting automatically.

F. Convenience Battery: Shall be concealed in header and capable of full operation with blackout conditions, including sensor capabilities for minimum of 100 cycles.

2.7 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Painted Finish:

1. Powder coat painted to match architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical source power to verify actual locations of wiring connections.

C. Proceed only after such discrepancies or conflicts have been resolved.

3.2 INSTALLATION

A. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets and guides level and true to location with anchorage for permanent support.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections.

D. Glazing: Glaze sliding automatic entrance door panels in accordance with the Glass Association of North America (GANA) Glazing Manual, published recommendations of glass product manufacturer, and published instructions of automatic entrance system manufacturer.

E. Sealants: Comply with requirements specified in division 7 Section "Joint Sealants" to provide a weather tight installation.

1. Set thresholds, bottom guide and track systems and framing members in full bed of sealant.
2. Seal perimeter of framing members with sealant.

F. Signage: Apply signage on both sides of each door and sidelite as required by ANSI/BHMA A156.10 and manufacturers installation instructions.

3.3 ADJUSTING

A. Adjust door operators, controls and hardware for smooth and safe operation and for weather tight closure. Adjust doors in compliance with ANSI/BHMA A156.10.

B. Verify installation and alignment of all entrance weather-stripping as required for compliance with specified air infiltration requirements.

3.4 FIELD QUALITY CONTROL

A. Before placing doors into operation, AAADM certified technician shall inspect and approve doors for compliance with ANSI/BHMA A156.10. Certified technician shall be approved by the manufacturer.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door installation.

B. Clean glass and metal surfaces promptly after installation. Remove excess sealants, compounds, dirt and other substances. Repair damages to match original finish.

3.6 DEMONSTRATION

A. Engage a factory-authorized representative to train Owner's maintenance personnel to adjust, operate, and maintain safe operation of the door.

END OF SECTION

SECTION 08 51 13 ALUMINUM WINDOWS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Aluminum windows for exterior locations.
   2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of product, including construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Submit plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, two inches by four inches (50 by 100 mm) in size.

D. Samples:
   1. For aluminum windows and components required, showing full range of color variations for finishes, and prepared on samples of size indicated below:
      a. Exposed finishes: Two inches by four inches (50 by 100 mm).
      b. Exposed hardware: Full size units.

E. Product Schedule: Use same designations indicated on Drawings.

F. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

G. Field quality control reports.

1.4 PERFORMANCE REQUIREMENTS

A. Performance Class and Grade AAMA/WDMA/CSA 101/I.S.2/A440:
   1. Minimum performance class: AW or as indicated on Drawings.
   2. Minimum performance grade: 40.

B. Solar Heat Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.27.

C. Condensation Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.

D. Thermal Movements:
   1. Provide aluminum windows, including anchorage, that allow for thermal movements

resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:
a. Temperature change: 120 degrees F (67 degrees C) ambient; 180 degrees F (100 degrees C) material surfaces.

E. Sound Transmission Class (STC): Rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

F. Outside-Inside Transmission Class (OITC): Rated for not less than 22 OITC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.

G. Windborne Debris Impact Resistance: Capable of resisting impact from windborne debris based on testing glazed windows identical to those specified, according to ASTM E1886 and testing information in ASTM E1996 and requirements of authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Energy code: Provide window units compliant with the IECC with California amendments.
2. Product standard - Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated:
   a. Window certification: AAMA certified with label attached to each window.
3. Accessibility requirements - comply with applicable requirements:
   a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
   b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
   c. State of California T-24, Part I, CBC Section 11B (Accessible).

B. Manufacturer Qualifications: Manufacturer having minimum five (5) years' documented experience who is capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting the performance by test reports and calculations.

C. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

D. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

E. Mockups:
1. Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution:
   a. Build mockup of typical wall 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. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Pre-Installation Conference:

1. Conduct conference at site:
   a. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
   c. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
   d. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
   e. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.6 WARRANTY

A. Manufacturer's written warranty, signed by manufacturer, in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period:
   1. Failures include, but are not limited to, the following:
      a. Failure to meet performance requirements.
      b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
      c. Faulty operation of movable sash and hardware.
      d. Deterioration of materials and finishes beyond normal weathering.
      e. Failure of insulating glass.
   2. Warranty period:
      a. Window: Ten (10) years from date of Substantial Completion.
      b. Glazing units: Ten (10) years from date of Substantial Completion.
      c. Aluminum finish: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers are subject to compliance with requirements; provide impact resistant window products by one of the following:
   1. Arcadia, Inc.
   2. Kawneer North America; an Alcoa company.
   3. Peerless Products, Inc.
   4. Wausau Window and Wall Systems; Apogee Wausau Group.
   5. Winco Manufacturing Co.
   6. EFCO Corporation.

2.2 OPERATING TYPES

A. Provide the following operating types in locations indicated on Drawings:
   1. Casement: Project [**out**] [**in**].
   2. Awning: Project out.
   3. Hopper: Project in.
   4. Single hung.
   5. Double hung.
   6. Horizontal sliding.
   7. Fixed.

2.3 FRAMES AND SASHES

A. Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440:
   1. Thermally improved construction: Fabricate frames, sashes, and muntins with an integral, concealed, low conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal to metal contact.

2.4 GLASS

A. Glass:
   1. Clear annealed glass, ASTM C1036, Type 1, Class 1, q3:
      a. Kind: Fully tempered.

B. Windborne Debris Impact Resistant Laminated Glass - ASTM C1172 with two plies of float glass:
   1. Float glass: Fully tempered.
   2. Inner ply: Clear.
   3. Interlayer: As required by performance requirements indicated.
   4. Outer ply: Clear.
   5. Low-E coating: Pyrolytic on second surface.

C. Windborne Debris Impact Resistant Insulating Glass - ASTM E2190:
   1. Factory assembled sealed glass unit units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190:
      a. Sealing system: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
      b. Spacer: Aluminum with black, color anodic finish.
      c. Desiccant: Molecular sieve or silica gel, or a blend of both.
      d. Overall unit thickness: One inch (25 mm).
      e. Minimum thickness of each glass lite: Six (6) mm.
      f. Outdoor lite: Low-E tinted float glass, impact resistant laminated glass.
      g. Interspace content: Air.
      h. Indoor lite: Fully tempered float glass.

D. Insulating Glass Units - ASTM E2190:
   1. Glass: ASTM C1036, Type 1, Class 1, q3:
      a. Tint: Clear.
      b. Kind: Fully tempered.
   2. Lites: Two (2).
   3. Filling: Fill space between glass lites with air.
   4. Low-E coating: Pyrolytic on second surface.
   5. Integral louver blinds:
      a. Horizontal louver blinds with aluminum slats and polyester fiber cords, located in space between glass lites, and operated by hardware located on inside face of sash:
         1) Operation: Sliding.
         2) Color: Selected by Architect.

E. Windborne Debris Impact Resistant Insulating Glass Units - ASTM E2190 with two (2) lites and complying with impact resistance requirements:
   1. Exterior lite, ASTM C1036, Type 1, Class 1, q3:
      a. Tint: Clear.
      b. Kind: Fully tempered.
   2. Interior lite, ASTM C1172, clear laminated glass with two (2) plies of float glass:
      a. Float glass: Fully tempered.

b. Interlayer thickness: Required by performance requirements indicated.
3. Filling: Fill space between glass lites with air.
4. Low-E coating: Pyrolytic on second surface.

F. Glazing System:
1. Factory glazing system that produces weathertight seal:
a. Dual glazing system:
1) Interior lite: Glass.
2) Exterior lite: Glass.

G. Hardware:
1. Provide hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions:
a. Exposed hardware color and finish selected by Architect from manufacturer's full range.

H. Projected Window Hardware:
1. Gear type rotary operators, complying with AAMA 901 when tested according to ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets:
a. Type and style: Selected by Architect.
2. Lock: Window manufacturer.

I. Horizontal Sliding Window Hardware:
1. Sill cap/track: Extruded aluminum track with natural anodized finish of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
2. Locks and latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
3. Roller assemblies: Low friction design.

J. Weather Stripping: Provide full perimeter weather stripping for each operable sash unless otherwise indicated.

K. Fasteners:
1. Noncorrosive and compatible with window members, trim, hardware, anchors, and other components:
a. Exposed fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.5 ACCESSORIES

A. Integral Ventilating System/Device: Where indicated, provide weather-stripped, adjustable, horizontal fresh air vent, with a free airflow slot, full width of window sash by approximately one inch (25 mm) when open, complying with AAMA/WDMA/CSA 101/I.S.2/A440. Equip vent bar with an integral insect screen, removable for cleaning.

B. Horizontal Louver Blinds:
1. Provide removable, horizontal louver blinds with aluminum slats and polyester fiber cords that are operated by hardware located on inside face of sash:
a. Operation: Tilt, raising, and lowering.
b. Color: Selected by Architect.

C. Subsills: Thermally broken, extruded aluminum subsills in configurations indicated on Drawings.

D. Column Covers: Extruded aluminum profiles in sizes and configurations indicated on Drawings.

E. Interior Trim: Extruded aluminum profiles in sizes and configurations indicated on Drawings.

F. Panning Trim: Extruded aluminum profiles in sizes and configurations indicated on Drawings.

G. Receptor System: Two-piece, snap together, thermally broken, extruded aluminum receptor system that anchors windows in place.

2.6 INSECT SCREENS

A. Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

B. Aluminum Frames:
1. Aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame:
   a. Tubular framing sections and cross braces: Roll formed from aluminum sheet.

C. Glass Fiber Mesh Fabric:
1. 18 by 14 (1.1 mm by 1.4 mm) or 18 by 16 (1.0 mm by 1.1 mm) mesh of PVC coated, glass fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M:
   a. Mesh color: Black.

2.7 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water shed members above side-hinged sashes and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for

shipment and installation.

2.8 FINISH REQUIREMENTS

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

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (mechanical finish: non-specular as fabricated; chemical finish: etched, medium matte; anodic coating: architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

C. 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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and

moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Testing Agency - Owner will engage a qualified testing agency to perform tests and inspections:
   1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services - Testing and inspecting of installed windows shall take place as follows:
   1. Testing methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
   2. Air infiltration testing:
      a. Test pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
      b. Allowable air-leakage rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one (1) decimal place.
   3. Water resistance testing:
      a. Test pressure: 2/3 times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
      b. Allowable water infiltration: No water penetration.
   4. Testing extent: One (1) window of each type or/as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
   5. Test reports: Prepared according to AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances:
   1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 08 51 13

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:

    a. "Metal Doors and Frames"
    b. "Flush Wood Doors"
    c. "Stile and Rail Wood Doors"
    d. "Interior Aluminum Doors and Frames"
    e. "Aluminum-Framed Entrances and Storefronts"
    f. "Stainless Steel Doors and Frames"
    g. "Special Function Doors"
    h. "Entrances"

6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

E. 2019 California Building Code

1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:

   a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

   a. Wiring Diagrams: For power, signal, and control wiring and including:
      1) Details of interface of electrified door hardware and building safety and security systems.
      2) Schematic diagram of systems that interface with electrified door hardware.
      3) Point-to-point wiring.
      4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

    a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:

    a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
    b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
    c. Indicate complete designations of each item required for each opening, include:
        1) Door Index: door number, heading number, and Architect's hardware set number.
        2) Quantity, type, style, function, size, and finish of each hardware item.
        3) Name and manufacturer of each item.
        4) Fastenings and other pertinent information.
        5) Location of each hardware set cross-referenced to indications on Drawings.
        6) Explanation of all abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for hardware.
        8) Door and frame sizes and materials.
        9) Degree of door swing and handing.
        10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:

    a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
    b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
    c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
    d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
    e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
    f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:

a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Final approved hardware schedule edited to reflect conditions as installed.
d. Final keying schedule
e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:

a. Fire door assemblies, in compliance with NFPA 80.
b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

a. For door hardware: DHI certified AHC or DHC.
b. Can provide installation and technical data to Architect and other related subcontractors.
c. Can inspect and verify components are in working order upon completion of installation.
d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:

   a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
   b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:

   a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
   b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware

   a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:

   a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference

   a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
      1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
      2) Preliminary key system schematic diagram.
      3) Requirements for key control system.
      4) Requirements for access control.
      5) Address for delivery of keys.

2. Pre-installation Conference

   a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Inspect and discuss preparatory work performed by other trades.
   c. Inspect and discuss electrical roughing-in for electrified door hardware.
   d. Review sequence of operation for each type of electrified door hardware.

e. Review required testing, inspecting, and certifying procedures.
f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:

a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

D. Regulatory Requirements:

1. Pairs of doors with independently-activated hardware both leafs: limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2019 California Building Code Section 11B-703.4.2.
2. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).
3. Thresholds: floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2019 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches: beveled to slope no greater than 1:2 (50 percent slope). 2019 California Building Code Section 11B-303.2 & ~.3.
4. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2019 California Building Code Section 11B-404.2.3.

a. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2019 California Building Code 11B-307.4.
b. Exception: doors not requiring full passage through the opening, that is, to spaces less than 24 inches in depth, may have the clear opening width reduced to 20 inches. Example: shallow closets.

5. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2019 California Building Code Section 11B-404.2.10.

a. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.
b. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.

6. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2019 California Building Code Section 11B-404.2.7.

a. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully-closed.

7. Low-energy powered doors: comply with ANSI/BHMA A156.19. Reference: 2019 California Building Code Section 11B-404.2.9, Exception 2.

a. Actuator location: conspicuously located, clear and level floor/ground space for forward or parallel approach.

b. Actuators, plate type: use two at each side of the opening. Minimum 4-inches diameter or 4-inches square. Displays International Symbol of Accessibility, per 2019 California Building Code Section 11B-703.7. Locate centerline of lower plate between 7- and 8-inches above floor or ground, and upper plate between 30- and 44-inches above floor or ground.
c. Actuators, vertical bar type: minimum 2-inches wide, 30-inches high, bottom located minimum 5-inches above floor or ground, top located minimum 35-inches above floor or ground. Displays International Symbol of Accessibility, per 2019 California Building Code Section 11B-703.7.
d. Where powered door serves an occupancy of 100 or more, provide back-up battery power or stand-by generator power, capable of supporting a minimum of 100 cycles.

8. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2019 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.

    a. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.

9. Handles, pull, latches, locks, other operable parts:

    a. Force required to activate the operable parts: 5.0 pounds maximum, per 2019 California Building Code Section 11B-309.4.
    b. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2019 California Building Code Section 11B-309.4.
    c. Panic hardware: locate between 36 inches to 44 inches above the finished floor.
    d. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2019 California Building Code, Section 11B-404.2.7.

10. Door and door hardware encroachment: when door is swung fully-open into means-of-egress path, the door may not encroach/project more than 7 inches into the required exit width, except for door release hardware such as lockset levers or panic hardware. These hardware items must be located no less than 34-inches and no more than 48-inches above the floor/ground. 2019 California Building Code, Section 1005.7.1.

    a. In I-2 occupancies, latch release hardware is not permitted to project in the required exit width, regardless of its mounting height, per 2019 California Building Code, Section 1005.7.1 at Exception 1.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

    1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
    2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.

        a. Mechanical Warranty
            1) Locks
                a) Schlage L Series: 3 years
            2) Closers
                a) LCN 4000 Series: 30 years

        b. Electrical Warranty
            1) Locks
                a) Schlage: 1 year

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: ''Owner Standard.''

    1. Where ''Owner Standard'' is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as ''Scheduled Manufacturer'' or ''Acceptable Manufacturers'' in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
C. Approval of products from manufacturers indicated in ''Acceptable Manufacturers'' is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

    1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer’s recognized installation standards for application intended.
    2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
    3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with “Metal Doors and Frames”, “Flush Wood Doors”, “Stile and Rail Wood Doors” to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

    1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

C. Cable and Connectors:

    1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
    2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
    3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Stanley CB1900 Series

2. Acceptable Manufacturers and Products:

    a. Hager AB700/800 series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide 3 knuckle, concealed bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

    a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
    b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

    a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
    b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:

    a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
    b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

    a. Steel Hinges: Steel pins
    b. Non-Ferrous Hinges: Stainless steel pins
    c. Out-Swinging Exterior Doors: Non-removable pins
    d. Out-Swinging Interior Lockable Doors: Non-removable pins
    e. Interior Non-lockable Doors: Non-rising pins

10. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
11. Provide hinges with electrified options as scheduled in the hardware sets Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Roton
b. Hager

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Trimco
c. Don-Jo

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.06 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Trimco
c. Don-Jo

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes, or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

2.07 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Schlage L9000 series

2. Acceptable Manufacturers and Products:

a. Owner Standard

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
7. Provide motor based electrified locksets that comply with the following requirements:

a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case.

c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate "hot levers" in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
e. Connections – provide quick-connect Molex system standard.

8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

a. Provide levers that return to within 1/2 inch (13 mm) of door face.
b. Vandlgard: Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
c. Lever Design: Rhodes (06A).

2.08 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Von Duprin 6000 Series

2. Acceptable Manufacturers and Products:

a. Folger Adam 300 Series
b. HES 1006 Series

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.09 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Schlage Everest 29 Primus XP

2. Acceptable Manufacturers and Products:

a. Owner Standard

B. Requirements:

1. Provide cylinders/cores, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.

    a. High Security: dual-locking cylinder with permanent core requiring restricted, patented keyway. Dual-locking mechanism with interlocking finger pin(s) to check for patented features on keys.

3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
4. Nickel silver bottom pins.

2.10 KEYING

A. Scheduled System:

1. Existing factory registered system:

    a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:

    a. Replaceable Construction Cores.
        1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
            a) 3 construction control keys
            b) 12 construction change (day) keys.
        2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2. Permanent Keying:

    a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
        1) Master Keying system as directed by the Owner.

    b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
    c. Provide keys with the following features:
        1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
        2) Patent Protection: Keys and blanks protected by one or more utility patent(s).

    d. Identification:
        1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
        2) Identification stamping provisions must be approved by the Architect and Owner.

3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

e. Quantity: Furnish in the following quantities.
1) Change (Day) Keys: 3 per cylinder/core.
2) Permanent Control Keys: 3.
3) Master Keys: 6.

2.11 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:

a. Telkee

2. Acceptable Manufacturers:

a. HPC
b. Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
b. Provide hinged-panel type cabinet for wall mounting.

2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. LCN 4040XP series

2. Acceptable Manufacturers and Products:

a. Owner Standard

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.14 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:

a. Glynn-Johnson

2. Acceptable Manufacturers:

a. Owner Standard

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
2. Provide friction type at doors without closer and positive type at doors with closer.

2.15 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Trimco

2. Acceptable Manufacturers:

a. Owner Standard

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.16 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:

a. Zero International

2. Acceptable Manufacturers:

a. National Guard
b. Reese
c. Legacy

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.17 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Rockwood
c. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.18 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20
5. California Building Code, Section 1010.1.9.2 and 11B-404.2.7.

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
I. Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
L. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
M. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

    1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
    2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
    3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
    4. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2019 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.

        a. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.
B. Clean operating items per manufacturer's instructions to restore proper function and finish.
C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
D. Hardware Sets:

Legend:
Link to catalog cut sheet
Electrified Opening

Hardware Group No. 01

For use on Door #(s):
8.1

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	CB1900R 4.5 x 4.5			652	STA
1	EA	STOREROOM LOCK	L9080T 06A			626	SCH
1	EA	PRIMUS CORE	20-740			626	SCH
1	EA	SURFACE CLOSER	4040XP			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	FLOOR STOP	1214			626	TRI
3	EA	SILENCER	SR64/SR65			GRY	IVE

CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.

Hardware Group No. 02

For use on Door #(s):
1A.1

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	CB1900R 4.5 x 4.5			652	STA
1	EA	OFFICE/ENTRY LOCK	L9050T 06A L583-363			626	SCH
1	EA	PRIMUS CORE	20-740			626	SCH
1	EA	FLOOR STOP	1214			626	TRI
3	EA	SILENCER	SR64/SR65			GRY	IVE

CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.

Hardware Group No. 03

For use on Door #(s):
7.1

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	CB1960R 4.5 x 4.5			630	STA
1	EA	ELECTRIFIED HINGE	CECB1960R-58 4.5 x 4.5			630	STA
1	EA	CORRIDOR LOCK	L9456T 06A L583-363 L283-722 DM			626	SCH
1	EA	ELECTRIC STRIKE	6216 FSE 12/16/24/28 VAC/VDC			630	VON
1	EA	SURFACE CLOSER	4040XP EDA			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	FLOOR STOP	1214			626	TRI
1	SET	SEALS	328 HEAD AND JAMBS			AA	ZER
1	EA	* CREDENTIAL READER	BY SECURITY CONTRACTOR			BLK	SCE
1	EA	* POWER SUPPLY	BY SECURITY CONTRACTOR				B/O

CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.
* = BY ACCESS CONTROL CONTRACTOR. (SHOWN HERE FOR COORDINATION AND TEMPLATING PURPOSES)
CONDUIT, JUNCTION BOXES BY ELECTRICAL CONTRACTOR.
CARD READER, LOW VOLTAGE WIRING AND CONNECTIONS BY SECURITY CONTRACTOR.

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL TEMPORARILY UNLOCKS DOOR. INSIDE THUMBTURN THROWS DEADBOLT, ALLOWING FOR PRIVACY. DEADBOLT MONITOR TEMPORARILY DISABLES CARD ACCESS FOR PRIVACY. KEYED OVERRIDE AVAILABLE AT ALL TIMES. ROTATING INSIDE LEVER RETRACTS BOTH LATCH BOLT AND DEAD BOLT, ENABLES CARD READER. FREE EGRESS AT ALL TIMES. ACCESS CONTROL SYSTEM CAN BE PROGRAMMED TO ALLOW FREE ACCESS DURING DESIGNATED HOURS.

Hardware Group No. 04

For use on Door #(s):
1.1

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	MORTISE CYLINDER	AS REQ				
1	EA	PRIMUS CORE	20-740			626	SCH
1	EA	* CREDENTIAL READER	BY SECURITY CONTRACTOR			BLK	SCE
1	EA	* DOOR CONTACT	BY SECURITY CONTRACTOR			BLK	
1	EA	* POWER SUPPLY	BY SECURITY CONTRACTOR				B/O

HARDWARE BY DOOR/FRAME MANUFACTURER.
CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.
* = BY ACCESS CONTROL CONTRACTOR. (SHOWN HERE FOR COORDINATION AND TEMPLATING PURPOSES)
CONDUIT, JUNCTION BOXES BY ELECTRICAL CONTRACTOR.
CARD READER, LOW VOLTAGE WIRING AND CONNECTIONS BY SECURITY CONTRACTOR.

Hardware Group No. 05

For use on Door #(s):
5.2 6.2

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	CB1900R 4.5 x 4.5			652	STA
1	EA	ELECTRIFIED HINGE	CECB1900R-58 4.5 x 4.5		✓	652	STA
1	EA	EU MORTISE LOCK	L9092TEU 06A 12/24 VDC		✓	626	SCH
1	EA	PRIMUS CORE	20-740			626	SCH
1	EA	SURFACE CLOSER	4040XP			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	FLOOR STOP	1214			626	TRI
3	EA	SILENCER	SR64/SR65			GRY	IVE
1	EA	*CREDENTIAL READER	BY SECURITY CONTRACTOR		✓	BLK	SCE
1	EA	*POWER SUPPLY	BY SECURITY CONTRACTOR		✓		B/O

CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.

* = BY ACCESS CONTROL CONTRACTOR. (SHOWN HERE FOR COORDINATION AND TEMPLATING PURPOSES)
CONDUIT, JUNCTION BOXES BY ELECTRICAL CONTRACTOR.
CARD READER, LOW VOLTAGE WIRING AND CONNECTIONS BY SECURITY CONTRACTOR.

Hardware Group No. 06

For use on Door #(s):
5.1

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	CB1960R 4.5 x 4.5			630	STA
1	EA	ELECTRIFIED HINGE	CECB1960R-58 4.5 x 4.5		✓	630	STA
1	EA	EU MORTISE LOCK	L9092TEU 06A 12/24 VDC		✓	626	SCH
1	EA	PRIMUS CORE	20-740			626	SCH
1	EA	SURFACE CLOSER	4040XP EDA			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	FLOOR STOP	1214			626	TRI
1	SET	SEALS	328 HEAD AND JAMBS			AA	ZER
1	EA	*CREDENTIAL READER	BY SECURITY CONTRACTOR		✓	BLK	SCE
1	EA	*POWER SUPPLY	BY SECURITY CONTRACTOR		✓		B/O

CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.

* = BY ACCESS CONTROL CONTRACTOR. (SHOWN HERE FOR COORDINATION AND TEMPLATING PURPOSES)
CONDUIT, JUNCTION BOXES BY ELECTRICAL CONTRACTOR.
CARD READER, LOW VOLTAGE WIRING AND CONNECTIONS BY SECURITY CONTRACTOR.

Hardware Group No. 07

For use on Door #(s):
6.1

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	CB1960R 4.5 x 4.5			630	STA
1	EA	ELECTRIFIED HINGE	CECB1960R-58 4.5 x 4.5			630	STA
1	EA	EU MORTISE LOCK	L9092TEU 06A 12/24 VDC			626	SCH
1	EA	PRIMUS CORE	20-740			626	SCH
1	EA	SURFACE CLOSER	4040XP EDA ST-2731			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	SECURITY FLOOR STOP	1209			BLK	TRI
1	SET	SEALS	328 HEAD AND JAMBS			AA	ZER
1	EA	*CREDENTIAL READER	BY SECURITY CONTRACTOR			BLK	SCE
1	EA	*POWER SUPPLY	BY SECURITY CONTRACTOR				B/O

CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.

* = BY ACCESS CONTROL CONTRACTOR. (SHOWN HERE FOR COORDINATION AND TEMPLATING PURPOSES)
CONDUIT, JUNCTION BOXES BY ELECTRICAL CONTRACTOR.
CARD READER, LOW VOLTAGE WIRING AND CONNECTIONS BY SECURITY CONTRACTOR.

Hardware Group No. 08

For use on Door #(s):
G.2

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	GATE HINGES/PIVOTS	BY GATE MFG				B/O
1	EA	GATE CLOSER	BY GATE MFG				B/O
1	EA	CLASSROOM SEC HOLDBK	LV9077T 06A L283-711			626	SCH
2	EA	PRIMUS CORE	20-740			626	SCH
1	EA	WELDED GATE BOX FOR LOCK	BY GATE MFG				B/O
1	EA	SECURITY FLOOR STOP	1209			BLK	TRI

CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.

Hardware Group No. 09

For use on Door #(s):
1.2 2.1 2.2

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	CONT. HINGE	224XY			628	IVE
1	EA	CONST LATCHING BOLT	FB51P			630	IVE
1	EA	DUST PROOF STRIKE	DP1/2 AS REQ'D			626	IVE
1	EA	CLASSROOM SEC HOLDBK	LV9077T 06A 10-072 7/8" LIP L283-711			626	SCH
2	EA	PRIMUS CORE	20-740			626	SCH
1	EA	COORDINATOR	COR X FL			628	IVE
2	EA	MOUNTING BRACKET	MB1/MB2 AS REQ			689	IVE
2	EA	SURFACE CLOSER	4040XP EDA ST-1754			689	LCN
2	EA	FLOOR STOP	1214			626	TRI
1	SET	SEALS	BY DOOR/FRAME MFG			BLK	BYO
1	EA		ASTRAGAL BY DOOR MFG.				B/O
2	EA	DOOR SWEEP	381A			A	ZER
1	EA	THRESHOLD	102A (OR PER SILL DETAIL)			A	ZER

WIDE STILE ALUMINUM DOOR.
CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.

Hardware Group No. 10

For use on Door #(s):
G.1

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	MORTISE CYLINDER	AS REQ				
1	EA	PRIMUS CORE	20-740			626	SCH

HARDWARE BY DOOR/FRAME MANUFACTURER.
CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.

Hardware Group No. 11

For use on Door #(s):
1.3

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	CONT. HINGE	224XY			628	IVE
1	EA	CONST LATCHING BOLT	FB51P			630	IVE
1	EA	DUST PROOF STRIKE	DP1/2 AS REQ'D			626	IVE
1	EA	CLASSROOM SEC HOLDBK	LV9077T 06A 10-072 7/8" LIP L283-711			626	SCH
1	EA	PRIMUS CORE	20-740			626	SCH
1	EA	COORDINATOR	COR X FL			628	IVE
2	EA	MOUNTING BRACKET	MB1/MB2 AS REQ			689	IVE
1	EA	OVERHEAD STOP	100S			630	GLY

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	SURFACE CLOSER	4040XP EDA ST-1754			689	LCN
1	EA	FLOOR STOP	1214			626	TRI
1	SET	SEALS	BY DOOR/FRAME MFG			BLK	BYO
1	EA		ASTRAGAL BY DOOR MFG.				B/O

WIDE STILE ALUMINUM DOOR.
CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.
FLOOR STOP TO BE USED ON LEAF WHICH CAN SWING 180 DEGREES INTO WALL. OVERHEAD STOP TO BE USED ON OTHER LEAF TO STOP AT 90 DEGREES.

Hardware Group No. 12

For use on Door #(s): 9.1

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	CB1960R 4.5 x 4.5			630	STA
1	EA	ELECTRIFIED HINGE	CECB1960R-58 4.5 x 4.5		✓	630	STA
1	EA	EU MORTISE LOCK	L9092TEU 06A 12/24 VDC			626	SCH
1	EA	ELECTRIC STRIKE	6216 FSE 12/16/24/28 VAC/VDC		✓	630	VON
1	EA	SURFACE CLOSER	4040XP EDA			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	FLOOR STOP	1214			626	TRI
1	SET	SEALS	328 HEAD AND JAMBS			AA	ZER
1	EA	* CREDENTIAL READER	BY SECURITY CONTRACTOR		✓	BLK	SCE
1	EA	* POWER SUPPLY	BY SECURITY CONTRACTOR		✓		B/O

CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.
* = BY ACCESS CONTROL CONTRACTOR. (SHOWN HERE FOR COORDINATION AND TEMPLATING PURPOSES)
CONDUIT, JUNCTION BOXES BY ELECTRICAL CONTRACTOR.
CARD READER, LOW VOLTAGE WIRING AND CONNECTIONS BY SECURITY CONTRACTOR.

Hardware Group No. 13

For use on Door #(s): 2.3

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	CB1900R 4.5 x 4.5 NRP			630	STA
1	EA	CLASSROOM SEC LOCK	L9071T 06A			626	SCH
2	EA	PRIMUS CORE	20-740			626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	SURFACE CLOSER	4040XP EDA			689	LCN
1	EA	FLOOR STOP	1214			626	TRI
1	SET	SEALS	BY DOOR/FRAME MFG			BLK	BYO
1	EA	DOOR SWEEP	381A			A	ZER
1	EA	THRESHOLD	102A (OR PER SILL DETAIL)			A	ZER

CONFIRM CYLINDER/KEYING REQUIREMENTS WITH SCHOOL LOCKSMITH PRIOR TO ORDERING.

SECTION 08 80 00 GLAZING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Float glass.
2. Tempered glass.
3. Reflective glass.
4. Spandrel coated glass.
5. Insulated glass.
6. Laminate glass.
7. Fire resistive glazing.
8. Spandrel glazing.
9. Glazing sealants.
10. Glass film overlay.
11. Insulated metal panel.
12. Accessories necessary for a complete installation.

1.3 DEFINITIONS

A. Glass Thickness: Indicated by thickness designations in millimeters according to ASTM C1036.

B. Interspace: Space between lites of an insulating glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design glass panels including comprehensive engineering analysis by a qualified professional engineer lawfully licensed in the State of California, using performance requirements and design criteria indicated.

B. Installed Glazing: Design glazing systems to withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

C. Structural Performance:
1. Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the CBC and ASTM E1300:
   a. Design Wind Pressures: Indicated on Structural Drawings.
   b. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE 7, based on heights above grade indicated on Drawings:
      1) Wind Design Data: As indicated on Drawings.
      2) Basic Wind Speed: 115 mph.
      3) Importance Factor: 1.0.
2. Exposure Category: D.

3. Design Snow Loads: Indicated on Drawings.
4. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
5. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
6. Maximum Lateral Deflection: For glass supported on all four edges, limit center of glass deflection at design wind pressure to not more than 1/50 times the short side length or 1 inch (25 mm), whichever is less.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties:
1. Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
a. For monolithic glass lites, properties are based on units with lites 6 mm thick.
b. For laminated glass lites, properties are based on products of construction indicated.
c. For insulating glass units, properties are based on units of thickness indicated for overall unit and for each lite.
d. U-Factors: Center of glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
e. Solar Heat Gain Coefficient and Visible Transmittance: Center of glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
f. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

1.5 SUBMITTALS

A. Product Data: Technical data for each type of product including recommended installation and cleaning procedures.

B. Glass Samples: For each type of glass required. Prepare samples from same material to be used for Work.

C. Glazing Schedule: List glass types and thickness for each size opening and location. Use same designations indicated on Drawings.

D. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Product Certificates:
1. Submit glass product certificates required by Code:
g. Glass Manufacturer Certificate: The glass manufacturer shall submit a letter certifying it has reviewed the glazing details proposed for the project, including the use of gaskets and sealants, and that each product furnished is recommended for the application shown and compliance with the Code.

F. Thermal Stress and Wind Load Analyses:
1. Submit the following from the glass manufacturer:
h. Thermal stress analysis for each exterior glass unit type, each building elevation. The analysis shall clearly indicate the expected service temperature ranges and the effects of partial and full shading on the glass:
1) Attach to the thermal stress analysis a statement from the glass

manufacturer that based upon this analysis that the resulting thermal stresses will not reduce the specified statistical probability of breakage.

2. Wind load analysis for each glass unit type, each building elevation. The analysis shall indicate the statistical probability of breakage at the design wind pressure does not exceed the specified statistical probability of breakage.

G. Product Test Reports:
1. Submit test reports for insulating glass and glazing sealants, for tests performed by a qualified testing agency:
i. Glazing Sealants: Provide test reports based on testing current sealant formulations within previous 36 month period.
j. Glazing Sealants: Preconstruction adhesion and compatibility test report.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Comply with applicable requirements of the CBC for glazing.
2. Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies:
k. As a minimum provide Category II materials complying with testing requirements in 16 CFR 1201 (Consumer Product Safety Commission *Safety Standard for Architectural Glazing Materials*, published in the Code of Federal Regulations) and ANSI Z97.1.
l. Permanently mark safety glass with certification label of Safety Glazing Certification Council.
3. Insulating Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
4. Comply with published recommendations of glass product organizations:
m. GANA: Glazing Manual.
n. IGMA: SIGMA TM-3000 Vertical Glazing Guidelines.
o. GANA: Laminated Glazing Reference Manual.
p. AAMA: AAMA GDSG-1 Glass Design for Sloped Glazing.
q. AAMA: TIR A7 Sloped Glazing Guidelines.
r. IGMA for Sloped Glazing: IGMA TB-3001 Guidelines for Sloped Glazing.
s. IGMA for Insulating Glass: SIGMA TM-3000 North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use.
5. Fire Rated Door Assemblies: Assemblies complying with NFPA 80 listed and labeled by UL for fire ratings indicated, based on testing according to NFPA 252.
6. Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated:
t. Minimum Glass Thickness for Exterior Lites: 1/4 inch (6 mm).
u. Thickness of Tinted Glass: Provide same thickness for each tint color indicated.
7. Where annealed float glass is indicated, provide annealed float glass, heat strengthened float glass, or fully tempered float glass necessary to comply with performance requirements:
v. Where heat strengthened float glass is indicated, provide heat strengthened float glass or fully tempered float glass necessary to comply with performance requirements.
w. Where fully tempered float glass is indicated, provide fully tempered float glass.

B. Manufacturer Qualifications for Insulating Glass Units with Sputter Coated, Low E Coatings: Insulating glass manufacturer who is approved and certified by coated glass manufacturer.

C. Installer Qualifications, Glazer: Experience entity having minimum 5 years documented

experience and who employs glass installers certified under the National Glass Association's Certified Glass Installer Program.

D. Installer Qualifications, Decorative Film: Experience entity having minimum 5 years documented experience in the installation of glass films.

E. Source Limitations for Glass and Glass Accessories: Obtain each type of glass and glass accessories from a single source.

F. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

G. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

H. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

I. Install glazing in mockups specified to match glazing systems required for Project, including glazing methods:
   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

J. Preconstruction Adhesion and Compatibility Testing:
   1. Test each glass product, tape sealant, gasket, glazing accessory, and glass framing member for adhesion to and compatibility with elastomeric glazing sealants:
      x. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
      y. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
      z. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
      aa. Schedule enough time for testing and analyzing results to prevent delaying the Work.
      bb. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

K. Pre-installation Conference: Conduct conference at site.

1.7 WARRANTY

A. Written warrant, executed by glass manufacturer agreeing to repair or replace **glass** units that fail in materials and workmanship or deteriorate within warranty period. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to decorative glass manufacturer's published instructions:
   1. Warranty Period: Five (5) years from date of Substantial Completion.

B. Written warranty signed by manufacturer in which glass manufacturer agrees to replace **coated glass** units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating:

1. Warranty Period: Ten (10) years from date of Substantial Completion.

C. Written warranty signed by manufacturer in which manufacturer agrees to replace **laminated glass** units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard:
   1. Warranty Period: Ten (10) years from date of Substantial Completion.

D. Written warranty signed by manufacturer in which manufacturer agrees to replace **insulating glass** units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass:
   1. Warranty Period: Ten (10) years from date of Substantial Completion.

E. Written warranty signed by **glass film** manufacturer and installer in which manufacturer and installer agree to replace glass film that crack, peel, delaminate, discolor, change appearance, or failure to meet solar criteria within specified warranty period:
   1. Warranty Period: Five (5) years from date of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

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

B. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by manufacturer.

D. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coating on glass.

E. Comply with insulating glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   1. Glass:
      cc. Vitro Architectural Glass (Basis of Design).
      dd. AGC Glass Company North America, Inc.
      ee. Cardinal Glass Industries.
      ff. Guardian Industries Corp.;
      gg. Pilkington North America.
      hh. Viracon.

2. Fire Protection Rated Glazing:
   ii. AGC Glass Company North America, Inc.
   jj. Pilkington North America.
   kk. SAFTI FIRST Fire Rated Glazing Solutions.
   ll. Schott North America, Inc.
   mm. Technical Glass Products.
3. Glass Film:
   nn. 3M Construction Markets Division. http://www.3m.com
   oo. Bekaert Specialty Films. http://www.solargard.com
   pp. Madico.http://www.madico.com

B. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

C. Ultraclear Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3.

D. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

E. Fully Tempered Float Glass:
1. ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3:
   qq. Fabrication Process: By horizontal (roller hearth) process with roll wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

F. Heat Strengthened Float Glass:
1. ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3:
   rr. Fabrication Process: By horizontal (roller hearth) process with roll wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

G. Pyrolytic Coated, Low Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.

H. Ceramic Coated Vision Glass: ASTM C1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in GANA *Engineering Standards Manual*.

I. Adhered Backing:
1. Adhered scrim backing to ceramic coated surface; provide backed units identical to materials which, while possibly developing cracks and fissures, show no shear nor develop any openings large enough for the unobstructed penetration of 3 inch diameter sphere when tested by approved independent testing laboratory:
   ss. Mount test specimens consisting of 3 glass assemblies, 34" x 76" (plus zero or minus 3/16 inch), for testing as specified in ANSI Z-97.1.
   tt. Expose specimens to 100 cycles of the following conditions:
      1) 1 hour at 0 degrees F, ambient humidity.
      2) 3 hours increase from 0 degrees F to 140 degrees F, 95 to 100 percent relative humidity.
      3) 1 hour at 140 degrees F, 95 to 100 percent relative humidity.
      4) 3 hours decrease from 140 degrees F to 0 degrees F, ambient humidity.
   uu. Break glass by springloaded prick punch at midpoint of either vertical edge.
   vv. After breaking glass, subject it to pressure of 4 lbf per sq. ft. for 5 minutes to simulate wind load.
   ww. Inorganic Opacifier: Provide polyethylene opacifier where no insulation and other backing material is applied directly to spandrel glass. Use polyester where direct attachment does occur.

xx. Fallout Resistance: Provide spandrel units identical to those passing fallout resistance test for spandrel glass specified in ASTM C1048.

J. Silicone Coated Spandrel Glass: ASTM C1048, Type I, Condition C, Quality-Q3.

K. Reflective Coated Spandrel Glass: ASTM C1376, Kind CS.

L. Glass Film Overlay: Translucent, dimensionally stable, cast PVC film, 2 mil (0.05 mm) minimum thickness, with pressure sensitive, clear adhesive back for adhering to glass and releasable protective backing.

2.2 LAMINATED GLASS

A. ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation:
1. Construction: Laminate glass with cast in place and cured transparent resin interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Thickness: 0.090 inch (2.29 mm).
4. Interlayer Color: Clear unless otherwise indicated.

B. Windborne Debris Impact Resistant Laminated Glass: Comply with requirements for laminated glass except laminate glass with ionomeric polymer interlayer to comply with interlayer manufacturer's written instructions:

2.3 INSULATING GLASS

A. Factory assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

B. Performance Properties:
1. Basis of Design Product: Vitro Architectural Glass: Tint Color **Solargray**
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 1/4 inch (6 mm).
4. Outdoor Lite: Fully tempered float glass.
5. Interspace Content: Air.
6. Indoor Lite: Fully tempered float glass.
7. Safety glazing required.

C. Sealing System:
1. Dual seal, with polyisobutylene and silicone primary and secondary sealants:
yy. Spacer: Aluminum with black, color anodic finish. Thermally broken aluminum.
zz. Manufacturers: Subject to compliance with requirements, provide products by Technoform Glass Insulation NA, Inc.
aaa. Desiccant: Molecular sieve or silica gel, or a blend of both.

D. Fire Protection Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire protection ratings indicated, based on positive pressure testing according to NFPA 257 or UL 9, including the hose stream test, and complying with NFPA 80. For ratings 60 minutes or greater, glazing shall meet the test requirements of ASTM E119 or UL 263.

E. Fire Protection Rated Glazing Labeling: Permanently mark fire protection rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction indicating

manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 degrees F (250 degrees C) temperature rise limitation; and the fire resistance rating in minutes.

F. Film Faced Ceramic Glazing: Clear, ceramic flat glass; 5 mm thickness; faced on one surface with a clear glazing film; and complying with 16 CFR 1201, Category II.

2.4 GLASS FILM

A. Performance Requirements:
   1. Scratch resistant coating that, after fully cured, facilitates cleaning without damaging or scratching film.
   2. Optical Distortion: When viewed from a distance of 10 feet at angles up to 45 degrees from either side of the glass, there is no discernable distortion.
   3. Edges: Seal edges except when the film is applied with a lacquer that prevents moisture or free water from penetrating between the film and the glass.

B. Provide coating with uniform finish, without noticeable pin holes, streaks, thin spots, scratches, or banding:
   1. Light Transmission:
      bbb. Maximum Variation across Width and Length: Not to exceed 1 percent.
      ccc. Variation in Transmission across Width and Length: Not to exceed 2 percent.

C. Rate of Change of Total Transmission across Width and Length: Not to exceed 1 percent in 4 inches.

2.5 GLAZING ACCESSORIES

A. Compatibility: Provide glazing sealants compatible with one another and with other materials in contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of service and application, demonstrated by sealant manufacturer based on testing and field experience.

B. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

C. Colors of Exposed Glazing Sealants: Selected by Architect.

D. Glazing Sealant - Neutral curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      ddd. Dow Corning Corporation.
      eee. GE Construction Sealants; Momentive Performance Materials Inc.
      fff. May National Associates, Inc.; a subsidiary of Sika Corporation.
      ggg. Pecora Corporation.
      hhh. Sika Corporation.

E. Glazing Sealant - Neutral curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      iii. BASF Corporation; Construction Systems.

jjj. Dow Corning Corporation.
kkk. GE Construction Sealants; Momentive Performance Materials Inc.
lll. May National Associates, Inc.; a subsidiary of Sika Corporation.
mmm. Pecora Corporation.
nnn. Polymeric Systems, Inc.
ooo. Sika Corporation.

F. Glazing Sealant - Neutral curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use NT:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
ppp. Bostik, Inc.
qqq. Dow Corning Corporation.
rrr. GE Construction Sealants; Momentive Performance Materials Inc.
sss. May National Associates, Inc.; a subsidiary of Sika Corporation.
ttt. Polymeric Systems, Inc.
uuu. Schnee-Morehead, Inc., an ITW company.
vvv. Sika Corporation.

G. Glazing Sealant - Acid curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use NT:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
www. BASF Corporation; Construction Systems.
xxx. Bostik, Inc.
yyy. Dow Corning Corporation.
zzz. GE Construction Sealants; Momentive Performance Materials Inc.
aaaa. May National Associates, Inc.; a subsidiary of Sika Corporation.
bbbb. Pecora Corporation.
cccc. Polymeric Systems, Inc.
dddd. Schnee-Morehead, Inc., an ITW company.
eeee. Sika Corporation.

H. Glazing Sealants for Fire rated Glazing Products - Neutral curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
ffff. Dow Corning Corporation.
gggg. GE Construction Sealants; Momentive Performance Materials Inc.
2. Colors of Exposed Glazing Sealants: Selected by Architect.

I. Back Bedding Mastic Glazing Tapes:
1. Preformed, butyl based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
hhhh. Tape, where indicated.
iiii. Tape, for glazing applications in which tape is subject to continuous pressure.
jjjj. Tape, for glazing applications in which tape is not subject to continuous pressure.

J. Expanded Cellular Glazing Tapes:
1. Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
kkkk. Type 1, for glazing applications in which tape acts as the primary sealant.

lll. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

K. Miscellaneous Glazing Accessories:
1. Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with proven record of compatibility with surfaces contacted in installation:
mmmm. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
nnnn. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
oooo. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
pppp. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
qqqq. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
rrrr. Perimeter Insulation for Fire Resistive Glazing: Product approved by testing agency listed and labeled fire resistant glazing product with which it is used for application and fire protection rating indicated.

2.6 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements:
1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components:
ssss. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.
2. Edge and Surface Conditions: Comply with the recommendations of AAMA *Structural Properties of Glass* for clean cut edges, except comply with manufacturer's recommendations.
3. Exposed Glass Edges and Surface Condition: Finish edges flat with an arrissed edge profile (small bevel of uniform width not exceeding 1.5 mm at an angle of approximately 45 degrees to the surface of the glass) with polished (surface is reflective in appearance similar to the major surface of the glass) surface.

B. Cutting: Wheel cut or sawed edges and seamed at manufacturer's option. For site cut glass, provide glass 2 inches (50.8 mm) larger than required in both dimensions to facilitate cutting of clean cut edges without the necessity of seaming or nipping. Do not cut, seam, nip or abrade heat treated glass.

C. Butt Glazing: Clean cut or flat grind vertical edges of butt glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

D. Edges: Grind smooth and polish exposed glass edges and corners.

2.7 INSULATED METAL INFILL PANELS – SP1

A. Metal Composite Material Wall Panel System:
1. Basis of Design:
tttt. Product/Manufacturer: **8200 System as manufactured by NOW Specialties Inc.,**

Carrollton, Texas 75006:

1) Other manufacturers listed below are to provide factory-formed and assembled, metal composite material panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation with existing aluminum storefront system and new aluminum storefront system. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
2) Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a) Alucobond, manufactured by 3A Composites USA, Inc., Benton, KY 42025.
   b) Alpolic, Mitsubishi Plastics Composites America, Inc., Chesapeake, VA 23320
   c) Reynobond, Alcoa Architectural Products, Eastman GA 31023.

B. Composite Panels:
   1. Aluminum-faced panel with thermoplastic core:
      uuuu. Overall Panel thickness: 1 inch.
      vvvv. Aluminum-Face: 0.0197 inches, with strippable protective film. Protective film: heavy and opaque if required to indicate finish grain direction.
      wwww. Aluminum Backer Sheet thickness: 0.0197 inches.
      xxxx. Aluminum Alloy: ASTM B209 3003 at coated finish.

C. Composition:
   1. Two sheets of aluminum sandwiching core of extruded thermoplastic material formed in continuous process with no glues or adhesives between dissimilar materials. Products laminated sheet by sheet or in batch process using glues or adhesives between materials shall not be acceptable:
      yyyy. Fire-Retardant Core (where required by CBC): Complies with NFPA 285, with the following surface-burning characteristics as determined by testing identical products per ASTM E84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
         1) Flame-Spread Index: 15 or less.
         2) Smoke-Developed Index: 105 or less.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Environmental Limitations:
   1. Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes:
      zzzz. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degrees F (4.4 degrees C).

B. Field Measurements: Verify actual dimensions of openings and construction contiguous with decorative glass by field measurements before fabrication.

3.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

3.3 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation after correcting unsatisfactory conditions.

3.4 PREPARATION

A. Clean glazing channels and framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates:
   1. Comply with manufacturer instructions for wiping of surfaces immediately before application of primers.
   2. Wipe metal surfaces with IPA (isopropyl alcohol) unless otherwise required by compatibility and adhesion testing results.

B. Inspect each piece of glass immediately before installation. Do not install pieces improperly sized or with damaged edges, scratches, abrasion, or evidence damage. Remove labels from glass immediately after installation.

C. Examine glazing units to locate exterior and interior surfaces. Label or mark units so exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

D. Seal vent (breather or capillary) tubes in insulating glass units in accordance with insulating glass manufacturer written recommendations.

E. Glass Film Preparation:
   1. Remove particulate matter on the glass surface using a scraping blade.
   2. Place an absorbent towel on window sill or sash to absorb moisture generated by the film application.

3.5 GLAZING

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

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

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

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

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

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm):
1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8 inch (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

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

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

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement:
1. Square cut wedge shaped gaskets at corners and install gaskets as recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

K. Tape Glazing:
1. Position tapes on fixed stops so that, when compressed by glass, the exposed edges are flush with or protrude slightly above sightline of stops:
aaaaa. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make tapes fit opening.
bbbbb. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
ccccc. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
ddddd. Do not remove release paper from tape until right before each glazing unit is installed.
eeeee. Apply heel bead of elastomeric sealant.
fffff. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
ggggg. Apply cap bead of elastomeric sealant over exposed edge of tape.

L. Gasket Glazing (Dry):
1. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation:
hhhhh. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
iiiii. Installation with Drive in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing

bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

jjjjj. Installation with Pressure Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

kkkkk. Install gaskets to protrude past face of glazing stops.

M. Sealant Glazing (Wet):

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

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

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

N. Erection Tolerances:

1. Maximum Deviation from Vertical: 1/8 inch in any story and 1/4 inch in any 45 foot run.
2. Maximum Deviation from Horizontal: 1/8 inch in any 30 foot run.
3. Maximum Deviation from True Alignment: 1/32 inch for any two (2) abutting units. Allow no edge projections.
4. Maximum Joint Gap: 1/32 inch.

O. Insulating-Glass Unit(s)

1. Double Glazed Tinted Solar Control Insulating Glass Unit [Solarban® 60 on Solargray® 6mm (2) | Air 1/2" (12.7mm) | Clear 6mm:

nnnnn. Conformance: ASTM E2190.

ooooo. Outdoor Lite: Solargray® Tinted Float Glass as manufactured by Vitro Architectural Glass:

1) Conformance: ASTM C1036, Type 1, Class 2, Quality q3.
2) Glass Thickness: 6mm (1/4")
3) Magnetic Sputter Vacuum Deposition Coating (MSVD): ASTM C1376.
4) Coating: Solarban® 60 on Surface # 2
5) Heat-Treatment: [None] [Heat-strengthened, ASTM C1048, Kind HS] [Tempered; ASTM C1048, Kind FT; Safety Glazing meets ANSI Z97.1 and CPSC 16CFR-1201] Specifier Notes: Specify the method of heat treatment. Vitro recommends that heat strengthened glass be specified and used, except where tempered glass is mandated for safety or other purposes by code.

ppppp. Interspace Content: Air 1/2" (12.7mm)

qqqqq. Indoor Lite:

1) Clear float glass as manufactured by Vitro Architectural Glass:
   a) Conformance: ASTM C1036, Type 1, Class 1, Quality q3.
   b) Heat-Treatment: [None] [Heat-strengthened, ASTM C1048, Kind HS] [Tempered; ASTM C1048, Kind FT; Safety Glazing meets ANSI Z97.1 and CPSC 16CFR-1201] Specifier Notes: Specify the method of heat treatment. Vitro recommends that heat strengthened glass be specified and used, except where tempered glass is mandated for safety or other purposes by code.
   c) Glass Thickness: 6mm (1/4")

rrrrr. Performance Requirements:
2) Visible Light Transmittance: 35 percent minimum.
3) Winter Nighttime U-Factor: 0.29 (Btu/hr*ft2*°F) maximum.
4) Summer daytime U-Factor: 0.27 (Btu/hr*ft2*°F) maximum.
5) Shading Coefficient: 0.29 maximum.
6) Solar Heat Gain Coefficient: 0.25 maximum.
7) Outdoor Visible Light Reflectance: 9 percent maximum.

3.6 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains:
1. If contaminating substances come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

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

PART 4 SCHEDULE

4.1 GLAZING SCHEDULE

A. G-1 Insulated Glass: 1 inch (25 mm) sealed insulated unit consisting of an exterior lite of 1/4 inch (6 mm) low-e tinted tempered float glass, 1/2 inch gas filled air space, and 1/4 inch (6 mm) clear tempered float glass interior lite.

B. G-2 Tinted Tempered Glass: 1/4 inch (6 mm) tinted tempered glass.

C. G-3 Clear Tempered Glass: 1/4 inch (6 mm) clear tempered float glass.

D. G-4 Annealed Float Glass: Not Used.

E. G-7 Laminated Glass: 6 mm (1/4 inch) clear laminated safety glass comprised of two 1/8 inch (3 mm) clear float glass lites, laminated to each side of a clear 0.030 inch thick polyvinyl butyral (PVB) interlayer.

END OF SECTION 08 80 00

SECTION 09 21 16 GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Gypsum Board.
2. Reinforced Gypsum Board Sheathing (Tile Backer Board).
3. Cementitious Backer Units.
4. Impact Resistant Gypsum Board.
5. Accessories necessary for a complete installation.

B. Related Sections:
1. Section 05 50 00: Metal Fabrications.
2. Section 06 10 00: Rough Carpentry.
3. Section 08 11 13: Hollow Metal Doors and Frames.
4. Section 08 51 00: Aluminum Windows.
5. Section 09 30 00: Tiling.
6. Section 09 90 00: Painting and Coating.

1.3 PERFORMANCE REQUIREMENTS

A. Comply with manufacturer's load tables and the following design pressures and deflections:
1. Stairs, Elevator Hoistways, and Vertical Shafts: 1/120 at 10 psf.
2. Ground Floor Lobbies: 1/120 at 15 psf.
3. Partitions Receiving Lath and Plaster, or Plaster Veneer: 1/360 at 15 psf.
4. Partitions Receiving Monitors, Televisions, Heavy Audio/Visual Equipment: 1/360 at 15 psf.
5. Typical Partitions: 1/240 at 5 psf.
6. Other Partitions: 1/240 at 5 psf.
7. Maximum Deflection:
   a. L/240 at 5 lbf per sq. ft.
   b. L/120 at 5 lbf per sq. ft.
   c. L/120 at 7.5 lbf per sq. ft.
   d. L/120 at 10 lbf per sq. ft.

B. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

C. STC Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

1.4 SUBMITTALS

A. Product Data: Submit For each type of drywall including calculations for loadings and stresses of exterior walls and specially fabricated framing based on manufacturer’s load

tables.

B. Shop Drawings: Indicate locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

C. Samples:
1. Trim Accessories: Full size Sample in 12-inch (300 mm) long length for each trim accessory indicated.
2. Textured Finishes: 12 inches by 12 inches (300 mm by 300 mm) for each textured finish indicated and on same backing indicated for Work.

D. Calculations: Submit calculations verifying steel partition stud minimum base metal thickness and depth compliance with Code and ASTM C645 for height, load, and deflection.

E. Evaluation Reports: ICC-ES reports for dimpled steel studs and runners and firestop tracks.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
   a. CBC– Chapter 7, Fire Resistant Materials and Construction
   b. CBC – Chapter 19A, Concrete
   c. CBC – Chapter 25, Gypsum Board and Plaster.
2. Division of the State Architect, Interpretation of Regulations (DSA-IR):
   a. DSA-IR 25-3, Drywall Ceiling Suspension Conventional Construction-One Layer.
   b. DSA-IR 25-2.13, Metal Suspension Systems for Lay in Panel Ceilings.
3. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
4. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. Single Source Responsibility:
1. Wood Framing Members: Refer to drawing S0.03 Standard General Notes.
2. Steel Framing Members: Obtain steel framing members from single manufacturer.
3. Panel Products: Obtain each type of gypsum board and other panel products from single manufacturer.
4. Finishing Materials: To the extent possible, obtain finishing materials from same manufacturer supplying gypsum board products. When not possible, obtain materials from manufacturer acceptable to gypsum board manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   1. Gypsum Board.
   2. Cementitious Board:
      a. USG Corporation; Durock Brand Cement Board.

B. Gypsum Board - ASTM C1396/C1396M, applicable to type of gypsum board indicated and whichever is more stringent:
   1. Core - Use Type X throughout:
      a. Thickness: 5/8 inch (15.9 mm).
      b. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
   2. Ceiling Type - Manufactured for sag resistance:
      a. Thickness: 1/2 inch (13mm).
      b. Long Edges: Tapered.
   3. Moisture and Mold Resistant Type - Type X with moisture and mold resistant core and surfaces. Core:
      a. Thickness: 5/8 inch (15.9 mm).
      b. Long Edges: Tapered.

C. Impact Resistant Gypsum Board - ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M:
   1. Core and Thickness: 5/8 inch (15.9 mm), Type X.
   2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
   3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
   4. Soft Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
   5. Hard Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements according to test in Annex A1.
   6. Long Edges: Tapered.
   7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

D. Acoustically Enhanced Gypsum Board - ASTM C1396/C1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. National Gypsum Company.
      b. Quiet Solution.
   2. Core: 1-3/8 inch (35 mm), regular type.
   3. Long Edges: Tapered.

E. Reinforced Gypsum Sheathing (Tile Backer Board) - ASTM C1278/C1278M, standard edges. Cellulose fiber reinforced panels may be used in lieu of cementitious board:
   1. Core and Thickness: 1/2 inch (12.7 mm) or 5/8 inch (15.9 mm) to match conditions, Type X.
   2. Long Edge: Tapered.
   3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

F. Glass Mat Gypsum Sheathing Board - ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with standard edges:
   1. Core: Type X
   2. Thickness: 5/8 inch (15.9 mm).
   3. Size: 48 inches by 96 inches (1219 mm by 2438 mm).
   4. Long Edges: Tapered.

G. Cementitious Backer Units - ASTM C1288 or ASTM C1325:
   1. Thickness: 1/2 inch (12.7 mm) and 5/8 inch (15.9 mm) to match conditions.
   2. Long Edges: Standard.
   3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

H. Exterior Gypsum Board For Ceilings and Soffits:
   1. Glass Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with standard edges.
   2. Core: 5/8 inch (15.9 mm), Type X.

I. Exterior Trim - ASTM C1047, hot dip galvanized steel sheet, plastic, or rolled zinc:
   1. Shapes:
      a. Cornerbead.
      b. LC Bead: J shaped; exposed long flange receives joint compound.
      c. Expansion (Control) Joint: One piece, rolled zinc with V shaped slot and removable strip covering slot opening.

J. Interior Trim - ASTM C1047, galvanized or aluminum coated steel sheet, rolled zinc, plastic, or paper faced galvanized steel sheet:
   1. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC Bead: J shaped; exposed long flange receives joint compound.
      d. L Bead: L shaped; exposed long flange receives joint compound.
      e. U Bead: J shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.

   2. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Pittcon Industries.
      b. Fry Reglet Corp.
      c. Gordon, Inc.

K. Continuous Corner - Extruded Aluminum, continuous integral fin for surface contact with gypsum board; 7/8-inch (22 mm) wide, tapered to edge; punched with holes staggered to accept screw fastening. Prime with corrosion resistant primer. Provide Pittcon Softforms (Basis of Design) or Schluter:
   1. Subject to compliance with requirements, provide basis of design or comparable by one of the following:
      a. Pittcon Industries.
      b. Fry Reglet Corporation.
      c. Schluter.

L. Joint Treatment - ASTM C475/C475M:
   1. Joint Tape:
      a. Exterior Gypsum Soffit Board: USG Sheetrock Brand Paper Tape.
      b. Glass Mat Gypsum Sheathing Board Exterior Applications: USG Sheetrock Brand Paper Tape.
      c. Interior Gypsum Board: USG Sheetrock Brand Paper Tape.
      d. Cementitious Board: USG Durock Tape.
   2. Joint Compound:
      a. Gypsum Board – Prefilling - At open joints, rounded or beveled panel edges, and damaged surface areas, use setting type taping compound: USG Sheetrock Brand Easy Sand Setting-Type Joint Compound:
         1) Embedding and First Coat - For embedding tape and first coat on joints, fasteners, and trim flanges, use setting type taping compound. USG

Sheetrock Brand All Purpose Joint Compound:
a) Use setting type compound for installing paper faced metal trim accessories: USG Sheetrock Brand All Purpose Joint Compound.
2) Fill Coat: For second coat, use setting type, sandable topping compound: USG Sheetrock Brand Topping Joint Compound.
3) Finish Coat: For third coat, use setting type, sandable topping compound: USG Sheetrock Brand Topping Joint Compound.
4) Skim Coat: For final coat of Level 4 finish, use setting type, sandable topping compound: USG Sheetrock Brand Topping Joint Compound.

b. Cementitious Units: USG Sheetrock Brand Easy Sand Setting-Type Joint Compound.
c. Tile Backing Panels: USG Sheetrock Brand Easy Sand Setting-Type Joint Compound.
d. Water Resistant Gypsum Backing Board: Use setting type taping compound and setting-type, sandable topping compound: USG Sheetrock Brand Easy Sand Setting-Type Joint Compound.
e. Glass Mat Sheathing Board: USG Sheetrock Brand Easy Sand Setting-Type Joint Compound.

M. Auxiliary Gypsum Materials - Comply with referenced installation standards and manufacturer's written recommendations:
1. Steel Drill Screws: ASTM C1002, use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112-inch (0.84 to 2.84 mm) thick.
2. Sound Attenuation Blankets:
a. ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool:
1) Fire Resistance Rated Assemblies: Comply with mineral-fiber requirements of assembly.
3. Acoustical Sealant:
a. Nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90:
1) USG Corporation; Sheetrock Brand Acoustical Sealant

N. Ceiling Suspension Components:
1. Tie Wire Ceiling Grid:
a. USG Corporation; Drywall Suspension System.
b. ASTM A641/A641M, 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: Postinstalled, chemical anchor or postinstalled, expansion anchor 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 E488 by an independent testing agency.
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 E1190 by an independent testing agency.
3. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12 mm) diameter.
4. Carrying Channels: Cold rolled, commercial steel sheet with base metal thickness of 0.0538-inch (1.37 mm) and minimum 1/2-inch (12.7 mm) wide flanges. Depth

indicated on Drawings.

5. 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. Hat Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch (22.2 mm) deep; Minimum base metal thickness of 0.0312 inch (0.79 mm).
6. Resilient Furring Channels: 1/2 inch (12.7 mm) deep members designed to reduce sound transmission. Configuration: Hat shaped.
7. Grid Suspension System for Ceilings: ASTM C645, direct hung system composed of main beams and cross furring members that interlock.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Comply with ASTM C840 for gypsum board manufacturer's written instructions, whichever are more stringent:
      a. Do not install paper faced gypsum panels until installation areas are enclosed and conditioned.

B. Room Temperatures: Maintain minimum 40 degrees F (4 degrees C). For adhesive attachment and finishing of gypsum board, maintain minimum 50 degrees F (10 degrees C) for 48 hours before application and continuously after until dry. Do not exceed 95 degrees F (35 degrees C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

D. Do not install panels that are wet, moisture damaged, and mold damaged:
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.2 EXAMINATION

A. Examine areas and substrates including welded hollow metal frames, cast in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.4 INSTALLATION

A. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.

B. Gypsum Board Assemblies: Comply with requirements in ASTM C840 applicable to framing

installation.

C. Suspension System:
1. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement:
   a. Suspend hangers from building structure:
      1) Install hangers plumb and free from contact with insulation or objects within ceiling plenum that are not part of supporting structural or suspension system. Splay hangers where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
      2) 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:
         a) Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
      3) Do not attach hangers to steel roof deck.
      4) Do not attach hangers to permanent metal forms. Furnish cast in place hanger inserts that extend through forms.
      5) Do not attach hangers to rolled in hanger tabs of composite steel floor deck.
      6) Do not connect or suspend steel framing from ducts, pipes, or conduit.
   b. Fire Resistance Rated Assemblies: Wire tie furring channels to supports.
   c. 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. 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.

E. Sound Insulation: Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

F. Gypsum Panels:
1. Comply with ASTM C840. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged:
   a. 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.
   b. 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.
   c. 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.
   d. Form control and expansion joints with space between edges of adjoining gypsum panels.
   e. Cover both faces of support framing with gypsum panels in concealed spaces, except in chases braced internally:
      1) Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.

2) Fit gypsum panels around ducts, pipes, and conduits.
3) Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4-inch to 3/8-inch (6.4 mm to 9.5 mm) wide joints to install sealant.

f. Isolate perimeter of gypsum board applied to nonload bearing partitions at structural abutments, except floors. Provide 1/4-inch to 1/2-inch (6.4mm to 12.7mm) 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.
g. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Gypsum Board:
1. Install interior gypsum board where indicated on drawings:
a. Single Layer Application:
1) On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2) On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire resistance rated assembly, and minimize end joints. Stagger abutting end joints not less than one framing member in alternate courses of panels.
3) Fastening Methods: Apply gypsum panels to supports with steel drill screws.
2. Multilayer Application:
a. 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.
b. On Z shaped 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.
c. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

H. Backing Panels:
1. Cementitious Backer Units: ANSI A108.11; install where indicated with 1/4-inch (6.4 mm) gap where panels abut other construction or penetrations. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

I. Exterior Gypsum Board 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.

J. Trim Accessories:
1. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Attach trim according to manufacturer's written instructions:
a. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
b. Exterior Trim: Install in the following locations:

1) Cornerbead: Use at outside corners.
2) LC Bead: Use at exposed panel edges.

c. Interior Trim - Install in the following locations:
1) Cornerbead: Use at outside corners, unless otherwise indicated.
2) Bullnose Bead: Use at outside corners.
3) LC Bead: Use at exposed panel edges.
4) L Bead: Use where indicated or necessary.
5) U Bead: Use at exposed panel edges.

K. Gypsum Board Finishing:
1. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces:
a. Prefill open joints, rounded or beveled edges, and damaged surface areas.
b. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
c. Gypsum Board Finish Levels - Finish panels to levels indicated below and according to ASTM C840:
1) Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2) Level 2: Panels that are substrate for tile.
3) Level 3: Surfaces be coated with drywall primer prior to final finishes. Heavy or medium texture finishes before final painting, or where heavy-grade wall coverings are to be applied as the final decoration. This level of finish is not recommended where smooth painted surfaces, or light to medium weight wall coverings as specified.
4) Level 4: For surfaces receiving wall covering and flat paints.
5) Level 5: For surfaces receiving gloss or semigloss paint and surfaces subjected to severe lighting. To be used in Kitchen areas and food service areas only.
d. Glass Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
e. Glass Mat Faced Panels: Finish according to manufacturer's written instructions.

L. Installation Tolerances:
1. Suspension System: 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.
2. Installation Tolerances, Suspension System: Install suspension systems 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.

3.5 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged:
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 21 16

SECTION 09 24 00 CEMENT PLASTERING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Exterior plasterwork (stucco).
2. Metal framing and accessories.
3. Metal lath and furring.
4. Accessories necessary for a complete installation.

B. Related Sections:
1. Section 05 50 00: Metal Fabrications.
2. Section 06 10 00: Rough Carpentry.
3. Section 07 92 00: Joint Sealants.
4. Section 09 21 16: Gypsum Board Assemblies.
5. Section 09 90 00: Painting and Coating.
6. Section 09 96 53: Elastomeric Coating.

1.3 SUBMITTALS

A. Product Data: Submit technical data for product and accessory, including construction details and material descriptions.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Building Code:
a. Comply with applicable provisions of the CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
1) CBC 2019, 2507.3 Attachment requirements.
2. Fire Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E119 by a qualified testing agency.

B. Pre-installation Conference: Conduct conference at site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver cementitious materials in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.

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

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers are subject to compliance with requirements; provide products of one of the following:
   1. Metal Lath and Accessories:
      a. Alabama Metal Industries.
      b. CEMCO.
      c. ClarkDietrich Building Systems.
      d. Marino/WARE.
      e. Phillips Manufacturing.
   2. Wire Fabric Lath:
      a. Davis Wire.
      b. Jaenson Wire Company.
      c. Keystone Steel and Wire Co.
      d. K-Lath.
   3. Plastic Accessories:
      a. Alabama Metal Industries.
      b. Phillips manufacturing.
      c. Plastic Components.
      d. Vinyl Corp.
   4. Ready Mixed Finish Coat Plaster:
      a. Omega Products International.
      b. California Stucco Product.
      c. El Rey Solutions.
      d. Florida Stucco.
      e. Quikrete.
      f. Shamrock Stucco.
   5. Acrylic Based Finish Coat:
      a. California Stucco Product.
      b. Dryvit Systems.
      c. El Rey Solutions.
      d. Finestone, BASF Corp.
      e. Omega Products International.
      f. Senergy, BASF Corp.
      g. Sto Corp.

B. Cold Formed Steel Framing: Refer to Sections 05 50 00 for steel Fabrications and 09 21 16 for Gypsum Board Assemblies framing for exterior plaster.

C. Steel Studs and Runners: Refer to Section 09 21 16 for steel partition framing for interior plaster.

D. Soffit Framing: Refer to Sections 06 10 00 and 09 21 16.

E. Metal Lath:
   1. Expanded Metal Lath:
      a. ASTM C847, cold rolled carbon steel sheet with ASTM A653/A653M, G60 (Z180), hot dip galvanized zinc coating:
         1) Diamond Mesh Lath: Self furring, 3.4 lb/sq. yd. (1.8 kg/sq. m).
         2) Comply with DSA IR 25-4 for the installation of Self-Furring Metal Lath.
   2. Paper Backing:
      a. FS UU-B-790a, Type I, Grade B, Style 1a vapor retardant paper:
         1) Provide paper backed lath at exterior locations.
   3. Building Wrap:

a. Spun-bounded high density polyethylene fibers. No binders or fillers. As manufactured by: Dupont Tyvek Commercial Type D Building Wrap or approved equal. Install per manufacturer's instructions (Installation to meet CBC 2510.6).

F. Accessories:
1. Comply with ASTM C1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required:
   a. Metal Accessories:
      1) Foundation Weep Screed: Fabricated from hot dip galvanized steel sheet, ASTM A653/A653M, G60 (Z180) zinc coating.
      2) Cornerite: Fabricated from metal lath with ASTM A653/A653M, G60 (Z180), hot dip galvanized-zinc coating.
      3) Outside Corner Reinforcement: Fabricated from metal lath with ASTM A653/A653M, G60 (Z180), hot dip galvanized zinc coating.
      4) Cornerbeads - Fabricated from zinc or zinc coated (galvanized) steel:
         a) Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
         b) Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
      5) Casing Beads: Fabricated from zinc or zinc coated (galvanized) steel; square edged style; with expanded flanges.
      6) 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.
      7) Expansion Joints: Fabricated from zinc or zinc coated (galvanized) steel; folded pair of unperforated screeds in M shaped configuration; with expanded flanges.
      8) Two Piece Expansion Joints: Fabricated from zinc or zinc coated (galvanized) steel; formed to produce slip joint and square edged reveal adjustable from 1/4 to 5/8-inch (6 to 16 mm) wide; with perforated flanges.
   b. Plastic Accessories - Manufactured from high impact PVC:
      1) Cornerbeads - With perforated flanges:
         a) Smallnose cornerbead; use unless otherwise indicated.
         b) Bullnose cornerbead, radius 3/4 inch (19 mm) minimum; use at locations indicated on Drawings.
      2) Casing Beads - With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated:
         a) Square edge style, unless otherwise indicated.
         b) Bullnose style, radius 3/4 inch (19 mm) minimum; use at locations indicated on Drawings.
      3) 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.
      4) Expansion Joints: Two piece type, formed to produce slip joint and square edged 1/2 inch (13 mm) wide reveal; with perforated concealed flanges, unless otherwise detailed or noted in Section 07 95 00: Expansion Control.
   c. Aluminum Reveals and Moldings, where applicable:
      1) Manufacturer: Fry Reglet
      2) Width: 2 inch
      3) Material: Extruded 6063 T5 Aluminum
      4) Finish: Kynar - Silver Satin.
      5) Provide all required accessories, moldings, and prefabricated intersection/corner transition pieces for a complete installation.
   d. Aluminum Soffit Vents:
      1) Manufacturer: Fry Reglet

2) Width: 3 inch
3) Material: Extruded 6063 T5 Aluminum
4) Finish: Kynar - Silver Satin
5) Provide all required accessories, moldings, and prefabricated intersection/corner transition pieces for a complete installation.

G. 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. Fiber for Base Coat: Alkaline resistant glass or polypropylene fibers, 1/2-inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.
3. Bonding Compound: ASTM C932.
4. Fasteners for Attaching Metal Lath to Substrates: ASTM C1063.
5. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21 mm) diameter unless otherwise indicated.
6. Building Wrap: Spun-bounded high density polyethylene fibers. No binders or fillers. As manufactured by: Dupont Tyvek Commercial Type D Building Wrap or approved equal. Install per manufacturer's instructions.
7. Sound Attenuation Blankets:
   a. ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool:
      1) Fire Resistance Rated Assemblies: Comply with mineral-fiber requirements of assembly.

H. Plaster Materials:
1. Portland Cement - ASTM C150/C150M, Type I or II:
   a. Color for Finish Coats: Match existing.
2. Colorants for Job Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color selected by Architect.
3. Lime: ASTM C206, Type S; or ASTM C207, Type S.
4. Sand Aggregate - ASTM C897:
   a. Color for Job Mixed Finish Coats: White.
5. Exposed Aggregates for Finish Coats: Match existing.
6. Ready Mixed Finish Coat Plaster:
   a. Mill mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
      1) Color: Selected by Architect.
7. Acrylic Based Finish Coatings:
   a. Factory mixed acrylic emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic based finishes:
      1) Color: Selected by Architect.

2.2 PLASTER MIXES

A. Comply with ASTM C926 for applications indicated:
1. 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.

B. Base Coat Mixes for Use over Metal Lath:
1. Scratch and brown coats for three coat plasterwork:
   a. Portland Cement Mix:

1) Scratch Coat: 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.
2) Brown Coat: For cementitious material, mix 1-part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Job Mixed Finish Coat Mixes:
1. Portland Cement Mix: For cementitious materials, mix 1-part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

D. Factory Prepared Finish Coat Mixes: For ready mixed finish coat plasters or acrylic based finish coatings, comply with manufacturer's written instructions.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Comply with applicable requirements of ASTM C926.

B. Environmental Requirements: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.

C. Cold Weather Requirements: Provide heat and protection, temporary or permanent, as required to protect each coat of plaster from freezing for at least 24 hours after application. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.

D. Warm Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

E. Ventilation: Provide natural or mechanical means of ventilation to properly dry interior spaces after portland cement plaster has cured.

F. Exterior Plasterwork:
1. 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.
2. Apply plaster when ambient temperature is greater than 40 degrees F (4.4 degrees C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

G. Protect contiguous Work from soiling and moisture deterioration caused by plastering. Provide temporary covering and take precautions necessary to minimize spattering of plaster on adjacent Work.

H. Factory Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

3.2 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

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

B. Prepare smooth, solid substrates for plaster according to ASTM C926.

3.4 INSTALLATION

A. Metal Lath:
   1. Install according to ASTM C1063:
      a. Partition Framing and Vertical Furring: Flat diamond mesh lath.
      b. Horizontal Framing: Flat diamond mesh lath.

B. Accessories:
   1. Install according to ASTM C1063 and at locations indicated on Drawings:
      a. Reinforcement for External (Outside) Corners:
         1) Install [lath type, external corner reinforcement] [cornerbead] at exterior locations.
         2) Install cornerbead at interior locations.
      b. Control Joints - Locate as approved by Architect for visual effect:
         1) As required to delineate plasterwork into areas (panels) of the following maximum sizes:
            a) Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
            b) Horizontal and Other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
         2) At distances between control joints of not greater than 18 feet (5.5 m) o.c.
         3) As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
         4) Where control joints occur in surface of construction directly behind plaster.
         5) 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.

3.5 PLASTER APPLICATION

A. Comply with ASTM C926:
   1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6 mm in 3 m) from a true plane in finished plaster surfaces when measured by a 10-foot (3-m) straightedge placed on surface.
   2. 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.
   3. Provide plaster surfaces ready to receive field applied finishes indicated.

B. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8 inch in 10 feet (3 mm in 3 m) from a true plane in finished plaster surfaces, measured by a 10 foot (3m) straightedge placed at any location on surface.

C. Walls; Base Coat Mixes for Use over Metal Lath:
   1. For scratch and brown coats, for three coat plasterwork with 3/4 inch (19 mm) total

thickness:
a. Portland cement mixes.

D. Plaster Finish Coats: Apply to provide dash finish.

E. Acrylic Based Finish Coatings (Contractor Option to Plaster Finish Coat): Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

F. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.

3.6 PLASTER REPAIRS

A. 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.

B. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other Work. Repair cracks and indented surfaces. Point up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace Work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.7 TOLERANCES

A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet (3mm in 3 m).

B. Maximum Variation from True Position: 1/8 inch (3mm).

3.8 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of Work after plastering is complete. 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.

B. Remove unused materials, containers, equipment, and plaster debris.

C. Protect plaster and maintain conditions ensuring finished plaster is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 24 00

SECTION 09 24 00 CEMENT PLASTERING (PATCH AND REPAIR)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
1. Exterior cement plaster repair.
2. Metal lath and furring.
3. Accessories necessary for a complete installation.

B. Related documents:
1. Section 01 33 00; Submittal Procedures.
2. Section 01 73 29; Cutting and Patching.
3. Section 02 41 19; Selective Demolition.
4. Section 06 10 00; Rough Carpentry.
5. Section 07 13 26; Self-Adhering Waterproofing
6. Section 07 62 00; Roof Related Flashing
7. Section 07 92 00; Joint Sealants.
8. Section 09 90 00; Painting and Coatings.

1.3 SUBMITTALS

A. Product Data: Submit technical data for product and accessory, including construction details and material descriptions.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Building Code: Comply with applicable provisions of the CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
2. Fire Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E 119 by a qualified testing agency.

B. Preinstallation Conference: Conduct conference at site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver cementitious materials in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.

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

1.6 PROJECT CONDITIONS

A. Comply with applicable requirements of ASTM C 926.

B. Environmental Requirements: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.

C. Cold Weather Requirements: Provide heat and protection, temporary or permanent, as required to protect each coat of plaster from freezing for at least 24 hours after application. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.

D. Warm Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

E. Exterior Plasterwork:
1. 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.
2. Apply plaster when ambient temperature is greater than 40 degrees F (4.4 degrees C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

F. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and take precautions necessary to minimize spattering of plaster on adjacent work.

G. Factory Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
1. Metal Lath and Accessories:
   a. Alabama Metal Industries (AMICO).
   b. CEMCO.
   c. ClarkDietrich Building Systems.
   d. Marino/WARE.
   e. Phillips Manufacturing.
2. Plastic Accessories:
   a. Alabama Metal Industries (AMICO).
   b. Phillips manufacturing.
   c. Plastic Components.
   d. Vinyl Corp.
3. Ready Mixed Finish Coat Plaster:
   a. California Stucco Product.
   b. El Rey Solutions.
   c. Omega Products International.

d. Quikrete.
e. Shamrock Stucco.

4. Acrylic Based Finish Coat:
   a. California Stucco Product.
   b. Dryvit Systems.
   c. El Rey Solutions.
   d. Finestone, BASF Corp.
   e. LaHabra, a brand of Parex USA, Inc.
   f. Omega Products International.
   g. Senergy, BASF Corp.
   h. Sto Corp.

B. Metal Lath:
   1. Expanded Metal Lath: ASTM C 847, cold rolled carbon steel sheet with ASTM A 653/A 653M, G60 (Z180), hot dip galvanized zinc coating.
      a. Diamond Mesh Lath: Self furring, 3.4 lb/sq. yd. (1.8 kg/sq. m).
      b. Comply with DSA IR 25-4 for the installation of Self-Furring Metal Lath.

C. Accessories: Comply with ASTM C 1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
   1. 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. Outside 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) Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
         2) Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
      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 adjustable from 1/4 to 5/8 inch (6 to 16 mm) wide; with perforated flanges.
   2. Plastic Accessories: Manufactured from high impact PVC.
      a. Cornerbeads: With perforated flanges.
         1) Smallnose cornerbead; use unless otherwise indicated.
         2) Bullnose cornerbead, radius 3/4 inch (19 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) Bullnose style, radius 3/4 inch (19 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 inch (25 mm) wide reveal; with perforated concealed flanges.

3. Aluminum Reveals and Moldings: Where applicable.
   a. Manufacturer: Fry Reglet
   b. Width: 2 inch
   c. Material: Extruded 6063 T5 Aluminum
   d. Finish: Kynar - Silver Satin.
   e. Provide all required accessories, moldings, and prefabricated intersection/corner transition pieces for a complete installation.
4. Aluminum Soffit Vents: Where applicable.
   a. Manufacturer: Fry Reglet
   b. Width: 3 inch
   c. Material: Extruded 6063 T5 Aluminum
   d. Finish: Kynar - Silver Satin
   e. Provide all required accessories, moldings, and prefabricated intersection/corner transition pieces for a complete installation.

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. Fiber for Base Coat: Alkaline resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.
3. Bonding Compound: ASTM C 932.
4. Fasteners for Attaching Metal Lath to Substrates: ASTM C 1063.
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 assembly.

E. Plaster Materials:
1. Portland Cement: ASTM C 150/C 150M, Type II.
   a. Color for Finish Coats: Integral color plaster shall match exterior paint color as indicated, provide sample/mock-up for approval by Architect.
2. Colorants for Job Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color selected by Architect.
3. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
4. Sand Aggregate: ASTM C 897.
   a. Color for Job Mixed Finish Coats: White**.**
5. Exposed Aggregates for Finish Coats: Match existing.
6. Ready Mixed Finish Coat Plaster: Mill mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
   a. Color: Integral color plaster shall match exterior paint color as indicated, provide sample/mock-up for approval by Architect.
7. Acrylic Based Finish Coatings: Factory mixed acrylic emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic based finishes.
   a. Color: Integral color plaster shall match exterior paint color as indicated, provide sample/mock-up for approval by Architect.

2.2 PLASTER MIXES

A. Comply with ASTM C 926 for applications indicated.
   1. 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.

B. Base Coat Mixes for Use over Metal Lath: Scratch and brown coats for three coat plasterwork:
   1. Portland Cement Mix:
      a. Scratch Coat: 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. Brown Coat: For cementitious material, mix 1 part portland cement and **3/4 to 1-1/2** parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Job Mixed Finish Coat Mixes:
   1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and **3/4 to 1-1/2** parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

D. Factory Prepared Finish Coat Mixes: For ready mixed finish coat plasters or acrylic based finish coatings, comply with manufacturer's written instructions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Remove plaster to nearest joint where possible. Saw cut joint for patch at location agreed upon with Architect prior to work.

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

C. Prepare smooth, solid substrates for plaster according to ASTM C 926.

3.3 INSTALLATION

A. Metal Lath: Install according to ASTM C 1063.
   1. Partition Framing and Vertical Furring: Flat diamond mesh lath.
   2. Horizontal Framing: Flat diamond mesh lath.

B. Accessories: Install according to ASTM C 1063 and at locations indicated on Drawings.
   1. Reinforcement for External (Outside) Corners:
      a. Install cornerbead at exterior corner locations.
      b. Install cornerbead at interior corner locations.
   2. Control Joints: Locate as approved by Architect for visual effect where not illustrated on drawings.
      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 12 feet 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. Where plasterwork repair involves any of the above referenced conditions.

3.4 PLASTER APPLICATION

A. Comply with ASTM C 926.
1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6 mm in 3 m) from a true plane in finished plaster surfaces when measured by a 10-foot (3-m) straightedge placed on surface.
2. 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.
3. Provide plaster surfaces ready to receive field applied finishes indicated.

B. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8 inch in 10 feet (3 mm in 3 m) from a true plane in finished plaster surfaces, measured by a 10 foot (3m) straightedge placed at any location on surface.

C. Walls; Base Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three coat plasterwork with 3/4 inch (19 mm) total thickness:
1. Portland cement mixes.

D. Plaster Finish Coats: Apply to provide dash finish.

E. Acrylic Based Finish Coatings (Contractor Option to Plaster Finish Coat): Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

F. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.

3.5 PLASTER REPAIRS

A. 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.

B. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.6 TOLERANCES

A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet (3mm in 3 m).

B. Maximum Variation from True Position: 1/8 inch (3mm).

3.7 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of work after plastering is complete. 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.

B. Remove unused materials, containers, equipment, and plaster debris.

C. Protect plaster and maintain conditions ensuring finished plaster is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 24 00

SECTION 09 30 00 TILING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Ceramic mosaic tile.
2. Accessories required for indicated installation.

B. Related Sections:
1. Section 09 21 16: Gypsum Board Assemblies.
2. Section 09 65 13.13: Resilient Base.

1.3 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction:
1. Level Surfaces: Minimum 0.6.
2. Ramp Surfaces: Minimum 0.8.

B. Ceramic Tile Flooring should be stable, firm, and slip resistant, pursuant to CBC Section 11B-302.1.

1.4 SUBMITTALS

A. Product Data: Technical data including data sheets, installation recommendation, and recommended joint widths.

B. Shop Drawings - Show locations of each type of tile and tile pattern:
1. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples - Submit samples showing full range of color and texture variations expected:
1. Full size units of each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required; minimum 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed work.
3. Waterproof membrane in 6 x 6-inch sample.
4. Thresholds in 6-inch (150 mm) lengths.

D. Test Reports: Submit test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile products with requirements for slip resistance.

E. Maintenance Instructions: Submit maintenance instructions for each type of product specified.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements for the CBC for interior finishes.
   2. Surface Burning Characteristics - ASTM E84; identify products with appropriate markings of applicable testing agency:
      a. Flame Spread Index: 25 or less.
      b. Smoke Developed Index: 450 or less.
   3. Accessibility Requirements - Comply with applicable requirements:
      a. Americans with Disabilities Act of 1990, as amended:
         1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
      b. CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
         2) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

B. Source Limitations for Tile: Obtain tile of same type and color or finish from one source or producer. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products - Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
   1. Stone thresholds.
   2. Waterproofing.
   3. Joint sealants.
   4. Cementitious backer units.
   5. Metal edge strips.

E. Mockups:
   1. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
      a. Build mockup of each type of floor tile installation.
      b. Build mockup of each type of wall tile installation.
      c. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided. Store liquid materials in unopened containers and protected from freezing.

C. 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.

PART 2 PRODUCTS

2.1 MATERIALS

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated. Provide tile complying with Standard grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. 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.

D. Mounting:
   1. 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.

2.2 TILE PRODUCTS

A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   1. Ceramic Tile:
      a. American Marazzi Tile, Inc.
      b. American Olean; a Division of Dal-Tile Corporation.
      c. Crossville, Inc.
      d. Daltile.
      e. Emser Tile.
      f. Trinity Tile.
      g. Interceramic.
      h. Concept Surfaces, LLC.

B. Ceramic Floor Tile - Factory mounted unglazed ceramic mosaic tile:
   1. Basis of Design Product/Manufacturer: As indicated in the Drawings.
   2. Type: As indicated in the Drawings.
   3. Module Size: Refer to Finish Schedule in the Drawings.
   4. Thickness: 1/4 inch (6.4 mm).
   5. Face: Plain with cushion edges.
   6. Surface: Smooth, without or slip resistant, with abrasive admixture.
   7. Dynamic Coefficient of Friction: Not less than 0.42.
   8. Location: As indicated in the Drawings.
   9. Grout Color: As indicated in the Drawings.
   10. Tile color: As indicated on Drawings or as selected by Architect.

C. Threshold - Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes:
   1. 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 C615/C615M, with polished finish:
      a. Description: Uniform, medium grained, black stone without veining.

2.3 WATERPROOF MEMBRANE

A. Waterproof membrane complies with ANSI A118 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fluid Applied Membrane - Liquid latex rubber or elastomeric polymer:
   1. Basis of Design - Laticrete 9235 Waterproofing Membrane. Subject to compliance with requirements, provide basis if design or comparable product by one of the following:
      a. Laticrete International, Inc.
      b. MAPEI Corporation.
      c. TEC; H.B. Fuller Construction Products Inc.

C. Fabric Reinforced, Fluid Applied Membrane - System consisting of liquid latex rubber or elastomeric polymer and continuous fabric reinforcement:
   1. Basis of Design - Laticrete 9235 Waterproofing Membrane and reinforcing Fabric. Subject to compliance with requirements, provide basis if design or comparable product by one of the following:
      a. Laticrete International, Inc.
      b. MAPEI Corporation.
      c. Merkrete by Parex USA, Inc.

D. Latex Portland Cement Waterproof Mortar - Flexible, waterproof mortar consisting of cement based mix and latex additive:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. C-Cure.
      b. MAPEI Corporation.
      c. TEC; H.B. Fuller Construction Products Inc.

E. Liquid Latex Waterproofing/Crack Isolation Membrane - Single Component, self-curing, load bearing liquid rubber polymer that forms a flexible seamless combined waterproofing membrane and crack isolation membrane compliance with ANSI A118:
   1. Basis of Design - Hydroban by Laticrete International. Subject to compliance with requirements, provide basis of design or comparable product by one of the following:
      a. Laticrete International, Inc.
      b. MAPEI Corporation.
      c. TEC; H.B. Fuller Construction Products Inc.

2.4 CRACK ISOLATION MEMBRANE

A. Crack isolation membrane complying with ANSI A118 for standard performance and recommended by manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric Reinforced, Modified Bituminous Sheet - Self adhering, modified bituminous sheet with fabric reinforcement facing; 0.040-inch (1 mm) nominal thickness:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Custom Building Products.
      b. MAPEI Corporation.

C. Fluid Applied Membrane - Liquid latex rubber or elastomeric polymer:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:

a. Custom Building Products.
b. Laticrete International, Inc.
c. MAPEI Corporation.
d. Merkrete by Parex USA, Inc.
e. TEC; H.B. Fuller Construction Products Inc.

D. Fabric Reinforced, Fluid Applied Membrane - System consisting of liquid latex rubber or elastomeric polymer and fabric reinforcement:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Bonsal American, an Oldcastle company.
b. Bostik, Inc.
c. Custom Building Products.
d. Laticrete International, Inc.
e. MAPEI Corporation.
f. Merkrete by Parex USA, Inc.

2.5 SETTING MATERIALS

A. Dry Set Mortar (Thinset) - ANSI A108:
1. Mortar Bed - Proportions of 1 part Portland Cement to 5 parts sand:
a. Portland Cement: ASTM C150, Type 1.
b. Sand: ASTM C144.
c. Water: Potable.
2. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Custom Building Products.
b. Laticrete International, Inc.
c. MAPEI Corporation.
3. Wall Applications: Provide mortar complying with requirements for nonsagging mortar in addition to requirements in ANSI A108.

B. Modified Dry Set Mortar (Thinset) - ANSI A118:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Laticrete International, Inc.
b. MAPEI Corporation.
c. TEC; H.B. Fuller Construction Products Inc.
2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at site.
3. Wall Applications: Provide mortar complying with requirements for nonsagging mortar in addition to requirements in ANSI A118.

C. Improved Modified Dry Set Mortar (Thinset) - ANSI A118:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Laticrete International, Inc.
b. MAPEI Corporation.
c. TEC; H.B. Fuller Construction Products Inc.
2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at Project site.
3. For wall applications, provide mortar complying with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.

D. Modified Dry Set Mortar (Medium Bed): ANSI A118; product approved by manufacturer for application thickness of 5/8 inch (16 mm).

1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a. Laticrete International, Inc.
   b. MAPEI Corporation.
   c. TEC; H.B. Fuller Construction Products Inc.
2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at Project site.

E. Portland Cement Mortar (Thickset) Installation Materials - ANSI A108:
1. Mortar Bed - Proportions of 1 part Portland Cement to 5 parts sand:
   a. Portland Cement: ASTM C150, Type 1.
   b. Sand: ASTM C144.
   c. Water: Potable.
2. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils (0.1 mm) thick.
3. 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 A1064, except for minimum wire size.
4. Expanded Metal Lath - Diamond mesh lath complying with ASTM C847:
   a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
   b. Base Metal and Finish for Exterior Applications: Zinc coated (galvanized) steel sheet.
   c. Configuration over Studs and Furring: Flat.
   d. Configuration over Solid Surfaces: Self furring.
   e. Weight: 3.4 lb/sq. yd. (1.8 kg/sq. m).
5. Latex Additive: 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.

F. Tile Setting Epoxy - ANSI A118, water cleanable; 100 percent solids epoxy grout:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a. Polyblend Tile Grout with 100% Solids Epoxy; Custom Building Products.
   b. SpectraLOCK PRO Stainless Grout; Laticrete International, Inc.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 degrees F and 212 degrees F (60 degrees C and 100 degrees C), respectively, and certified by manufacturer for intended use.
3. Color: Selected by Architect.

G. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thinset) - ANSI A118:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a. Laticrete International, Inc.
   b. MAPEI Corporation.
   c. TEC; H.B. Fuller Construction Products Inc.
2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at Project site.

2.6 GROUT MATERIALS

A. Sand Portland Cement Grout - ANSI A108, consisting of white or gray cement and white or colored aggregate as required to produce color indicated:
1. Portland Cement: ASTM C150, Type 1.
2. Lime: ASTM C206, Type S.

3. Sand: ASTM C144.

B. Commercial Cement Grout (Sanded Grout) - ANSI A118 for joints 1/8 inch (3.2 mm) or wider:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Custom Building Products.
      b. Laticrete International, Inc.
   2. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid latex form for addition to prepackaged dry grout mix.

C. High Performance Tile Grout - ANSI A118:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Custom Building Products.
      b. Laticrete International, Inc.
   2. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid latex form for addition to prepackaged dry grout mix.

D. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

E. Water Cleanable Epoxy Grout - ANSI A118:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Polyblend Tile Grout with 100% Solids Epoxy; Custom Building Products.
      b. SpectraLOCK PRO Stainless Grout; Laticrete International, Inc.
      c. MAPEI Corp., Kerapoxy or Kerapoxy CQ Epoxy Grout.
   2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 degrees F and 212 degrees F (60 degrees and 100 degrees C), respectively, and certified by manufacturer for intended use.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex modified, portland cement-based formulation provided or approved by manufacturer of tile setting materials for installations indicated.

B. Vapor Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils (0.1 mm) thick.

C. Metal Edge Strips:
   1. Angle or L-shaped, height to match tile and setting bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless steel, ASTM A666, 300 Series exposed edge material.
      a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
         1) Blanke Corporation.
         2) Ceramic Tool Company, Inc.
         3) Schluter Systems L.P.

D. 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.

E. Tile and Grout Sealer - Sealer for sealing grout joints and that does not change color or appearance of grout:

1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a. Custom Building Products.
   b. Summitville Tiles, Inc.
   c. TEC; H.B. Fuller Construction Products Inc.

F. Sealant: Silicone sealant; refer to Section 07 92 00.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. 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.

B. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.

C. Maintain temperatures at 50 degrees F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

3.2 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents:
   1. Tile and Trim Units: Furnish quantity of full size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

3.3 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of the work:
   1. Verify 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 for installations indicated.
   2. Verify concrete substrates for tile floors installed with thinset mortar comply with

surface finish requirements in ANSI A108 for installations indicated:
   a. Verify surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation after correcting unsatisfactory conditions.

3.4 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108 and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify 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 site before installing.

3.5 INSTALLATION

A. Comply with TCNA *Handbook for Ceramic, Glass, and Stone Tile Installation* for TCNA 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 TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used:
   1. For the following installations, comply with ANSI A108 series procedures for tile installation standards for providing 95 percent mortar coverage:
      a. Exterior tile floors.
      b. Tile floors in wet areas.
      c. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
      d. Tile floors consisting of rib-backed tiles.

B. 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.

C. 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.

D. Provide trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so tiles are flush.

F. Jointing Pattern:
   1. 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.

G. Joint Widths - Unless otherwise indicated, install tile with the following joint widths:
1. Ceramic Mosaic Tile: 1/8 inch (3.2 mm).

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints:
1. Provide expansion joints and 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.

J. Thresholds:
1. 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 modified dry set mortar (thinset).
b. Do not extend cleavage membrane waterproofing or crack isolation membrane under thresholds set in standard dry set, modified dry set or improved modified dry set mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproofing, or crack isolation membrane with elastomeric sealant.

K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

L. Floor Sealer: Apply floor sealer to grout joints according to floor sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

M. Waterproofing:
1. Install waterproofing to comply with ANSI A108 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate:
a. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

N. Crack Isolation Membrane:
1. Install crack isolation membrane to comply with ANSI A108 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate:
a. Allow crack isolation membrane to cure before installing tile or setting materials over it.

O. Floor and Paver Tile and Planks - Install tile to comply with requirements in the TCNA

installation methods and ANSI A108 series of tile installation standards:

1. Back Buttering - For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
   a. Exterior tile floors.
   b. Tile floors in wet areas, including showers, tub enclosures, laundries, and swimming pools.
   c. Tile floors composed of tiles 8 inches by 8 inches (203 mm by 203 mm) or larger.
   d. Tile floors composed of rib backed tiles.

P. Floor Tile - Install tile to comply with requirements in the TCNA installation methods and ANSI A108 series of tile installation standards:

1. Back Buttering - For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
   a. Exterior tile floors.
   b. Tile floors in wet areas, including showers, tub enclosures, laundries, and swimming pools.
   c. Tile floors composed of tiles 8 inches by 8 inches (203 mm by 203 mm) or larger.
   d. Tile floors composed of rib backed tiles.
2. Tile Installation Method:
   a. Interior Floor Installations, Concrete Subfloor:
      1) TCNA F125-Full; thinset mortar on crack isolation membrane.

Q. Wall Tile Installation:

1. Install types of tile designated for wall installations to comply with requirements, including those referencing TCNA installation methods and ANSI setting bed standards:
   a. Back Buttering - For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
      1) Exterior tile wall installations.
      2) Tile wall installations in wet areas, including showers, tub enclosures, laundries, and swimming pools.
      3) Tile installed with chemical resistant mortars and grouts.
      4) Tile wall installations composed of tiles 8 inches by 8 inches (203 mm by 203 mm) or larger.
   a. Tile Installation Method, Wood or Metal Studs:
      1) TCNA W245; thinset mortar on glass-mat, water-resistant gypsum backer board.

3.6 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning:

1. On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter:
   a. Remove 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.

3.7 PROTECTION

A. 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.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 00

SECTION 09 65 13.13 RESILIENT BASE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Rubber base.
   2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of product including manufacturer's installation instructions.

B. Samples: Sample of Base Selected or Color Chart if none selected.

C. Maintenance Data: Submit for inclusion in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Entity having minimum 5 years documented experience who employs workers competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store base and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F (10 degrees C) or more than 85 degrees F (29 degrees C). Store floor tiles on flat surfaces.

PART 2 PRODUCTS

2.1 MATERIALS

A. Basis of Design Product:
   1. Manufacturers and tile series, pattern, and color selections are indicated in the Finish Schedule and are a basis of design. Subject to compliance with requirements, provide product indicated in Finish Schedule or comparable product by one of the following:
      a. Flexco Floors.
      b. Johnsite, a division of Tarkett Group.
      c. Mannington Commercial.
      d. Roppe.

B. Rubber Base - ASTM F1861:
   1. Material: Rubber, vulcanized, Type TS, Group I, Styles A and B.
   2. Manufacturing Method: Group I (solid, homogeneous).
   3. Style: Topset cove; minimum 100 foot coil, cut to length required.

4. Minimum Thickness: 0.125 inch (3.2 mm).
5. Color: Selected by Architect.
6. Height: 4 inches, unless otherwise indicated on drawings.
7. Outside Corners: Job formed.
8. Inside Corners: Job formed.

C. Adhesives: Water resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F (21 degrees C) or more than 85 degrees F (29 degrees C), in spaces to receive floor tile during the following time periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F (13 degrees C) or more than 95 degrees F (35 degrees C).

C. Close spaces to traffic for 48 hours after installation.

3.2 EXAMINATION

A. Examine substrates for compliance with requirements for maximum moisture content and other conditions affecting performance of the work:
1. Verify that finishes of substrates comply with tolerances and other requirements specified for other work and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation after correcting unsatisfactory conditions. Installation of resilient flooring and accessories indicates acceptance of surfaces and conditions.

3.3 PREPARATION

A. Immediately before installation, sweep clean substrates to be covered by resilient base.

3.4 INSTALLATION

A. Comply with manufacturer's written instructions for installing flooring. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Extend flooring into toe spaces, door reveals, closets, and similar openings.

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

C. Resilient Base:
1. Comply with manufacturer's written instructions for installing resilient base. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and

other permanent fixtures in rooms and areas where base is required:

a. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
b. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
c. Do not stretch resilient base during installation.
d. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
e. Preformed Corners: Install preformed corners before installing straight pieces.
f. Job Formed Corners:
    1) Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
    2) Form without producing discoloration (whitening) at bends.
    3) Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length:
        a) Miter or cope corners to minimize open joints.

END OF SECTION 09 65 13.13

ECTION 09 65 23 LUXURY VINYL TILE FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes requirements limited to:
   1. Luxury vinyl floor tile.
   2. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 03 30 00: Cast-In-Place Concrete.
   2. Section 09 65 13.13: Resilient Base.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of product including manufacturer's installation instructions.

B. Shop Drawings - For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built in furniture, cabinets, and cutouts:
   1. Show details of special patterns.

C. Samples - Full size units of each color and pattern of floor tile required:
   1. Luxury Vinyl Tile (LVT) flooring: 18 inch by 18 inch (460 mm by 460 mm) tile in each color selected and 12 inch long piece of base material in each color selected for approval.

D. Product Schedule: Submit for floor tile using same designations indicated on Drawings.

E. Maintenance Data: Submit for inclusion in maintenance manuals.

F. Reports: Certified Moisture Testing Results.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire Test Response Characteristics - For resilient tile flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency:
      a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
      b. Smoke Density: Maximum specific optical density of 450 per ASTM E662.
   2. Accessibility Requirements - Comply with applicable requirements:
      a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
      b. 2010 ADA regulations.
      c. 2019 CBC Section 11B-302.1.

B. Installer Qualifications: Entity having minimum 5 years documented experience who employs workers competent in techniques required by manufacturer for floor tile installation

and seaming method indicated.

C. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products. Contractor shall provide certified moisture testing results per ASTM F2170 (*Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes*) to Architect and Owner prior to floor installation. Acceptable moisture content of concrete sub floor shall be within approved manufacture limits or lower prior to installation.

D. Source Limitations:
1. Tile: Obtain floor products of same type and color or finish from one source or producer. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
2. Setting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.5 WARRANTY

A. Warrant the Work specified herein for ten (10) years against becoming unserviceable or causing an objectionable appearance resulting from either defective, or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
1. Damaged tile, including broken or chipped edges.
2. Loose or missing tile.
3. Noticeable deterioration or discoloring of tile or grout.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F (10 degrees C) or more than 85 degrees F (29 degrees C). Store floor tiles on flat surfaces.

PART 2 PRODUCTS

2.1 MATERIALS

A. Basis of Design Product:
1. Manufacturers and tile series, pattern, and color selections are indicated in the Finish Schedule and are a basis of design. Subject to compliance with requirements, provide product indicated in Finish Schedule or comparable product by one of the following:
a. Luxury Vinyl Tile (LVT):
1) Basis of Design: **Premium Step by Mohawk, Art Select**.
2) Alternates include:
a) Karndean.
b) Aspecta.
c) Armstrong.
d) Patcraft.
e) Tandus Centiva.
f) Other comparable product.

B. Luxury Solid Vinyl Tile (LVT-1) - ASTM F1700:

1. Class I, monolithic vinyl tile:
   a. Type A: Smooth surface.
   b. Type B: Embossed surface.
2. Thickness: 0.125 inch (3.2 mm).
3. Size: Refer to Finish Schedule.
4. Construction: Heterogeneous Resilient Flooring with .030” (30 mil) high density wear layer.
5. Colors: As selected by Architect from manufacturer’s available colors.
6. Patterns: Factory mounted patterns as selected by Architect.

C. Trowelable Leveling and Patching Compounds: Latex modified, portland cement based formulation provided or approved by floor tile manufacturer for applications indicated.

D. Adhesives: Water resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

E. Floor Polish: Provide protective, liquid floor polish products recommended by floor tile manufacturer.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F (21 degrees C) or more than 85 degrees F (29 degrees C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F (13 degrees C) or more than 95 degrees F (35 degrees C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Where demountable partitions, cabinets, and similar items are indicated for installation on top of resilient tile flooring, install tile before these items are installed.

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

G. Install flooring after other finishing operations, including painting, have been completed.

3.2 EXTRA STOCK

A. Furnish extra materials matching products installed and packaged with protective covering for storage and identified with labels describing contents:
   1. LVT Flooring: 1 percent of quality installed or 2 full unopened containers, whichever is greater.

3.3 EXAMINATION

A. Examine substrates for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work:
   1. Verify that finishes of substrates comply with tolerances and other requirements specified for other Work and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation after correcting unsatisfactory conditions. Installation of resilient flooring and accessories indicates acceptance of surfaces and conditions.

3.4 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates - Prepare according to ASTM F710:
   1. Verify substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing - Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
      a. Perform anhydrous calcium chloride test according to ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Perform relative humidity test using in situ probes according to ASTM F2170. Proceed with installation only after substrates have a maximum **95** percent relative humidity level.
   5. Bond Test: Bond 3' x 3' panels spaced 50 feet apart throughout subfloor area. After moisture test proves floor acceptably dry, install panels using adhesive. If panels are securely bonded after 72 hours, subfloor is sufficiently clean of foreign materials for satisfactory installation of resilient flooring.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed:
   1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.5 INSTALLATION

A. Comply with manufacturer's written instructions for installing flooring. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Extend flooring into toe spaces, door reveals, closets, and similar openings.

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

C. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one/half tile at perimeter:
   1. Lay tiles square with room axis.

D. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles:
   1. Lay tiles with grain running in one direction.

E. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built in furniture, cabinets, pipes, outlets, and door frames.

F. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

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

H. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

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

J. Floor Tile - Comply with manufacturer's written instructions for installing floor tile:
   1. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one/half tile at perimeter:
      a. Lay tiles square with room axis unless pattern indicated for an area.
   2. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles. Lay tiles with grain running in one direction.

K. Resilient Accessories - Comply with manufacturer's written instructions for installing resilient accessories:
   1. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.6 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.

3. Damp mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish. Apply two coat(s).

E. Sealers and Finish Coats:
1. Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products:
   a. Sealer: Apply two base coats of liquid sealer.
   b. Finish: Apply two coats of liquid floor finish.

F. Cover floor tile until Substantial Completion.

G. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations:
1. Before cleaning, strip protective floor polish.
2. Reapply polish to floor surfaces to restore protective floor finish according to flooring manufacturer's written recommendations.

END OF SECTION 09 65 23

SECTION 09 90 00 PAINTING AND COATING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Surface preparation and field painting of exposed items and surfaces.
   2. Field preparation and painting of factory primed metal products and fabrications.
   3. Accessories necessary for a complete installation

1.3 DEFINITIONS

A. Standard coating terms defined in ASTM D16 apply:
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Semigloss refers to medium sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   4. Full gloss refers to high sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data:
   1. Submit technical data and information for block fillers, primers, paints, and coatings, including label analysis and instructions for handling, storing, and applying each coating material proposed for use:
      a. Indicate manufacturer's instructions for special surface preparation procedures, substrate conditions requiring special attention.
      b. Material List: Provide inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number, series, and general classification.
      c. Submit Zero VOC compliant products only.

B. Samples:
   1. Submit for each type of paint system and in each color and gloss of topcoat:
      a. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
      b. Provide list of material and application for each coat of each sample. Label each sample as to location and application.
      c. Submit samples on following substrates for review of color and texture only:
         1) Concrete: Provide two 4-inch square samples for each color and finish.
         2) Concrete Masonry: Provide two 4" x 8" samples of masonry, with mortar joint in the center, for each finish and color.
         3) Painted Wood: Provide two 12-inch square samples of each color and

material on hardboard.

4) Ferrous and Nonferrous Metals: Provide two 4-inch square samples of flat metal and two 8-inch-long samples of solid metal for each color and finish.

C. Product List: Submit list of including each paint system, color, and location of application. Use same product and location designations indicated in Finish Schedule.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with Federal and local toxicity and air quality regulations and with Federal requirements on content of for heavy metals including but not limited to: lead and mercury. Do not use solvents in paint products that contribute to air pollution.
   2. Performance and Durability:
      a. ASTM D16 Standard Test Method for Load Testing Refractory Shapes at High Temperatures.
      b. ASTM D2486 Standard Test Method for Scrub Resistance of Interior Wall Paint.
      c. ASTM D2805 Standard Test Method for Hiding Power of Paints by Reflectometry.
      d. ASTM D4828 Standard Test Method for Practical Washability of Organic Coatings.

B. Applicator Qualifications: A firm or individual having minimum 5 years documented experience in applying paints and coatings similar in material, design, and extent to those indicated.

C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.6 WARRANTY

A. Written warranty signed by the manufacturer and the installer in which the manufacture and installer agree to repair or replace paint and primers that fail within specified warranty period:
   1. Failures include, but are not limited to, the following:
      a. Flaking or delamination of paint with the substrate.
      b. Rust, scale, similar imperfections due to improper surface preparation.
      c. Thinning or watering of paint beyond that considered acceptable of paint manufacturer.
      d. Failure to achieve dry film thickness (DFT) recommended by manufacturer for each coat in a paint system.
      e. Deterioration or loss of color of paint beyond normal weathering.
   2. Warranty Period: One year from date of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F (7 degrees C):
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

PART 2 PRODUCTS

2.1 MATERIALS

A. Subject to compliance with requirements, provide first quality, 100% acrylic, commercial or industrial products of one of the specified manufacturers. Residential products are not

permitted:

1. Proprietary Names:
   a. Paint Schedule is based on a single manufacturer for convenience. Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that named products are required to the exclusion of comparable products of specified manufacturers. Furnish product technical data, including per cent solids by weight and volume; VOC content limits and emissions data; and certificates of performance for comparable paint products of specified manufacturer.
2. Acceptable Paint Manufacturers:
   a. Kelly-Moore Paints.
   b. Sherwin-Williams Co.
   c. Vista Paint.
   d. Benjamin Moore & Co.
   e. Dunn Edwards.
   f. Dulux; Theater Black.

B. Material Compatibility: Provide each paint system including block fillers, primers, and finish coats, that are compatible with one another and with substrates indicated under conditions of service and application, demonstrated by manufacturer based on testing and field experience.

C. Material Quality: Provide manufacturer's best quality commercial paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint material containers not displaying manufacturer's product identification will not be acceptable. Residential quality paint products are not permitted.

D. Chemical Components of Interior Paints and Coatings:
   1. Provide products complying with limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and SCAQMD Rule1113:
      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 components restricted by the EPA and the SCAQMD.

E. Accessories: Materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

F. Patching Materials: Latex filler compatible with paint systems.

G. Fastener Head Cover Materials: Latex filler.

H. Theater Black: No Exceptions or alternates.

2.2 SOURCE QUALITY CONTROL

A. Testing of Paint Materials:
   1. Owner reserves the right to invoke to engage the services of a qualified testing agency to sample paint materials:
      a. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to site, samples may be taken at the site. Samples will be identified, sealed, and certified by testing agency.
      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.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Apply waterborne paints when temperatures of surfaces to be painted and surrounding air are between 50 degrees F and 90 degrees F (10 degrees and 32 degrees C).

B. Do not thin or add water to water-based paints, including water-based alkyds.

C. Weather Conditions:
1. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
2. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F (3 degrees C) above dew point; or to damp or wet surfaces.
3. Minimum Application Temperatures for Water based Paints: Between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C).

D. Apply solvent thinned paints when temperatures of surfaces to be painted and surrounding air are between 45 degrees F. and 95 degrees F (7 degrees F and 35 degrees C):
1. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
2. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

E. Provide lighting level of 80-foot candles (860lx) measured mid-height at substrate surface.

F. Labels: Do not paint over Underwriters Laboratories, Factory Mutual, other code required labels, or equipment name, identification, performance rating, or nomenclature plates.

3.2 EXTRA MATERIALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents:
1. Paint: 2 percent, but not less than 1 gallon (3.8 L) of each material and color applied.

3.3 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for maximum moisture content and conditions affecting performance of the work.

B. Test substrates after repairing and cleaning substrates but prior to application of paint and coatings:
1. Maximum moisture content of substrates, when measured with an electronic moisture meter as follows:
a. Concrete: 12 percent.

b. Fiber Cement Board: 12 percent.
c. Masonry (Clay and CMUs): 12 percent.
d. Wood: 15 percent.
e. Gypsum Board: 12 percent.
f. Plaster: 12 percent.

2. Test cementitious and plaster cement/stucco for alkalinity (pH).

C. Gypsum Board Substrates: Verify taped joints are tapes and finishing compound is sanded smooth.

D. Plaster Substrates: Verify plaster has fully cured. Verify existing plaster is in good condition and can receive new paint coating.

E. Spray Textured Ceiling Substrates: Verify surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

1. Verify previously painted surfaces can be stripped to bare substrate, repaired if necessary, and prepared to receive new paint system consisting of primer and two top coats at a minimum:
   a. Where previously painted surfaces have failed to accept new paint systems. Determined cause of failure and take corrective measures to ensure each surface accepts new paint system. Failure of new paint system is not permitted.

G. Commence paint and coating application after correcting unsatisfactory conditions and surfaces are dry. Application of coating indicates applicator's acceptance of surfaces and conditions.

3.4 PREPARATION

A. Coordination of Work:

1. Review work in which primers are provided to ensure compatibility of the total system for various substrates. Notify Architect of anticipated problems when using materials specified over substrates primed by others:
   a. Preprimed Substrates: Inspect existing conditions in which primers are factory applied to ensure compatibility of the total system for each substrate. Notify Architect of anticipated problems when using the materials specified over factory primed or preprimed substrates.
   b. Existing Painted Surfaces: Inspect previously painted surfaces to ensure compatibility of the existing paints with new paint system for each substrate. Notify Architect of anticipated problems.
   c. Correct defects and clean surfaces affecting bond with paint system. Remove existing paints exhibiting loose surface defects showing signs of rust, scale, or delamination.
   d. Seal marks which may bleed through surface finishes.

B. Surface Preparation:

1. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified. Provide barrier coats over incompatible primers or remove and reprime. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting:
   a. Remove hardware and hardware accessories, plates, lighting fixtures, and similar items 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. After completing painting operations in each space or

area, reinstall items removed using workers skilled in the trades involved.
b. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface applied protection if any.
c. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
d. Clean and prepare surfaces to receive paint according to manufacturer's written instructions for each substrate condition and as specified. Provide barrier coats over incompatible primers, existing paint or coating, or remove and reprime.
e. Correct defects and clean surfaces affecting bond with paint or coating system. Remove existing coatings exhibiting loose surface defects. Seal marks which may bleed through surface finishes.

C. Cleaning:
1. Before applying paint or surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and contaminants from the cleaning process will not fall on wet, newly painted surfaces:
a. Remove incompatible primers, including factory applied primers, and reprime substrate with compatible primers or apply barrier coat as necessary to produce paint systems indicated.
b. 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.
c. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
d. 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.
e. Aluminum Substrates: Remove surface oxidation.

D. Mildew and Mold Removal: Remove mildew and mold by high power washing (pressure range of 1500 to 4000 psi) with solution of trisodium phosphate and bleach. If substrate is too soft for high power washing, scrub substrate with solution. Rinse with clean water and allow surface to dry.

E. Protective Coverings: Provide protections for duration of the work, including covering furnishings and decorative items. Protect and mask adjacent finishes and components against damage, marking, overpainting, and injury. Clean and repair or replace damage caused by painting.

F. Renovated Surfaces:
1. Clean surface free of loose dirt and dust. Except at gypsum board surfaces, remove existing paint and coatings to bare substrate and prepare substrates to receive new paint system. Test substrate to verify it will bond with primer and receive new paint system without failure. If test fails, clean surface to base substrate and apply barrier coat. Retest to verify surface will accept new paint system:
a. Remove surface film preventing proper adhesion and bond.
b. Wash glossy paint with a solution of sal soda and rinse thoroughly.
c. Remove loose, blistered, and defective paint and varnish; smooth edges with sandpaper.
d. Clean corroded iron and steel surfaces.
e. Repair and blend into portland cement plaster.
f. Prime bare surfaces.
g. Tone varnished surfaces with stain bringing to uniform color.
h. If existing surfaces cannot be put in acceptable condition for finishing by customary cleaning, sanding, and puttying operations, notify Owner and do not proceed until

correcting unsatisfactory conditions.

G. Cementitious Substrates:
1. Prepare concrete surfaces to receive paint. Remove efflorescence, chalk, dust, dirt, grease, oils, release agents, mold, mildew, and existing paint. Roughen as necessary to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation:
   a. Use abrasive blast cleaning methods if recommended by paint manufacturer.
   b. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions:
      1) Determine alkalinity and moisture content of surfaces by performing appropriate pH testing. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct condition prior to application of paint.
      2) Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m).
      3) Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation after substrates have obtained percent relative humidity level recommended by paint manufacturer.
      4) Perform additional moisture tests when recommended by manufacturer. Proceed with installation when moisture content complies with that permitted in manufacturer's written instructions.
      5) Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to thoroughly dry.
   c. Clean concrete floors to receive paint or coating with a 5 percent solution of muriatic acid or etching cleaner. Flush floors with clean water to remove acid; neutralize with ammonia, rinse, allow to dry; vacuum before painting.

H. Ferrous Metals:
1. Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations:
   a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC SP6/NACE No. 3.
   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

I. Galvanized Ferrous Metal Substrates: Clean galvanized surfaces with nonpetroleum based solvents leaving surface free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

J. Shop Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC PA1 for touching up shop primed surfaces.

K. Aluminum Substrates: Clean surfaces to remove oil, grease, surface oxidation, and contaminants in accordance with SSPC SP1 Solvent Cleaning. Lightly abrade surface with a nonmetallic pad.

L. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's

written instructions.

M. Plaster/Stucco Substrates:
1. Remove contaminants, release agents, curing compounds, efflorescence, chalk, mold, mildew, and similar deterrents. Spot patch existing plaster to eliminate blisters, buckles, excessive crazing, and to check cracking, dryouts, efflorescence, sweat outs, and similar deflects the prevent plaster from bonding with paint or coatings. Sand or texture repair or patch to match adjacent finish and to remove trowel marks and arises: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
   a. Deep Cracks: Clean out and fill deep cracks with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
   b. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions. Test for alkali using litmus paper.
   c. Allow patching and repair compounds to set and cure before painting.

N. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

O. Wood Substrates:
1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
2. Sand surfaces that will be exposed to view and dust off.
3. Prime, stain, or seal wood to be painted. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
4. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
5. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

P. Pipe Covering and Insulation: Clean to remove loose, foreign, and objectionable material before applying sealing coat.

Q. Preparation of Substrates for Wallcovering:
1. Prime and seal substrate with release coat in accordance with wallcovering manufacturer's recommendations for substrate:
   a. Assure compatibility with product of wall covering manufacturer.
   b. Fill indentations in substrate and prime with opaque white primer before applying release coat.
   c. Apply release coat in accordance with manufacturer's recommendations.

R. Barrier Coat: Provide barrier coats over incompatible primers or remove and reprime. Notify Owner in writing of anticipated problems using specified finish coat material over previously coated substrates.

S. Material Preparation:
1. Mix and prepare paint materials according to manufacturer's written instructions:
   a. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   b. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   c. Do not use thinners for water-based paints.
   d. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat

where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.5 APPLICATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated:
   1. The term *exposed surfaces* includes areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place. Extend coatings in these areas to maintain system integrity and provide desired protection.
   2. Use applicators and techniques suited for paint and substrate indicated.
   3. Provide finish coats compatible with primers.
   4. 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.
   5. Paint exposed surfaces (top, bottom, sides, edges, underneath). If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces:
      a. Field painting of exposed surfaces include bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory applied final finish.
      b. Areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place.
      c. Extend coatings in areas, as required, to maintain system integrity and provide desired protection.
   6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
   7. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   8. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   9. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   10. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or surface imperfections. Cut in sharp lines and color breaks.
   11. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
   12. Provide finish coats compatible with primers used.
   13. Sand lightly between each succeeding enamel or varnish coat.

B. Items not to Receive Paint: Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

C. Applicators:
   1. Apply paints and coatings by brush, roller, spray, or applicators recommended by manufacturer:
      a. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
      b. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool recommended by manufacturer for material and texture required.

c. Spray Equipment: Use airless spray equipment with orifice size recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness:
1. Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer:
a. Measure film thickness on magnetic surfaces by use of Elcometer thickness gauge and on nonmagnetic surfaces by pit gauge or Tooke Gauge.

E. Application:
1. Apply first coat to surfaces that have been cleaned, pretreated, or prepared for painting as soon as practicable after preparation and before subsequent surface deterioration:
a. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
b. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished after removing rust and scale and priming or touching up surface sand if acceptable to topcoat manufacturers.
c. If undercoats, stains, or conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried and cured to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

F. Mechanical and Electrical Work:
1. Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces:
a. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
b. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
c. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
d. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
e. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
f. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
g. Concealed Members: Wherever steel and metal parts to receive paint are built into and concealed by construction, paint as specified for exposed parts so finish painting is complete before members are concealed.

G. Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Painting is limited to items exposed in equipment rooms and occupied spaces:
a. Remove unfinished louvers, grilles, covers, and access panels on mechanical and

electrical components and paint separately.

b. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
c. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
d. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
e. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
f. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

H. Block Fillers: Apply block fillers to concrete masonry block at rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply prime coat, recommended by manufacturer, to material required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or defects due to insufficient sealing.

J. Finish Coats:
1. 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. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance without bleed through:
    a. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections is not acceptable.
    b. Transparent (Clear) Finishes: Use multiple coats to produce glass smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

L. Touch Up:
1. Touch up marred, scraped, and blemished areas of surfaces which were factory primed or previously coated:
    a. Prepare and touch up scratches, abrasions, and blemishes and remove foreign matter before proceeding with succeeding coats.
    b. Touch up marred, scraped, and blemished areas of factory primed or previously coated surfaces.
    c. Feather touch up coating overlapping minimum 2 inches onto adjacent unblemished areas producing smooth, uniform surface.
    d. As soon after erection and installation as possible, touch up fasteners, welded surfaces and surroundings, field connections, and areas on which shop coat has been abraded or damaged with specified primer before corrosion and other

damage occurs from exposure.

3.6 FIELD QUALITY CONTROL

A. Dry Film Thickness (DFT) Testing:
   1. Tests for dry film thickness may be determined by using a Tooke Scale and microgroover, an electronic scanner, or the Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness:
      a. Contractor shall touch up and restore painted surfaces damaged by testing.
      b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.7 CLEANING AND PROTECTION

A. It is of the upmost important to the AISD that the sites remain in a safe, clean, and well-maintained condition. At the end of each day, leave the site ready to use by staff and students. Protect staff and students and the learning environment throughout the work.

B. Cleanup: At the end of each day, remove empty cans, rags, rubbish, and discarded paint materials from site. After completion of painting work, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. Provide *Wet Paint* signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After related work is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

E. At completion of painting activities, touch up and restore damaged or defaced painted surfaces.

F. Waste Management: Legally dispose of unused paint and paint containers in accordance with manufacturer’s recommendations and environmental regulations.

PART 4 SCHEDULES

A. The following is a schedule of typical painted items and does not specifically include every item that is to receive paint but should establish type and quality of finish for all items normally included in a complete paint job.

B. Exterior Surfaces (Note: Exterior surfaces are divided into two (2) different categories, based upon color and level of graffiti resistance required. System 1 will be used when standard earthtone colors or neutral colors are specified, and System 2 will be used when bright colors [primary reds, yellows, and oranges] are specified and/or when a graffiti resistant coating is required):
   1. Galvanized Metal:
      a. Surface Preparation: Acid etch galvanized surfaces that have not weathered at least six (6) months prior to beginning painting operations. Krud Kutter Metal Clean and Etch.

b. Primer: One (1) coat Ultrashield ULDM00 DTM Gray Primer.
c. Finish: Two (2) coats Ultrashield ULSH40 Low Sheen High Performance Acrylic Urethane.
d. Finish: Two (2) coats US Coatings RustGrip 2300 1-2 Mils DFT.

2. Un-galvanized Metal:
   a. Primer: One (1) coat Ultrashield ULDM00 DTM Gray Primer.
   b. Finish: Two (2) coats Ultrashield ULSH40 Low Sheen High Performance Acrylic Urethane.
3. Concrete and CMU:
   a. Primer/Finish: (2) coats Eff-Stop Premium ESPR00 Masonry Primer / (2) coats US Coatings AquaGrip 2600 3-5 Mils DFT.
4. Wood (Includes plywood siding and wooden trim):
   a. Primer: One (1) coat EZ-Prime EZPR00 Exterior Wood Primer.
   b. Finish: Two (2) coats Spartashield SSHL60 100% Acrylic Gloss.
5. Fiber-Cement Materials:
   a. Primer: One (1) coat Eff-Stop Premium ESPR00 Masonry Primer.
   b. Finish: Spartashield SSHL60 100% Acrylic Gloss.
6. Parking Line and Driveway Paint: Vin-L-Stripe VSZM10 Zone Marking Paint Yellow.
7. All piping in mechanical rooms shall be painted in their entirety, in the following colors: Aristoshield ASHL70 High-Gloss Enamel:
   a. Gas lines: Orange
   b. Domestic cold water: White
   c. Domestic hot water: Pink
   d. Heating hot water: Red
   e. Condenser water: Green
   f. Chilled water: Blue

C. Interior Surfaces:
1. Galvanized Metal:
   a. Primer: One (1) coat Ultrashield Galvanized Metal Primer ULGM00.
   b. Finish: Two (2) coats Aristoshield ASHL50 Semi-Gloss Enamel.
2. Shop-Primed Ferrous Metals (Use for metal doors and frames and miscellaneous metal items):
   a. Shop coat by others.
   b. One (1) coat over Steel: Bloc-Rust Premium BRPR00 Rust Preventative Primer; Aluminum: Ultrashield Galvanized Metal Primer ULGM00.
   c. Two (2) coats Aristoshield ASHL50 Semi-Gloss Enamel.
3. Gypsum Wallboard:
   a. Primer: One (1) coat Vinylastic Premium VNPR00 Acrylic Wall Sealer.
   b. Finish: Two (2) coats Spartawall Premium SWLL30 Acrylic Latex Eggshell.
4. Primer Concrete and CMU (Enamel):
   a. One (1) coat Smooth Blocfil Premium SBPR00 100% Acrylic Block Filler.
   b. Finish: Two (2) coats Premium SWLL50 Acrylic Latex Semi-Gloss.
5. Wood (Painted):
   a. Primer: Interkote Premium IKPR00 100% Acrylic Enamel Undercoater.
   b. Finish: Aristoshield ASHL50 Semi-Gloss Enamel.
6. Wood (Stained):
   a. Stain: Gemini Craftsman Collection Wiping Stain CCW Water-Based Series.
   b. Finish (First Coat): WB-0230 Gemini Titanium Clear Urethane Satin
   c. Finish (Second Coat): Gemini WB-0230 Gemini Titanium Clear Urethane Satin.
7. Gypsum Wallboard (Epoxy) – Kitchens, bathrooms, laboratories, etc.:
   a. Primer: One (1) coat US Coatings AquaGrip 2600 2-3 Mils DFT.
   b. Finish: Two (2) coats US Coatings AquaGrip 2600 3-5 Mils DFT per coat.
8. CMU (Epoxy) - Kitchens, bathrooms, laboratories, etc.:
   a. Primer: Two (2) coats Smooth Blocfil Premium SBPR00 100% Acrylic Block Filler.
   b. Finish: Two (2) coats US Coatings AquaGrip 2600 3-5 Mils DFT.

9. Pipe and fittings, including but not limited to copper and brass, at kitchen areas (but excluding aluminum, stainless steel, nickel and chrome plated pipe and fittings):
   a. Primer: One (1) coat; US Coatings RustGrip 2300 1-2 Mils DFT.
   b. Finish: Two (2) coats bright aluminum paint, US Coatings UreGrip 3000 VOC 2-3 Mils DFT per coat.

D. Paint Types: Refer to the Finish Schedule in the Drawings.

END OF SECTION 09 90 00

SECTION 09 97 23 CONCRETE AND MASONRY COATINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Application of membrane type curing and sealing compound on concrete surfaces to remain exposed.

B. Related Sections:
1. Section 09 90 00: Painting and Coating.
2. Section 09 96 23: Graffiti-Resistant Coatings.

1.3 DEFINITIONS

A. Comparable Product: Product demonstrated and approved through submittal process, or where indicated as a produce substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.4 SUBMITTALS

A. Application of membrane type curing and sealing compound on concrete surfaces to remain exposed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Keep product from freezing.

D. Avoid direct contact with this product as it may cause mild-to-moderate irritation of the eyes and/or skin.

E. Protect materials during handling and application to prevent damage or contamination.

F. Do not mix any compound containing solvent.

G. Do not mix or agitate aggressively as foaming can occur.

PART 2 PRODUCT

2.1 MANUFACTURERS

A. Basis of design is Vocomp-20, as manufactured by W.R. Meadows, Inc., or comparable

product approved by Architect:

1. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered and have Architect's approval prior to its use on the Project:
   a. Dayton-Superior Corp.
   b. Euclid Chemical Company.

2.2 MATERIALS

A. Typical, except as noted: Membrane type curing and sealing compound conforming to ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, Type I, Class B and complying with Sealtight Vocomp-20, as manufactured by W.R. Meadows, Inc., 2300 W. Valley Blvd., Pomona, CA 91768, Phone: (909) 469-2606, Fax: (909) 469-2611 or comparable product approved by the Architect.

B. Exterior Non-slip Traffic Coating: Vocomp-20 as specified above, with "Sure-Step" slip-resistant additive as manufactured by W.R. Meadows, Inc., 2300 W. Valley Blvd., Pomona, CA 91768, Phone: (909) 469-2606, Fax: (909) 469-2611 or comparable product approved by the Architect.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive curing and sealing compound. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive curing and sealing compound.

B. Clean and prepare surfaces to receive curing and sealing compound in accordance with manufacturer's instructions.

C. Ensure concrete surface is clean and dry, with all stains, oil, grease, dust, and dirt removed.

D. Concrete surface water should be dissipated when used on new concrete.

E. Concrete surfaces should not be marred by walking workers.

3.3 APPLICATION

A. Apply curing and sealing compound in accordance with manufacturer's instructions.

B. Ensure product is mixed for optimum performance. Avoid aggressive mixing as foaming may occur.

C. Use an industrial sprayer with a 5916 tip that produces a flow rate of 1/10 of one gallon per minute under 0.276 MPa (40 psi) of pressure.

D. Spray on in a fine, fog pattern, without spurts and dribbles, to form a thin, continuous film.

E. Alternatively apply using a lint-free roller or lamb's wool roller.

F. Avoid puddling in low areas.

END OF SECTION 09 97 23

SECTION 10 22 39 FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Related Sections:
1. Section 03 30 00: Cast-In-Place Concrete.
2. Section 05 50 00: Metal Fabrications.
3. Section 06 10 00: Rough Carpentry.
4. Section 09 21 16: Gypsum Board Assemblies.

B. Reference Standards:
1. ASTM E90 (UL 723): Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
2. ASTM E413: Classification for Rating Sound Insulation.
3. ASTM E557: Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions.
4. ASCE 7: Minimum Design Loads for Buildings and Other Structures.
5. NFPA 70: National Electrical Code.
6. UL 508: Standard for Industrial Control Panels.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00: Submittal Procedures.

B. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

C. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

D. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

E. Samples: Color samples demonstrating full range of finishes available. Verification samples shall be available in same thickness and material indicated for the work.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and maintenance of all components.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Experienced installer, certified by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in accordance with ASTM E90 test procedure to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of Opening: Conform to ASTM E557.

1.5 WARRANTY

A. Provide operable partition manufacturer's written warranty agreeing to repair or replace components with manufacturing defects for a period of two years.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's instructions and as required to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Modernfold, Inc., which is located at: 215 W. New Rd.; Greenfield, IN 46140; Toll Free Tel: 800-869-9685; Tel: 317-468-6700; Fax: 866-410-5016; Email:request info (info@modernfold.com); Web:www.modernfold.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00: Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until supports and substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and ASTM E557 installation procedures. Test for proper operation and make necessary adjustments until satisfactory

results are obtained.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10 22 39

SECTION 10 24 00 EQUIPMENT SCREEN

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. PRE-FORMED METAL PANELS FOR ENCLOSING ROOF TOP MECHANICAL EQUIPMENT.

2. GALVANIZED CURB MOUNTED ASSEMBLY FRAMING FOR DIRECT ATTACHMENT OF SCREENING PANELS TO STRUCTURAL ROOF CURB; NO INSTALLING INTO MECHANICAL EQUIPMENT ALLOWED.

3. ASSEMBLY MADE TO PERMIT EASY ACCESS TO MECHANICAL EQUIPMENT FOR SERVICING.

4. TOUCH-UP PAINTING REQUIRED FOR SCRATCHES AND SCREW HEADS.

B. PRODUCTS NOT INSTALLED OR FURNISHED IN THIS SECTION:

1. FIELD PAINTING OF PRIME PAINTED SCREENS

1.02 RELATED SECTIONS

A. SECTION [_____] – ROOFTOP UNITS.

B. SECTION [07720] – STRUCTURAL ROOF CURBS

C. SECTION [_____] – METAL PANELS

1.03 SYSTEM DESCRIPTION

A. DESIGN CRITERIA:

1. MANUFACTURER IS RESPONSIBLE FOR THE STRUCTURAL DESIGN OF ALL MATERIALS, ASSEMBLY AND ATTACHMENTS TO RESIST SNOW, WIND, SUCTION AND UPLIFT LOADING AT ANY POINT WITHOUT DAMAGE OR PERMANENT SET.

1.04 SUBMITTALS

A. PRODUCT DATA: SUBMIT MANUFACTURER'S CATALOG DATA, DETAIL SHEETS, SPECIFICATION AND OTHER DATA SUFFICIENT TO INDICATE COMPLIANCE WITH THESE SPECIFICATIONS.

B. SHOP DRAWINGS: INDICATE LAYOUTS HEIGHTS, COMPONENT CONNECTION DETAILS, AND DETAILS OF INTERFACE WITH ADJACENT CONSTRUCTION. MARK DATA TO INDICATE:

1. ROOF TOP MECHANICAL EQUIPMENT TO BE ENCLOSED.

D. CLOSEOUT SUBMITTALS: WARRANTY DOCUMENTS, ISSUED AND EXECUTED BY MANUFACTURER, COUNTERSIGNED BY CONTRACTOR.

1.05 QUALITY ASSURANCE

A. REGULATORY REQUIREMENTS: COMPLY WITH REQUIREMENTS OF BUILDING AUT HORITIES HAVING JURISDICTION IN PROJECT LOCATION.

1.06 DELIVERY, STORAGE AND HANDLING

A. DELIVERY: DELIVER MATERIALS TO SITE IN MANUFACTURER'S ORIGINAL, UNOPENED CONTAINERS AND PACKAGING, WITH LABELS CLEARLY INDICATING MANUFACTURER AND MATERIAL.

B. STORAGE AND HANDLING: PROTECT MATERIALS AND FINISHES DURING HANDLING AND INSTALLATION TO PREVENT DAMAGE.

1.07 COORDINATION

A. INSTALLER FOR WORK UNDER THIS SECTION SHALL BE RESPONSIBLE FOR COORDINATION OF PANEL AND FRAMING SIZES AND REQUIRED OPTIONS WITH THE CONTRACTOR'S REQUIREMENTS.

1. REQUEST INFORMATION ON SIZES AND OPTIONS REQUIRED FROM THE CONTRACTOR.

B. SUBMIT SHOP DRAWINGS TO THE CONTRACTOR AND OBTAIN WRITTEN APPROVAL OF SHOP DRAWING FROM THE CONTRACTOR PRIOR TO FABRICATION.

1.08 WARRANTY

A. IF ANY PART OF THE ROOFTOP EQUIPMENT SCREEN FAILS BECAUSE OF A MANUFACTURING DEFECT WITHIN ONE YEAR FROM THE DATE OF SUBSTANTIAL COMPLETION, THE MANUFACTURER WILL FURNISH WITHOUT CHARGE THE REQUIRED REPLACEMENT PART(S). ANY LOCAL TRANSPORTATION, RELATED SERVICE LABOR OR DIAGNOSTIC CALL CHARGES ARE NOT INCLUDED.

B. THIS WARRANTY DOES NOT COVER FAILURE OF YOUR ROOFTOP EQUIPMENT SCREEN IF IT IS DAMAGED BY THE OWNER, OR IF THE FAILURE IS CAUSED BY IMPROPER INSTALLATION. IN NO EVENT SHALL WARRANTOR BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

PART II - PRODUCTS

2.01 MANUFACTURERS

A. ACCEPTABLE PRODUCTS: CURBS PLUS EQUIPMENT SCREEN

2.02 MATERIALS

A. METAL PANELS: FABRICATED FROM RIGID GALVALUME METAL SHEETS.

B. FRAMING: MINIMUM 18 GAUGE LFQ, CQ, G-90 GALVANIZED STEEL, OR HEAVIER GAUGE (AS REQUIRED)

C. THREADED FASTENERS: ALL SCREWS, BOLTS, NUT AND WASHERS SHALL BE STAINLESS STEEL.

1. FASTENERS SHALL BE #10-16 X STAINLESS STEEL TEK SCREWS. LENGTH AS REQUIRED TO DEVELOP FULL HOLDING CAPACITY OF SCREW WHEN FASTENED TO CURB MOUNTED SYSTEM.

SECTION 10 44 00 FIRE EXTINGUISHER AND CABINETS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
1. Fire Extinguisher Cabinets.
2. Fire Extinguishers

B. Related Sections:
1. Section 06 10 00: Rough Carpentry.

1.3 SUBMITTALS

A. Product Data:
1. Manufacturer's specifications and technical data to indicate specification compliance.
2. Manufacturer’s installation instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Specifications are based on the products of named manufacturers. Other listed manufacturers who produce products equivalent to those specified are approved for use on the Project. Other manufacturers must have a minimum of five (5) years’ experience manufacturing equivalent to those specified and comply with Division 01 requirements regarding substitutions to be considered:
1. Larsen's Manufacturing Co.
2. The Williams Bros. Corporation of America.
3. J. L. Industries, Inc.
4. Potter-Roemer.

2.2 MATERIALS

A. Fire Extinguishers and Cabinets must comply with CBC Sections 11B-307, 11B-308, 11B-309, and 11B-403.

B. Fire Extinguisher Cabinets (FEC):
1. Size: 24 inches x 9-1/2 inches x 6 inches inside tub dimension.
2. Type: Semi-recessed with 2-1/2 inch return trim rolled edge; ADA compliant.
3. Tub Construction: 22 gauge min. steel with standard baked acrylic enamel interior finish.
4. Door and Frame: 18 gauge min. 304 stainless steel door and frame with vertical decal lettering "FIRE EXTINGUISHER" in red color, unless directed otherwise by Architect.
5. Glazing: clear acrylic “Duo” vertical glazing panel
6. Hardware: Continuous concealed piano hinge constructed of material which matches door and trim material. Satin finish pull handle with cam cylinder lock with safety pull designed to release upon firm pull on handle (Larsen’s “Larsen-Loc”™, J.L. Industries

"Saf-T-Lok"™; or equivalent).

7. Bracket: Hook type; Larsen's #1007, or equal.
8. Finish of Exterior: #4 Stainless steel.
9. Fire rating: as occurs, provide fire rated cabinet, for one or two hour rated conditions as indicated or required by specific location. Cabinet shall be tested and approved by Warnock Hersey to ASTM E814, and shall bear the Warnock Hersey label.

C. Fire Extinguishers (F.E):

1. Models/Types:
   a. Multipurpose dry chemical with 10 lbs. capacity: C rating conforming to MP10 Series. UL Rating: 4A:80B:C.
   b. Wet-Chemical Type, WC Series, (FE-K): UL-rated 2-A: K, 2.5-gal. (9.5-L) nominal capacity, with potassium carbonate-based chemical in stainless-steel container; with pressure-indicating gage.
2. Mounting: Provide eye brackets for direct wall mounting to hook and for mounting in Fire Extinguisher cabinets. Refer to drawings for location and quantity.
3. Provide initial inspection tag for each extinguisher.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fire extinguishers and cabinets in openings in accordance with manufacturer's printed instructions.

B. Install fire extinguishers and cabinets where indicated on the drawings, or if not indicated, in locations required by governing code and as directed by Owner.

END OF SECTION 10 44 00

SECTION 22 0523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Ball valves.

1.02 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors in dry environment.
      b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Domestic, Hot and Cold Water Valves:
   1. 2 NPS (50 DN) and Smaller:
      a. Bronze and Brass: Provide with solder-joint or threaded ends.
      b. Bronze Angle: Class 125, bronze disc.
      c. Ball: One piece, full port, brass or bronze with brass trim.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
   1. Gear Actuator: Quarter-turn valves 8 NPS (200 DN) and larger.

D. Valves in Insulated Piping: With 2 NPS (50 DN) stem extensions and the following features:
   1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:
   1. Threaded End Valves: ASME B1.20.1.
   2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
   3. Pipe Flanges and Flanged Fittings 1/2 NPS (15 DN) through 24 NPS (600 DN): ASME B16.5.

F. Valve Materials for Potable Water: NSF 61 and NSF 372.

G. Valve Bypass and Drain Connections: MSS SP-45.

H. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRASS BALL VALVES

A. Two Piece, Full Port and Regular Port with Brass Trim:
   1. Comply with MSS SP-110.
   2. SWP Rating: 150 psig (1035 kPa).
   3. CWP Rating: 600 psig (4140 kPa).
   4. Body: Forged brass.
   5. Ends: Threaded.
   6. Seats: PTFE.

2.04 BRONZE BALL VALVES

END OF SECTION

SECTION 22 0553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe markers.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Piping: Pipe markers.

2.02 PIPE MARKERS

A. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Color code as follows:
   1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
   2. Fire Quenching Fluids: Red with white letters.
   3. Toxic and Corrosive Fluids: Orange with black letters.
   4. Flammable Fluids: Yellow with black letters.
   5. Combustible Fluids: Brown with white letters.
   6. Compressed Air: Blue with white letters.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic pipe markers in accordance with manufacturer's instructions.

B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum Service Temperature: 850 degrees F (454 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. K (Ksi) Value: ASTM C177, 0.23 at 75 degrees F (0.034 at 24 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

2.04 JACKETS

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F (Minus 18 degrees C).
      b. Maximum Service Temperature: 150 degrees F (66 degrees C).
      c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil (0.25 mm).
      e. Connections: Brush on welding adhesive.
   2. Covering Adhesive Mastic: Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
   1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with PVC jacket and fitting covers.

L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

M. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Hot Water Supply:

a. Glass Fiber Insulation:
   1) Pipe Size Range: 1 1/2 inch and larger .
   2) Thickness: 1 1/2 inch.
b. Glass Fiber Insulation:
   1) Pipe Size Range: 1 1/4 inch and smaller .
   2) Thickness: 1 inch.
c. Cellular Foam Insulation:
   1) Pipe Size Range: 1 1/4 inch and smaller .
   2) Thickness: 1 inch.

2. Domestic Hot Water Recirculation:
   a. Glass Fiber Insulation:
      1) Pipe Size Range: All sizes.
      2) Thickness: 1 inch (25 mm).
3. Domestic Cold Water: 1 inch
4. Roof Drain Bodies: Glass Fiber 1 inch
5. Roof Drainage Above Grade: Glass Fiber 1 inch
6. Roof Drainage Within 10 Feet (3 Meters) of the Exterior: Glass FIber 1 inch
7. Roof Drainage Run Horizontal at Roof Level: 1 inch
8. Plumbing Vents Within 10 Feet (3 Meters) of the Exterior: Glass Fiber 1 inch

B. Other Systems:
   1. Piping Exposed to Freezing with Heat Tracing: 1 inch

END OF SECTION

SECTION 22 1005
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Storm water.
   4. Flanges, unions, and couplings.
   5. Pipe hangers and supports.
   6. Valves.
   7. Flow controls.
   8. Check.
   9. Water pressure reducing valves.

1.02 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.03 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Cast Iron Pipe: CISPI 301, hubless.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. PVC Pipe: ASTM D2729.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

B. CPVC Pipe: ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M.
1. Fittings: CPVC; ASTM D2846/D2846M, ASTM F437, ASTM F438, or ASTM F439.
2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

C. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
1. PPI TR-4 Pressure Design Basis:
a. 100 psig (689 kPa) at maximum 180 degrees F (82 degrees C).
2. Joints: Mechanical compression fittings.

2.06 STORM WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.07 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
1. Ferrous Pipe: Class 150 malleable iron threaded unions.
2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch (25 mm):
1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
1. Dimensions and Testing: In accordance with AWWA C606.
2. Housing Material: Provide ASTM A47/A47M malleable iron or ductile iron, galvanized.
3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F (minus 34 degrees C) to 230 degrees F (110 degrees C).
4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
5. When pipe is field grooved, provide coupling manufacturer's grooving tools.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.08 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
a. Cold and Hot Pipe Sizes 6 Inches (150 mm) and Over: Double hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.

2.09 BALL VALVES

A. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port,

teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.10 PIPING SPECIALTIES

A. Flow Controls:
   1. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
   2. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi (24 kPa).

2.11 WATER PRESSURE REDUCING VALVES

A. Up to 2 Inches (50 mm):
   1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

B. Over 2 Inches (50 mm):
   1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.

I. Establish elevations of buried piping outside the building to ensure not less than local requirements for cover depth.

J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

L. Provide support for utility meters in accordance with requirements of utility companies.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.

N. Install bell and spigot pipe with bell end upstream.

O. Install valves with stems upright or horizontal, not inverted.

P. Install water piping to ASME B31.9.

Q. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

R. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

S. Sleeve pipes passing through partitions, walls, and floors.

T. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

U. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
   4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   8. Provide copper plated hangers and supports for copper piping.
   9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
   10. Provide hangers adjacent to motor-driven equipment with vibration isolation.
   11. Support cast iron drainage piping at every joint.

V. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install ball valves for throttling, bypass, or manual flow control services.

F. Provide spring-loaded check valves on discharge of water pumps.

G. Provide flow controls in water recirculating systems where indicated.

3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system.

B. Prior to starting work, verify system is complete, flushed, and clean.

C. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

D. Maintain disinfectant in system for 24 hours.

E. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

3.06 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve.
   1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
   2. Provide 18 gage, 0.0478-inch (1.21 mm) galvanized sheet metal sleeve around service main to 6 inch (150 mm) above floor and 6 feet (1800 mm) minimum below grade. Size for minimum of 2 inches (50 mm) of loose batt insulation stuffing.

3.07 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
         1) Maximum Hanger Spacing: 6.5 ft (2 m).
         2) Hanger Rod Diameter: 3/8 inches (9 mm).
      b. Pipe Size: 1-1/2 inches (40 mm) to 2 inches (50 mm):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 3/8 inch (9 mm).
      c. Pipe Size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 1/2 inch (13 mm).
      d. Pipe Size: 4 inches (100 mm) to 6 inches (150 mm):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 5/8 inch (15 mm).
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum Hanger Spacing: 6 ft (1.8 m).
         2) Hanger Rod Diameter: 3/8 inch (9 mm).

END OF SECTION

SECTION 22 4000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Lavatories.

1.02 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 3 EXECUTION

2.01 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

2.02 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

2.03 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2.04 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

END OF SECTION

SECTION 23 0548
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Seismic control requirements.
   1. Includes requirements for seismic qualification of equipment not specified in this section.

C. Vibration-isolated equipment support bases.

D. Vibration isolators.

E. External seismic snubber assemblies.

F. Seismic restraint systems.

G. Vibration-isolated and/or seismically engineered roof curbs.

1.02 RELATED REQUIREMENTS

A. Section 01 4533 - Code-Required Special Inspections and Procedures.

B. Section 03 3000 - Cast-in-Place Concrete.

1.03 DEFINITIONS

A. HVAC Component: Where referenced in this section in regards to seismic controls, applies to any portion of the HVAC system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., ductwork, piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

A. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

C. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2002.

D. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.

E. FEMA 414 - Installing Seismic Restraints for Duct and Pipe 2004.

F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.

G. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components 2010, with Editorial Revision (2015).

H. MFMA-4 - Metal Framing Standards Publication 2004.

I. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Seismic Controls:
      a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.

b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
2. Seismic Controls: Include seismic load capacities.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.07 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
1. Designer may be employed by the manufacturer of the seismic restraint products.

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

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch (50 mm) operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation: As indicated on drawings.

E. Piping Isolation:

1. Provide vibration isolators for piping supports:
   a. Located in equipment rooms.
   b. Located within 50 feet (15.2 m) of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
   c. For piping over 2 inch (50 mm) located below or within 50 feet (15.2 m) of noise-sensitive areas indicated.
2. Minimum Static Deflection:
   a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch (50 mm) deflection required.
   b. Remainder of Supports: 0.75 inch (19 mm) deflection unless otherwise indicated.
3. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
4. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
5. Floor-Mounted Piping, Nonseismic Applications: Use open (unhoused) spring isolators.
6. Floor-Mounted Piping, Seismic Applications: Use seismic type restrained spring isolators.
7. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

F. Thrust Restraint Applications:
1. Use thrust restraints to resist horizontal motion due to thrust for fan heads, suspended fans, and base-mounted and suspended air handling equipment operating at 2.0 inches wg (0.5 kPa) or greater total static pressure.
2. Minimum Static Deflection: Same as static deflection of equipment.
3. Limit lateral movement to 0.25 inch (6 mm) or less unless otherwise indicated.

2.02 SEISMIC CONTROL REQUIREMENTS

A. Design and provide HVAC component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor HVAC components.

B. Seismic Design Criteria: As indicated on drawings.

C. Component Importance Factor (Ip): HVAC components to be assigned a component importance factor (Ip) of 1.5 unless otherwise indicated.

D. Seismic Qualification of Equipment:
1. Provide special certification for HVAC equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Premanufactured Modular HVAC Equipment: Where not otherwise seismically qualified, premanufactured modules 6 feet (1.8 m) high and taller furnished under other sections to be designed in accordance with seismic provisions for nonbuilding structures.

F. Seismic Restraints:
1. Provide seismic restraints for HVAC components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.

2. Seismic Restraint Exemptions:
   a. Exemptions for Seismic Design Category C:
      1) HVAC components where either of the following apply:
         (a) The component importance factor (Ip) is 1.0 and the component is positively attached to the structure.
         (b) The component weighs 20 pounds (89 N) or less or, in the case of a distributed system, 5 pounds per foot (73 N/m) or less.
      2) HVAC piping with component importance factor (Ip) of 1.5 and nominal pipe size of 2 inch (50 mm) or less, where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, and where piping is positively attached to the structure; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).
   b. Exemptions for Seismic Design Category D, E, and F:
      1) Discrete HVAC components that are positively attached to the structure where either of the following apply:
         (a) The component weighs 400 pounds (1,780 N) or less, has a center of mass located 4 feet (1.22 m) or less above the adjacent floor level, flexible connections are provided between the component and associated ductwork, piping, and conduit, and the component importance factor (Ip) is 1.0.
         (b) The component weighs 20 pounds (89 N) or less or, in the case of a distributed system, 5 pounds per foot (73 N/m) or less.
      2) HVAC piping with component importance factor (Ip) of 1.0 and nominal pipe size of 3 inch (80 mm) or less, or with component importance factor (Ip) of 1.5 and nominal pipe size of 1 inch (25 mm) or less, where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, and where piping is positively attached to the structure; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).
   c. Duct System Exemptions, All Seismic Design Categories:
      1) Duct systems not designed to carry toxic, highly toxic, or flammable gases and not used for smoke control with component importance factor (Ip) of 1.0, where flexible connections or other assemblies are provided between duct system and associated components, where duct system is positively attached to the structure, and where one of the following apply:
         (a) Trapeze supported duct with trapeze assemblies using 3/8 inch (10 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds (445 N) or less.
         (b) Trapeze supported duct with trapeze assemblies using 1/2 inch (13 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 200 pounds (890 N) or less.
         (c) Trapeze supported duct with trapeze assemblies using 1/2 inch (13 mm) diameter rod hangers not exceeding 24 inches (610 mm) in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds (445 N) or less.
         (d) Hanger supported duct with individual rod hangers 3/8 inch (10 mm) or 1/2 inch (13 mm) in diameter not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.
      2) Duct systems not designed to carry toxic, highly toxic, or flammable gases and not used for smoke control, where there are provisions to avoid impact with other ducts or mechanical components or to protect ducts in the event of such

impact, and where duct system is positively attached to the structure and has a cross sectional area of less than 6 square feet (0.557 sq m) and weighs 20 pounds per foot (292 N/m) or less.

d. HVAC Piping Exemptions, All Seismic Design Categories:
   1) HVAC piping where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, where piping is positively attached to the structure, and where one of the following apply:
      (a) Trapeze supported piping weighing less than 10 pounds per foot (146 N/m), where all pipes supported meet size requirements for exemption as single pipes described under specific seismic design category exemptions above.
      (b) Trapeze supported piping with trapeze assemblies using 3/8 inch (10 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 100 pounds (445 N) or less.
      (c) Trapeze supported piping with trapeze assemblies using 1/2 inch (13 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 200 pounds (890 N) or less.
      (d) Trapeze supported piping with trapeze assemblies using 1/2 inch (13 mm) diameter rod hangers not exceeding 24 inches (610 mm) in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 100 pounds (445 N) or less.
      (e) Hanger supported piping with individual rod hangers 3/8 inch (10 mm) or 1/2 inch (13 mm) in diameter not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, where pipe has a component importance factor (Ip) of 1.0 and meets size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single rod is 50 pounds (220 N) or less.

3. Seismic Restraint Exemptions:
   a. Exemptions for Seismic Design Category C:
      1) HVAC components with component importance factor (Ip) of 1.0.
      2) HVAC piping with component importance factor (Ip) of 1.5 and nominal pipe size of 2 inch (50 mm) or less; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).
   b. Exemptions for Seismic Design Category D, E, and F:
      1) HVAC components with component importance factor (Ip) of 1.0 where all of the following apply:
         (a) The component is positively attached to the structure.
         (b) Flexible connections are provided between the component and associated ductwork, piping, and conduit.
         (c) Either:
            (1) The component weighs 400 pounds (1,780 N) or less and has a center of mass located 4 feet (1.22 m) or less above the adjacent floor level.
            (2) The component weighs 20 pounds (89 N) or less or, in the case of a distributed system, 5 pounds per foot (73 N/m) or less.

2) HVAC piping with component importance factor (Ip) of 1.0 and nominal pipe size of 3 inch (80 mm) or less, or with component importance factor (Ip) of 1.5 and nominal pipe size of 1 inch (25 mm) or less; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).

c. Ductwork Exemptions, All Seismic Design Categories:
   1) Ductwork not designed to carry toxic, highly toxic, or flammable gases and not used for smoke control where any of the following apply:
      (a) Trapeze supported ductwork weighing less than 10 pounds per foot (146 N/m).
      (b) Hanger supported ductwork where each hanger in the duct run is 12 inches (305 mm) or less in length from the duct support to the supporting structure; rod hangers, where used, to be equipped with swivels.
      (c) Ductwork having a cross sectional area of less than 6 square feet (0.557 sq m) or weighing 17 pounds per foot (248 N/m) or less, and where there are provisions to avoid impact with other ducts or mechanical components or to protect ducts in the event of such impact.

d. HVAC Piping Exemptions, All Seismic Design Categories:
   1) Trapeze supported piping weighing less than 10 pounds per foot (146 N/m), where all pipes supported meet requirements for exemption as single pipes described under specific seismic design category exemptions above.
   2) Hanger supported piping where each hanger in the piping run is 12 inches (305 mm) or less in length from the pipe support to the supporting structure; rod hangers, where used, to be equipped with swivels.

4. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
   a. ASHRAE (HVACA).
   b. FEMA 412.
   c. FEMA 413.
   d. FEMA 414.
   e. FEMA E-74.
   f. SMACNA (SRM).
5. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
6. Seismic Type Vibration Isolators:
   a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
7. External Seismic Snubber Assemblies:
   a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
   b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
8. Seismic Restraint Systems:
   a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
   b. Use only cable restraints to restrain vibration-isolated HVAC components, including distributed systems.
   c. Use only one restraint system type for a given HVAC component or distributed system (e.g., ductwork, piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
   d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain HVAC component in all lateral directions; consider bracket geometry in anchor load calculations.

e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported HVAC component weight.
f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported HVAC component weight.
g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.

9. Ductwork Applications:
a. Provide independent support and seismic restraint for in-line components (e.g., fans, heat exchangers, humidifiers) having an operating weight greater than 75 pounds (334 N).
b. Positively attach appurtenances (e.g., dampers, louvers, diffusers) with mechanical fasteners.

G. Seismic Attachments:
1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
3. Do not use power-actuated fasteners.
4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
a. Increase size of pad as required to comply with anchor requirements.
b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

H. Seismic Interactions:
1. Include provisions to prevent seismic impact between HVAC components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
3. Comply with minimum clearance requirements between HVAC equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.

I. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections to accommodate:
a. Relative displacements at connections between components, including distributed systems (e.g., ductwork, piping); do not exceed load limits for equipment utility connections.

b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
c. Design displacements at seismic separations.
d. Anticipated drifts between floors.

2. Include provisions to prevent interruption of utility service due to seismic displacements.

J. California Office of Statewide Health Planning and Development (OSHPD) Preapprovals:
1. Manufacturer's certifications of seismic design of supports for nonstructural components to have current approval under OSHPD Preapproval of Manufacturer's Certification (OPM) program.
2. Special seismic certifications to have current approval under OSHPD Special Seismic Certification Preapproval (OSP) program.

2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

2.04 VIBRATION ISOLATORS

A. General Requirements:
1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
a. Color code or otherwise identify springs to indicate load capacity.
b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
f. Selected to function without undue stress or overloading.
3. Seismic Snubbing Elements for Seismic Isolators:
a. Air Gap: Between 0.125 inches (3 mm) and 0.25 inches (6 mm) unless otherwise indicated.
b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch (6 mm) thick; capable of being visually inspected for damage and replaced.

B. Vibration Isolators for Nonseismic Applications:
1. Resilient Material Isolator Pads:
a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch (6 mm) thickness.
c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
2. Resilient Material Isolator Mounts, Nonseismic:
a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
3. Open (Unhoused) Spring Isolators:
a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
c. Furnished with integral leveling device for positioning and securing supported equipment.
4. Housed Spring Isolators:

a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
d. Furnished with integral leveling device for positioning and securing supported equipment.

5. Restrained Spring Isolators, Nonseismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
   b. Bottom Load Plate: Steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
6. Resilient Material Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
7. Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
9. Thrust Restraints:
   a. Description: Assembly utilizing free-standing, laterally stable steel spring designed for resisting horizontal motion due to thrust (e.g., air pressure from a fan), and intended for installation in pairs.

C. Vibration Isolators for Seismic Applications:
1. Resilient Material Isolator Mounts, Seismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
2. Restrained Spring Isolators, Seismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
   b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.

d. Provides constant free and operating height.

3. Resilient Material Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
4. Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.05 ACOUSTICAL AND VIBRATION ISOLATORS

A. General Requirements:
   1. Acoustical Isolation System: Through-stud isolators, pipe clamps, riser clamp pads, neoprene and felt lining material and associated support brackets.

2.06 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

B. Seismic Snubbing Elements:
   1. Air Gap: Between 0.125 inches (3 mm) and 0.25 inches (6 mm) unless otherwise indicated.
   2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch (6 mm) thick; capable of being visually inspected for damage and replaced.

2.07 SEISMIC RESTRAINT SYSTEMS

A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

B. Cable Restraints:
   1. Comply with ASCE 19.
   2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
   3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
   4. Use protective thimbles for cable loops where potential for cable damage exists.

C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

2.08 VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

A. Vibration Isolation Curbs:
   1. Nonseismic Curb Rail:

a. Location: Between existing roof curb and rooftop equipment.
b. Construction: Aluminum.
c. Integral vibration isolation to comply with requirements of this section.
d. Weather exposed components consist of corrosion resistant materials.

2. Nonseismic Curb:
a. Location: Between structure and rooftop equipment.
b. Construction: Aluminum.
c. Integral vibration isolation to comply with requirements of this section.
d. Weather exposed components consist of corrosion resistant materials.

3. Seismic Curb:
a. Location: Between structure and rooftop equipment.
b. Construction: Steel.
c. Integral vibration isolation to comply with requirements of this section.
d. Snubbers consist of minimum 0.25 inch (6 mm) thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
e. Weather exposed components consist of corrosion resistant materials.

B. Seismic Type Nonisolated Curb and Fabricated Equipment Piers:
1. Location: Between structure and rooftop equipment.
2. Construction: Steel.
3. Weather exposed components consist of corrosion resistant materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 4533 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Seismic special inspections include, but are not limited to:
1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with the certificate of compliance.
2. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units for Seismic Design Categories C, D, E, and F; periodic inspection.
3. Installation and anchorage of ductwork designed to carry hazardous materials for Seismic Design Categories C, D, E and F; periodic inspection.
4. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved Contract Documents require a nominal clearance of 1/4 inch (6.4 mm) or less between equipment support frame and seismic restraint; periodic inspection.

5. Verification of required clearances between HVAC equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs for Seismic Design Categories C, D, E, and F; periodic inspection.

D. Seismic special inspections include, but are not limited to:
   1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with the certificate of compliance.
   2. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units for Seismic Design Categories C, D, E, and F; periodic inspection.
   3. Installation and anchorage of ductwork designed to carry hazardous materials for Seismic Design Categories C, D, E and F; periodic inspection.
   4. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved Contract Documents require a nominal clearance of 1/4 inch (6.4 mm) or less between equipment support frame and seismic restraint; periodic inspection.

E. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

F. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

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

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
   1. Vibration-Isolated Equipment Support Bases:
      a. Provide specified minimum clearance beneath base.
   2. Spring Isolators:
      a. Position equipment at operating height; provide temporary blocking as required.
      b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
      c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
   3. Isolator Hangers:
      a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
      b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
   4. Thrust Restraints:
      a. Adjust restraint movement under normal operating static pressure.
   5. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
   6. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
   7. Adjust isolators to be free of isolation short circuits during normal operation.
   8. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

F. Seismic Controls:

1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch (3 mm), use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch (3 mm) or less.
4. Equipment with Sheet Metal Housings:
    a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
    b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
    c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
5. Concrete Housekeeping Pads:
    a. Size in accordance with seismic design to meet anchor requirements.
    b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
    a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
    b. Install restraints within permissible angles in accordance with seismic design.
    c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
    d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
    e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:
    1. Verify isolator static deflections.
    2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Seismic Controls:
    1. Verify snubbing element air gaps.

E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Automatic Controls: Tags. Key to control schematic.

C. Small-sized Equipment: Tags.

D. Thermostats: Nameplates.

2.02 NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1/4 inch (6 mm).

C. Background Color: Black.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. Equipment: 2-1/2 inch (65 mm) high letters.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

END OF SECTION

SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.02 SUBMITTALS

A. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Final test report forms to be used.
      d. Procedures for formal deficiency reports, including scope, frequency and distribution.

B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   5. Units of Measure: Report data in I-P (inch-pound) units only.
   6. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Architect.
      g. Project Engineer.
      h. Project Contractor.
      i. Project altitude.
      j. Report date.

C. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

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

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.04 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.

4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.05 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

J. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

K. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

L. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

M. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.06 SCOPE

A. Test, adjust, and balance the following:
1. Forced Air Furnaces.
2. Packaged Roof Top Heating/Cooling Units.
3. Packaged Terminal Air Conditioning Units.
4. Unit Air Conditioners.
5. Air Coils.
6. Air Handling Units.

7. Fans.
8. Air Terminal Units.
9. Air Inlets and Outlets.

3.07 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. Air Cooled Condensers:
1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

C. Cooling Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Water flow, design and actual.
11. Water pressure drop, design and actual.
12. Entering water temperature, design and actual.
13. Leaving water temperature, design and actual.
14. Air pressure drop, design and actual.

D. Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

E. Electric Duct Heaters:

1. Manufacturer.
2. Identification/number.
3. Location.
4. Model number.
5. Design kW.
6. Number of stages.
7. Phase, voltage, amperage.
8. Test voltage (each phase).
9. Test amperage (each phase).
10. Air flow, specified and actual.
11. Temperature rise, specified and actual.

F. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Return air flow, specified and actual.
7. Outside air flow, specified and actual.
8. Total static pressure (total external), specified and actual.
9. Inlet pressure.
10. Discharge pressure.
11. Sheave Make/Size/Bore.
12. Number of Belts/Make/Size.
13. Fan RPM.

G. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.

H. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

I. Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.

4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
   a. Blower.
   b. Orifice, tube size.
   c. Orifice size.
   d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

J. Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum design air flow.
8. Maximum design air flow.
9. Maximum actual air flow.

K. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.

L. Sound Level Reports:
1. Location.
2. Octave bands - equipment off.
3. Octave bands - equipment on.

END OF SECTION

SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

1.02 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K (Ksi) value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 1200 degrees F (649 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Indoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. K (Ksi) Value: 0.24 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F (232 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent.
   4. Maximum Density: 8.0 lb/cu ft (128 kg/cu m).

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Indoor Vapor Barrier Finish:
   1. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 180 degrees F (82 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 DUCT LINER

A. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.

B. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated Ducts Conveying Air Above Ambient Temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

F. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Exhaust Ducts Within 15 ft (3 m) of Exterior Openings: 1 inch

B. Outside Air Intake Ducts: 1 1/2 inch

C. Plenums: 1 1/2 inch

D. Supply Ducts: 1-1/2 inch

E. Supply ducts After Terminal Boxes: 1 1/2 inch

END OF SECTION

SECTION 23 0716
HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment insulation.

1.02 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.04 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturers:
   1. CertainTeed Corporation; [_____]: www.certainteed.com/#sle.
   2. Johns Manville Corporation; [_____]: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation; [_____]: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C553; flexible, noncombustible.
   1. K (Ksi) Value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum Service Temperature: 450 degrees F (232 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   1. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
   2. Secure with self-sealing longitudinal laps and butt strips.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.
   1. Manufacturers:

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc; Aerocel AC Sheet and Roll: www.aeroflexusa.com/#sle.
   2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
   3. K-Flex USA LLC; Insul-Sheet: www.kflexusa.com/#sle.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.

1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
2. Maximum Service Temperature: 220 degrees F (104 degrees C).
3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

END OF SECTION

SECTION 23 0913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure independent valves and actuators.

B. Dampers.

C. Damper Operators:
   1. Electric operators.

D. Humidistats:
   1. Room humidistats.

E. Input/Output Sensors:
   1. Temperature sensors.
   2. Humidity sensors.
   3. Static pressure (air pressure) sensors.
   4. Equipment operation (current) sensors.
   5. Damper position indicators.
   6. Carbon dioxide sensors.

F. Thermostats:
   1. Electric room thermostats.
   2. Low-limit temperature cutout switch (freezestat)
   3. Line voltage thermostats.
   4. Room thermostat accessories.

G. Time clocks.

H. Energy Metering:
   1. Hydronic BTU (J) meters.

I. Flow Sensors:
   1. Gas flow meters.
   2. Flow switches.

J. Level Switches:
   1. Float Sensors:
      a. Float switch.
      b. Top mount float type level control.
      c. Free-floating level switch.

1.02 SUBMITTALS

A. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

END OF SECTION

SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

C. Casings and plenums.

D. Kitchen hood ductwork.

E. Duct cleaning.

1.02 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

1.03 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. Ducts: Galvanized steel, unless otherwise indicated.

C. Low Pressure Supply (Heating Systems): 1 inch wg (250 Pa) pressure class, galvanized steel.

D. Low Pressure Supply (System with Cooling Coils): 1 inch wg (250 Pa) pressure class, galvanized steel.

E. Medium and High Pressure Supply: 2 inch w.g. (500 Pa) pressure class, galvanized steel.

F. Return and Relief: 1 inch wg (250 Pa) pressure class, galvanized steel.

G. General Exhaust: 1 inch wg (250 Pa) pressure class, galvanized steel.

H. Kitchen Cooking Hood Exhaust Type II: 2 inch wg (500 Pa) pressure class.
   1. Construct of 18 gauge, 0.0500 inch (1.27 mm) stainless steel using continuous external welded joints in rectangular sections.

I. Dishwasher Exhaust: 1 inch wg (250 Pa) pressure class.
   1. Construct of 18 gauge, 0.0500 inch (1.27 mm) stainless steel using continuous external welded joints in rectangular sections.

J. Kitchen Cooking Hood Grease Exhaust Type I: 2 inch wg (500 Pa) pressure class.
   1. Construct of 16 gauge (1.52 mm) un-galvanized steel.
   2. Construction:
      a. Liquidtight with continuous external weld for all seams and joints.
      b. Where ducts are not self draining back to equipment, provide low point drain pocket with copper drain pipe to sanitary sewer.
   3. Access Doors:
      a. Provide for duct cleaning inside horizontal duct at drain pockets, every 20 feet (6 m) and at each change of direction.
      b. Use same material and thickness as duct with gaskets and sealants rated 1500 degrees F (815 degrees C) for grease tight construction.

K. Outside Air Intake: 1/2 inch wg (125 Pa) pressure class, galvanized steel.

L. Combustion Air: 1/2 inch wg (125 Pa) pressure class, galvanized steel.

M. Transfer Air and Sound Boots: 1/2 inch wg (125 Pa) pressure class, galvanized steel.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Un-Galvanized Steel for Ducts: ASTM A1008/A1008M Designation CS (commercial steel), cold-rolled.

C. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

D. Stainless Steel for Ducts: ASTM A666, Type 304.

E. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

F. Gasket Tape: Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle rings connections.

G. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

H. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
   5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.

C. Duct systems have been designed for metal duct. At the Contractor's option, fibrous glass duct may be substituted for metal duct.

D. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

E. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

F. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

G. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

H. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Double Wall Insulated Round Ducts: Round spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
   1. Manufacture in accordance with SMACNA (DCS).
   2. Insulation:
      a. Thickness: 1 inch (25 mm).
      b. Material: Fiberglass.

B. Spiral Ducts: Round spiral lockseam duct with galvanized steel outer wall.
   1. Manufacture in accordance with SMACNA (DCS).

C. Round Ducts: Round lockseam duct with galvanized steel outer wall.
   1. Manufacture in accordance with SMACNA (DCS).

D. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
   1. UL labeled.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: 4 inches wg (1000 Pa) positive and 0.5 inches wg (175 Pa) negative.
   4. Maximum Velocity: 4000 fpm (20.3 m/sec).
   5. Temperature Range: Minus 20 degrees F to 175 degrees F (Minus 28 degrees C to 79 degrees C).

E. Kitchen Hood and Grease Exhaust Ducts:
   1. Fabricate in accordance with ductwork manufacturer's instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.

F. Dishwasher Exhaust Ducts: Minimum 21 gauge, 0.0344 inch (0.87 mm) thick, single wall, Type 304 stainless steel.
   1. Single wall, factory built chimney liner system.
   2. Designed, fabricated, and installed to be liquidtight preventing exhaust leakage into the building.
   3. Joints to be sealed during installation with factory supplied overlapping V-bands and sealant.

2.05 CASINGS AND PLENUMS

A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.

B. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

C. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gauge, 0.0598 inch (1.52 mm) sheet steel back facing and 22 gauge, 0.0299 inch (0.76 mm) perforated sheet steel front facing with 3/32 inch (2.4 mm) diameter holes on 5/32 inch (4 mm) centers. Construct panels 3 inches (75 mm) thick packed with 4.5 lb/cu ft (72 kg/cu m) minimum glass fiber insulation media, on inverted channels of 16 gauge, 0.0598 inch (1.52 mm) sheet steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Flexible Ducts: Connect to metal ducts with mechanical fastener.

E. Kitchen Hood Exhaust: Provide residue traps at base of vertical risers with provisions for clean out.

F. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

G. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.

J. Use double nuts and lock washers on threaded rod supports.

K. Connect terminal units to supply ducts directly or with one foot (300 mm) maximum length of flexible duct. Do not use flexible duct to change direction.

L. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.02 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

END OF SECTION

SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Duct access doors.

D. Duct test holes.

E. Flexible duct connectors.

F. Volume control dampers.

1.02 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Fusible Links: One of each type and size.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.02 BACKDRAFT DAMPERS - METAL

A. Gravity Backdraft Dampers, Size 12x12 inches (300x300 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.05 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).
   2. Metal: 3 inches (75 mm) wide, 24 gauge, 0.0239 inch (0.61 mm) thick galvanized steel.

2.06 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Splitter Dampers:
   1. Material: Same gauge as duct to 24 inches (600 mm) size in either direction, and two gauges heavier for sizes over 24 inches (600 mm).
   2. Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch (6 mm) diameter rod in self aligning, universal joint action, flanged bushing with set screw.

C. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch (150 by 760 mm).
   2. Blade: 24 gauge, 0.0239 inch (0.61 mm), minimum.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch (200 by 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gauge, 0.0478 inch (1.21 mm), minimum.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 inch (200 by 200 mm) size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch (100 by 100 mm) for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

F. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

H. Use splitter dampers only where indicated.

I. Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 3600 - Air Terminal Units.

J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers:
   1. Rectangular ceiling diffusers.

B. Registers/grilles:
   1. Ceiling-mounted, exhaust and return register/grilles.
   2. Ceiling and wall-mounted, supply register/grilles.
   3. Ceiling and wall-mounted, exhaust and return register/grilles.

1.02 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hart & Cooley, Inc; [_____]: www.hartandcooley.com/#sle.

B. Krueger-HVAC; [_____]: www.krueger-hvac.com/#sle.

C. Price Industries; [_____]: www.price-hvac.com/#sle.

D. Ruskin Company; [_____]: www.ruskin.com/#sle.

E. Titus, a brand of Air Distribution Technologies; [_____]: www.titus-hvac.com/#sle.

F. Tuttle and Bailey; [_____]: www.tuttleandbailey.com/#sle.

G. Greenheck; : www.greenheck.com.

2.02 RECTANGULAR CEILING DIFFUSERS

A. Connections: As indicated on drawings.

B. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel or aluminum with baked enamel finish.

D. Color: As selected by Architect from manufacturer's standard range.

2.03 CEILING AND WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.

C. Color: As selected by Architect from manufacturer's standard range.

D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.04 CEILING AND WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees, vertical face.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.

C. Fabrication: Steel with 20 gauge, 0.0359 inch (0.91 mm) minimum frames and 22 gauge, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gauge, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

END OF SECTION

SECTION 26 0505
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 EXECUTION

1.01 EXAMINATION

A. Verify that wiring and equipment to be removed serve only areas of demolition, or make provisions to maintain portions of systems serving areas outside of scope of demolition.

B. Demolition drawings are based on casual field observation and existing record documents.

C. Beginning of demolition means installer accepts existing conditions.

1.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

C. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

D. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner before partially or completely disabling system.
   2. Notify local fire service.
   3. Make notifications at least 24 hours in advance.
   4. Make temporary connections to maintain service in areas adjacent to work area.

1.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

F. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

1.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet.
      b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
      a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
         1) Services: Copper conductors size 1/0 AWG and larger.
         2) Feeders: Copper conductors size 1/0 AWG and larger.
      b. Where aluminum conductors are substituted for copper, comply with the following:
         1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
         2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
         3) Provide aluminum equipment grounding conductor sized according to NFPA 70.
         4) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

3. Tinned Copper Conductors: Comply with ASTM B33.

E. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
a. Exceptions:
1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

F. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

G. Conductor Color Coding:
1. Color code conductors as called for within the NEC or otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.04 METAL-CLAD CABLE

A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

E. Grounding: Full-size integral equipment grounding conductor.

F. Armor: Steel, interlocked tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

3.02 INSTALLATION

A. Circuiting Requirements:
1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same

raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install metal-clad cable (Type MC) in accordance with NECA 120.

C. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

D. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

E. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
   2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

F. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

G. Install conductors with a minimum of 12 inches of slack at each outlet.

H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

I. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

J. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 PRODUCTS

1.01 GROUNDING AND BONDING REQUIREMENTS

A. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

B. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

C. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
   1. Provide grounding electrode system for each separate building or structure.
   2. Provide equipment grounding conductor routed with supply conductors.
   3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
   4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

D. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
   2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
   3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
   4. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
      a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
      b. Metal gas piping.

E. Isolated Ground System:
   1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.

F. Communications Systems Grounding and Bonding:
   1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.

1.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 PRODUCTS

1.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 2 EXECUTION

2.01 INSTALLATION

A. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

B. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

C. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

D. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

SECTION 26 0533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 2 PRODUCTS

1.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Use galvanized steel rigid metal conduit, PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.

D. Concealed: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

E. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Exposed, Exterior: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

G. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet.

H. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet unless otherwise indicated.

1.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

PART 2 EXECUTION

2.01 INSTALLATION

A. Conduit Routing:
   1. Conceal all conduits unless specifically indicated to be exposed.
   2. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   3. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.

B. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

C. Connections and Terminations:
   1. Use suitable adapters where required to transition from one type of conduit to another.
   2. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
   3. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

D. Penetrations:
   1. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
   2. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
   3. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
   4. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

E. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation.

F. Provide grounding and bonding in accordance with Section 26 0526.

SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 2 PRODUCTS

1.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use raised covers suitable for the type of wall construction and device configuration where required.
   2. Use shallow boxes where required by the type of wall construction.
   3. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   4. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
   5. Minimum Box Size, Unless Otherwise Indicated:
      a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:
   3. Junction and Pull Boxes Larger Than 100 cubic inches:
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

D. Floor Boxes:
   1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.

PART 1 EXECUTION

2.01 INSTALLATION

A. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
   2. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   3. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

B. Install boxes plumb and level.

C. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

D. Close unused box openings.

E. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

SECTION 26 0533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 2 PRODUCTS

1.01 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

1.02 WIREWAYS

A. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.

B. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

PART 3 EXECUTION

2.01 INSTALLATION

A. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.

B. Close unused raceway openings.

SECTION 26 0539
UNDERFLOOR RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 PRODUCTS

1.01 DUCT SYSTEM REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete duct system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use duct systems for applications other than as permitted by NFPA 70 and product listing.

1.02 UNDERFLOOR DUCT

A. Configuration: Distribution and header underfloor duct for single service or multiple services as indicated on drawings; for multiple services use multiple compartment duct or parallel single compartment ducts positioned together.

B. Underfloor Duct:
   1. Description: Steel duct with corrosion-resistant coating, designed for installation beneath concrete floor surface; suitable for use as underfloor raceway and listed and labeled as complying with UL 884.
   2. Preset Inserts:
      a. Distribution Duct:
         1) Type: As required to accommodate specified service fittings.
         2) Height: Selected according to depth of concrete cover.
         3) Spacing: 24 inches.
         4) Furnish with removable cap recessed to hold concrete.
      b. Header Duct: None (blank duct).

C. Junction Boxes: Standard duty unless otherwise indicated.
   1. Provide junction box(es) for connections and intersections of duct runs as indicated or as required for duct configuration installed.
   2. Junction Boxes: Furnished with openings on four sides for duct connections and openings on four corners for conduit connections; with partitions to separate multiple services; with integral means for leveling adjustment prior to concrete pour.
   3. Height: Selected according to duct to be installed and depth of concrete cover.
   4. Cover Plate: Furnished with trim suitable for flooring to be installed.

D. Duct Supports: Steel with corrosion-resistant coating, with integral means for leveling adjustment prior to concrete pour; height to be selected according to duct to be installed and depth of concrete cover.

E. Marker Caps: Preset insert caps with integral marker screw for indicating location of duct run after concrete pour; provide different material screws for distinguishing between power and communications duct runs.

PART 2 EXECUTION

2.01 INSTALLATION

A. Unless otherwise indicated, arrange duct to be parallel or perpendicular to building lines.

B. Install duct supports located according to manufacturer's recommendations, but not exceeding 5 feet between supports. Permanently fasten duct supports to the supporting framework.

C. Provide expansion fittings with suitable bonding jumper where duct crosses structural joints intended for expansion.

D. Install marker caps in each insert adjacent to junction boxes, at end of each duct run, on both sides of permanent partitions, and on both sides of change in direction of duct. Adjust markers to be flush with finished floor except only extend through backing material for carpeted areas.

E. Prior to concrete placement, seal duct system connections and openings with duct tape or manufacturer's recommended compound to prevent entry of concrete.

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 PRODUCTS

1.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
   2. Service Equipment:
      a. Use identification nameplate to identify each service disconnecting means.
      b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
   3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
      a. Service equipment.
      b. Industrial control panels.
      c. Motor control centers.
      d. Elevator control panels.
      e. Industrial machinery.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.

1.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

1.03 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
   1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.

SECTION 26 0583
WIRING CONNECTIONS

PART 1 PRODUCTS

1.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SJO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

1.02 EQUIPMENT CONNECTIONS

A. As indicated in equipment schedules on drawings or as indicated on plans.:

PART 2 EXECUTION

2.01 ELECTRICAL CONNECTIONS

A. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

B. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

C. Provide receptacle outlet to accommodate connection with attachment plug.

D. Provide cord and cap where field-supplied attachment plug is required.

E. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

G. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

H. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 PRODUCTS

1.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

1.02 OCCUPANCY SENSORS

A. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
      b. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   5. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.

B. Wall Dimmer Occupancy Sensors:
   1. General Requirements:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
      b. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.

C. Ceiling Mounted Occupancy Sensors:
   1. All Ceiling Mounted Occupancy Sensors:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
   2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

D. Power Packs for Low Voltage Occupancy Sensors:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
   2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.

1.03 OUTDOOR PHOTO CONTROLS

A. Stem-Mounted Outdoor Photo Controls:
   1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.

B. Button Type Outdoor Photo Controls
   1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.

PART 2 EXECUTION

2.01 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.

B. Install lighting control devices in accordance with manufacturer's instructions.

C. Occupancy Sensor Locations:
   1. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

D. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

2.02 FIELD QUALITY CONTROL

A. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

B. Test outdoor photo controls to verify proper operation, including time delays where applicable.

C. Correct wiring deficiencies and replace damaged or defective lighting control devices.

2.03 ADJUSTING

A. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

B. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

SECTION 26 2416
PANELBOARDS

PART 1 PRODUCTS

1.01 MANUFACTURERS

A. ABB/GE; [_____]: www.geindustrial.com/#sle.

B. Eaton Corporation; [_____]: www.eaton.com/#sle.

C. Schneider Electric; Square D Products; [_____]: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc; [_____]: www.usa.siemens.com/#sle.

1.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
   3. Label equipment utilizing series ratings as required by NFPA 70.

B. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

C. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

D. Conductor Terminations: Suitable for use with the conductors to be installed.

E. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
   3. Lockable Doors: All locks keyed alike unless otherwise indicated.

F. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

G. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

H. Load centers are not acceptable.

I. Provide the following features and accessories where indicated or where required to complete installation:
   1. Feed-through lugs.
   2. Sub-feed lugs.

1.03 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
   4. Provide the following circuit breaker types where indicated:

a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.

5. Do not use tandem circuit breakers.
6. Do not use handle ties in lieu of multi-pole circuit breakers.
7. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
8. Provide the following features and accessories where indicated or where required to complete installation:
   a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

PART 2 EXECUTION

2.01 INSTALLATION

A. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

B. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

C. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

D. Install all field-installed branch devices, components, and accessories.

E. Provide filler plates to cover unused spaces in panelboards.

F. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

SECTION 26 2726
WIRING DEVICES

PART 1 PRODUCTS

1.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles installed in public area.

E. Provide GFCI protection for receptacles installed within 6 feet of sinks.

F. Provide GFCI protection for receptacles serving electric drinking fountains.

1.02 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

1.03 WALL DIMMERS

A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

B. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

1.04 RECEPTACLES

A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Convenience Receptacles:
   1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
   3. Tamper Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

C. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.

1.05 WALL PLATES

A. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.

B. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 2 EXECUTION

2.01 EXAMINATION

A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

2.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

2.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
   1. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   2. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

B. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

C. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

D. Do not share neutral conductor on branch circuits utilizing wall dimmers.

E. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

F. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

SECTION 26 2813
FUSES

PART 1 PRODUCTS

1.01 APPLICATIONS

A. Service Entrance:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

B. Feeders:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

C. General Purpose Branch Circuits: Class RK1, time-delay.

SECTION 26 2816.13
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.06 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; [_____]: www.eaton.com/#sle.

B. Schneider Electric; Square D Products; [_____]: www.schneider-electric.us/#sle.

C. Substitutions: See Section 01 6000 - Product Requirements.

D. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
   1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
   2. Listed series ratings are acceptable except where not permitted by motor contribution according to NFPA 70.
   3. Label equipment utilizing series ratings as required by NFPA 70.

E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Provide thermal magnetic circuit breakers unless otherwise indicated.

H. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

J. Provide externally operable handle with means for locking in the OFF position.

K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion circuit breakers with ground-fault shunt trips.
      a. Use zero sequence ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:
   1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
   2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   1. Provide the following field-adjustable trip response settings:
      a. Ground fault pickup and delay where ground fault protection is indicated.

F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

G. Provide the following circuit breaker types where indicated:
   1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   2. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   3. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

H. Provide the following features and accessories where indicated or where required to complete installation:
   1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

B. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed circuit breakers plumb.

F. Install flush-mounted enclosed circuit breakers so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

3.03 FIELD QUALITY CONTROL

A. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

B. Test GFCI circuit breakers to verify proper operation.

C. Test shunt trips to verify proper operation.

D. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

SECTION 26 2816.16
ENCLOSED SWITCHES

PART 1 PRODUCTS

1.01 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

C. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

SECTION 26 5100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.02 SUBMITTALS

A. Shop Drawings:

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: Equivalent products, except where individual luminaire types are designated with substitutions not permitted. Submit comparitive pricing with all fixture substitutions..

2.02 LUMINAIRES

A. Manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.
   4. Philips Lighting North America Corporation; [_____]; www.lightingproducts.philips.com/#sle.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

E. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

F. LED Luminaires:
   1. Tested in accordance with IES LM-79 and IES LM-80.

G. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EMERGENCY LIGHTING UNITS

A. Manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries; [_____]: www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

D. Battery:
   1. Sealed maintenance-free lead calcium unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

F. Provide low-voltage disconnect to prevent battery damage from deep discharge.

G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.04 EXIT SIGNS

A. Manufacturers - Powered and Self-Luminous Signs:
   1. Acuity Brands, Inc; [_____]: www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries; [_____]: www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc; [_____]: www.hubbelllighting.com/#sle.

B. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

C. Self-Powered Exit Signs:
   1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
   2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
   3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
   4. Provide low-voltage disconnect to prevent battery damage from deep discharge.
   5. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

D. Accessories:
   1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   2. Provide compatible accessory wire guards where indicated.

2.05 BALLASTS AND DRIVERS

A. Manufacturers:
   1. General Electric Company/GE Lighting: www.gelighting.com/#sle.
   2. Lutron Electronics Company, Inc; www.lutron.com/#sle.
   3. OSRAM Sylvania, Inc; [_____]: www.osram.us/ds/#sle.
   4. Philips Lighting North America Corporation; [_____]; www.usa.lighting.philips.com/#sle.
   5. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

C. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.06 LAMPS

A. Manufacturers:
   1. General Electric Company/GE Lighting; [_____]: www.gelighting.com/#sle.
   2. Osram Sylvania; [_____]: www.sylvania.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.
   4. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
   5. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.

3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.

M. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.

N. Remote Ballasts: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

O. Identify luminaires connected to emergency power system in accordance with Section 26 0553.

P. Install lamps in each luminaire.

3.02 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

SECTION 26 5600
EXTERIOR LIGHTING

PART 1 PRODUCTS

1.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 6000 - Product Requirements. Equivalent products, except where individual luminaire types are designated with substitutions not permitted. Submit comparitive pricing with all fixture substitutions.

1.02 LUMINAIRES

A. Provide products that are listed and labeled as complying with UL 1598, where applicable.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

E. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

F. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

G. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

H. Exposed Hardware: Stainless steel.

1.03 BALLASTS AND DRIVERS

A. Manufacturers:
   1. General Electric Company/GE Lighting: www.gelighting.com/#sle.
   2. OSRAM Sylvania, Inc; [_____]: www.osram.us/ds/#sle.

B. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

1.04 LAMPS

A. Manufacturers:
   1. General Electric Company/GE Lighting: www.gelighting.com/#sle.
   2. Osram Sylvania: www.sylvania.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.
   4. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.

B. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.

4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

PART 2 EXECUTION

2.01 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires in accordance with NECA/IESNA 501.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Install accessories furnished with each luminaire.

G. Bond products and metal accessories to branch circuit equipment grounding conductor.

H. Install lamps in each luminaire.

SECTION 31 10 00 SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. This Section requires the selective removal and subsequent off-site disposal of the following:

1. Removal and disposal of all abandoned pipe and conduit except for pipe or conduit indicated specifically on plans for abandonment in place.

2. Removal and offsite disposal of grass and root mat.

3. Demolition of asphalt concrete and pavements as indicated on the drawings to straight, neatly saw cut surface.

4. Trees as indicated on plans, completed including roots.

5. All other removals which may or may not been shown on plans as required for the project construction.

1.2 SITE CONDITIONS

A. Protections: Contractor shall provide temporary barricades and other forms of protection to protect general public from injury due to demolition work.

B. Traffic: Conduct demolition operations and debris removal to ensure minimum interference with roads, streets, walks, bike paths, and other adjacent occupied or used facilities. Access must be coordinated with District's Representative.

C. Utility Services: Maintain all existing utilities to remain in service and protect them against damage during demolition operations.

D. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations and County Air Pollution Control District pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as flooding and pollution.

1.3 REFERENCES

A. Standard Specifications for Public Works Construction (Green Book), latest edition.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 DEMOLITION

A. General: Perform demolition work in a systematic manner. Use such methods as required to complete work indicated on drawings in accordance with governing regulations.

B. Provide services for effective air and water pollution controls as required by County Air Pollution Control District regulations.

C. Prior to commencing grading operations, soil containing debris, organics, pavement, or other unsuitable materials, shall be stripped from the foundation and pavement areas. Demolition areas shall be cleared of old foundations, slabs, abandoned utilities, tree roots, and soil disturbed during the demolition process. Depressions or disturbed areas left from the removal of such material shall be replaced with compacted fill under observation by the Geotechnical representative.

D. Concrete sidewalks will be removed to the nearest construction or expansion joint to the limits of removal as shown on the plans. Exact locations will be determined in the field by the District's Representative.

3.2 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from Project site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose of off site.

B. If hazardous materials are encountered during demolition operations, contact District's Representative.

C. Burning of removed materials is not permitted on project site.

3.3 HAZARDOUS MATERIALS

A. Except as otherwise specified, in the event Contractor encounters on the Project site material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), or other hazardous materials which have not been rendered harmless, Contractor shall immediately stop Work in the area affected and report the condition to the District's Representative in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Contractor if in fact the material is asbestos, PCB, or other hazardous materials and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos, PCB, or other hazardous materials, or when such materials have been rendered harmless.

B. Construction involving asbestos cement (transite) pipe shall be performed by qualified personnel in accordance with the standards and specifications set forth by American Water Works Association (AWWA), the Occupational Safety and Health Act (OSHA) and the Environmental Protection Agency (EPA), as well as location jurisdictional codes.

3.4 CLEANUP AND REPAIR

A. General: Upon completion of demolition work, remove tools, equipment and demolished materials from site.

1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to existing condition prior to start of operations. Repair adjacent construction or surfaces soiled or damaged by demolition work.

END OF SECTION 31 10 00

SECTION 31 20 00 EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: Excavation, Compaction and Fill.

1.2 REFERENCE

A. Specifications for Public Works Construction (SSPWC), latest edition.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork in compliance with applicable requirements of governing authorities having jurisdiction.

1. Standard Specifications for Public Works Construction (SSPWC), latest edition.

2. CAL/OSHA Construction Safety Order Requirements.

B. Soil Testing Service

1. The District will engage a soil testing service to include testing soil materials proposed for use in the Work and for quality control testing during grading operations.

2. Samples of materials shall be furnished to the testing service by the Contractor at least one week before their anticipated use.

3. Work for this Section includes smoothing out areas for density tests and otherwise facilitate testing work, as directed.

4. Shoring Systems: Pre-engineered systems, clearly labeled as such, may be used. Refer to the Geotechnical Study for further requirements.

1.4 PROJECT CONDITIONS

A. The Contractor shall visit the site and familiarize himself with existing site conditions.

B. Additional test borings and other exploratory operations may be made by the Contractor at no cost or liability to the District.

C. Existing Utilities:

1. Where uncharted or incorrectly charted piping or other utilities are encountered during excavation, consult District 's Representative immediately for directions. Cooperate with the District's Representative in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the District's Representative at no cost to the District. Disturbed trench sections shall be replaced in kind.

D. Protection of Subgrade: Do not allow equipment to pump, rut, or disturb subgrade, stripped areas, or other areas prepared for Project.

E. Contractor shall implement measures to prevent soil erosion, and where possible, sediment shall be retained onsite.

F. Contractor shall implement all necessary recommendations contained in the Geotechnical Study.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 SITE PREPARATION

A. General:

1. Remove vegetation, improvements, or obstructions interfering with installation of new construction. Transport and legally dispose of off site. Removal includes stumps and roots. Contractor shall utilize the best construction method to minimize the erosive effect from the removal of site vegetation.

2. Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction. Paint cuts over one inch in size with tree pruning compound. Care shall be taken so as not to scar any area of the tree's bark.

3. In order to protect from sediment transfer or contamination from urban run-off during construction, the following grading and erosion control practices shall be followed:

a. If grading occurs during the rainy season (November through April), sediment traps, barriers, covers or other methods shall be used to reduce erosion and sedimentation.

b. Excavated materials shall not be deposited or stored where the material can be washed away by high water or storm run-off.

c. Grading operations on site shall be conducted so as to prevent damaging effects of sediment production and dust on the site and on adjoining properties.

d. When vegetation has to be removed on site, the methods shall be one that minimizes the erosive effects from the removal.

e. Exposure of soil to erosion by removing vegetation shall be limited to the area required for construction operations. The construction area shall be fenced to define the project.

f. Temporary mulching, seeding, or other suitable stabilization shall be used to protect areas during construction or other land disturbance activities on site.

g. Topsoil, removed from the surface in preparation for grading and construction activities on Campus is to be stored on or near the site and protected from erosion while grading operations are underway, provided that such storage may not be located where it would cause suffocation of root systems of trees to be preserved. After completion of such grading, topsoil is to be restored to exposed cut and fill embankments of building pads so as to provide a suitable base of seeding and planting.

h. Sediment basins, sediment traps, or similar control measures shall be installed before extensive clearing and grading operations begin for site development.

i. Water or dust palliatives shall be applied to exposed earth services as necessary to control dust emissions.

j. Revegetation or stabilization of exposed earth surfaces shall take place as soon as possible.

B. Removals

1. Clear the site of trees, shrubs, and other vegetation, which is indicated to be removed.

2. Completely remove stumps, roots, and other debris to avoid problems with future utilities.

3. Use only hand methods for grubbing inside the drip line of trees indicated to be left standing.

4. Existing fills, soil containing debris, organics, pavement, or other unsuitable materials shall be excavated and removed prior to commencing grading operations. Demolition areas shall be cleared of old foundations, slabs, abandoned utilities, landscaping, and soils disturbed during the demolition process. Depressions or disturbed areas left from the removal of such material shall be replaced with compacted fill.

5. The limits and depths for removal of existing fill materials shall be evaluated by project soils engineer during grading.

6. Revegetation or stabilization of exposed earth surface shall take place as soon as possible.

C. Removal of Improvements

1. Remove above-grade and below-grade improvements necessary to permit construction and other work as indicated.

2. Remove from site and legally dispose of off-site, existing fill materials, soil debris, or other unsuitable materials prior to commencing grading operations.

3.2 EXCAVATION

A. Excavation for Pavements: Cut surface under pavements to comply with cross-sections, elevations and grades as shown, within a tolerance of plus or minus 0.04 foot.

B. Excavation for Planting Areas: Conform to cross-sections, elevations and dimensions shown, within a tolerance of plus or minus 0.10 foot.

3.3 COMPACTION

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area, under the provisions of the Geotechnical Study.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the percentages of maximum dry density specified in the Geotechnical Study and in accordance with ASTM D1557-91 method of compaction.

C. Moisture Control:

1. When moisture content of exposed scarified soil and/or full material is below that sufficient to achieve recommended compaction, water shall be added to the soil and/or fill. While water is being added, soil shall be bladed and mixed to provide relatively uniform moisture content throughout the material.

2. When moisture content of exposed scarified soil and/or fill material is excessive, material shall be aerated by blading or other methods. Fill placed in pavement areas shall be compacted at near optimum moisture content. Jetting is not permitted for compaction.

3.4 FILL

A. In all excavations, use satisfactory excavated or borrow material sampled and tested by the District 's Testing Laboratory. Fill selection shall be per Geotechnical Study.

B. Fill excavations as promptly as Work permits, but not until completion of the following:

1. Acceptance by District’s Representative of construction below finish grade including, where applicable, waterproofing, damp-proofing, and drainage pipe.

2. Examination, testing, approval and recording locations of underground utilities.

3. Removal of concrete formwork.

4. Removal of shoring and bracing and backfilling of voids with satisfactory materials.

5. Removal of trash and debris.

6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

7. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

C. Continual dust control, as required by the District, and in accordance with County Air Pollution Control District's Standards shall be required for the project construction.

3.5 GRADING

A. General: To provide support for building floor slabs, all existing fill and unsuitable natural soils shall be excavated and replaced as properly compacted fill.

B. Compaction: After grading, compact subgrade surfaces to the depth and percentage of compaction for each area classification.

C. Fill placement and grading operations shall be performed only under the observation of the District's Testing Laboratory.

D. The exterior grades around building areas shall be sloped to drain away from the buildings to prevent ponding of water adjacent to foundations.

E. Grading operation shall be conducted so as to prevent damaging effects of sediment product and dust on the site and adjoining properties.

3.6 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Transport excess excavated material and legally dispose of off site.

3.7 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: District 's Testing Laboratory will observe, test and approve subgrades and fill layers before further construction Work can be performed. The District's Representative will determine the frequency of tests. Subgrade: Allow at least one field density test of subgrade to be made for every 2000 sq. ft. of paved area, but in no case less than 3 tests.

B. Field examination and testing will be performed by the District's Testing Laboratory. The Contractor shall cooperate with such testing and shall give the District's Representative advance notice of grading scheduling.

C. Frequency of Tests for Trenching: As specified in Geotechnical Study Section 8 and as determined by the District's Representative.

D. If in the opinion of the District's Representative, based on soil testing reports and observations, subgrades or fills which have been placed are below specified density, provide corrective work as specified at no additional expense to the District, and pay for retesting of the soil.

3.8 PROTECTION

A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work as specified, with retesting, prior to further construction.

END OF SECTION 31 20 00

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes Concrete Paving . Including the Following:

1. Curbs and gutters.
2. Walks.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" Section 033053 "Miscellaneous Cast-in-Place Concrete" for general building applications of concrete.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review methods and procedures related to concrete paving, including but not limited to, the following:
   a. Concrete mixture design.
   b. Quality control of concrete materials and concrete paving construction practices.
   c. Establish review protocols and timing for review of formwork, layout, and key accessibility and drainage slopes prior to pouring .
2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete paving Subcontractor.
   e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Laboratory Test Reports: For concrete paving mixtures, documentation indicating that cured concrete complies with Solar Reflectance Index requirements.

C. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

D. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:

1. Exposed Aggregate: 10 lb Sample of each mix.

E. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches .
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.9 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms , steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

C. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

D. Plain-Steel Wire: ASTM A 1064/A 1064M, .

E. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated, .

F. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars ; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

H. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

I. Zinc Repair Material: ASTM A 780/A 780M.

2.4 CONCRETE MATERIALS

A. Regional Materials: Verify concrete is manufactured within 500 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Regional Materials: Verify concrete is manufactured within 500 miles of Project site.

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

1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type II .
2. Fly Ash: ASTM C 618, Class C or Class F.

D. Normal-Weight Aggregates: ASTM C 33/C 33M, , uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

E. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1. Aggregate Sizes: 3/4 to 1 inch nominal.
2. Aggregate Source, Shape, and Color: .

F. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Retarding Admixture: ASTM C 494/C 494M, Type B.
2. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

G. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.

2. Color: As indicated on drawings .

H. Water: Potable and complying with ASTM C 94/C 94M.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Dayton Superior Corporation.
   b. Master Builders Solutions.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.
3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 2-1/2 percent plus or minus 1-1/2 percent for 1-1/2-inch nominal maximum aggregate size.
2. Air Content: 3 percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
3. Air Content: 3-1/2 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use in concrete as required for placement and workability.

F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd. .

G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

H. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 3000 psi .
2. Maximum W/C Ratio at Point of Placement: 0.50 .
3. Slump Limit: 5 inches , plus or minus 1 inch.
4. Solar Reflectance Index: Not less than 29.

2.8 CONCRETE MIXING

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

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

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

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

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

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

3.4 STEEL REINFORCEMENT INSTALLATION

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

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

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

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

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

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

1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

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

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation , steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

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

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

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

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies , reinforcement, or side

forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

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

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.7 FLOAT FINISHING

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

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse non slip finish on all walk surfaces by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:

1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

3.9 CONCRETE PROTECTION AND CURING

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

B. Comply with ACI 306.1 for cold-weather protection.

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

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

E. Curing Methods: Cure concrete by moisture-retaining-cover curing as follows:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.12 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

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

END OF SECTION 32 13 13

SECTION 32 14 43 - POROUS UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Concrete Unit Pavers:
   a. Solid concrete pavers for porous paving.
2. Curbs and edge restraints.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavation and compacted subgrade.
2. Section 321313 "Concrete Paving" for cast-in-place concrete curbs that serve as edge restraints for porous paving.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data:

1. For materials other than aggregates.
2. For the following:
   a. Pavers.
   b. Edge restraints.
   c. Geotextiles.

B. Sieve Analyses: For aggregate materials, according to ASTM C136.

C. Samples:

1. Full-size units of each type of unit paver indicated.
2. Exposed edge restraints.
3. Aggregate fill.
4. Aggregate setting bed materials.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.

1. For solid interlocking paving units, include test data for freezing and thawing according to ASTM C67.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified porous unit paving installer. Installer's field supervisor shall have Concrete Paver Installer Certification from the Interlocking Concrete Pavement Institute (ICPI) with PICP (Permeable Interlocking Concrete Pavement) Specialist Designation.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store pavers 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.

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

PART 2 - PRODUCTS

2.1 CONCRETE UNIT PAVERS

A. Regional Materials: Manufacture concrete pavers within 500 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Regional Materials: Manufacture concrete pavers within 500 miles of Project site.

C. Source Limitations: Obtain each type of paver from single source that has resources to provide materials and products of consistent quality in appearance and physical properties.

D. Solid Concrete Pavers for Porous Paving: Solid interlocking paving units of shapes that provide openings between units, complying with ASTM C936/C936M, and made from normal-weight aggregates.

1. Thickness: 2-3/8 inches .
2. Face Size and Shape: As indicated .
3. Opening Percentage: variable percent.
4. Color: As indicated by manufacturer's designations equal blend of sandlewood, onyx black and shale grey .

2.2 CURBS AND EDGE RESTRAINTS

A. Aluminum Edge Restraints: Straight, 1/8 inch thick by 4 inches high extruded-aluminum edging, with loops pressed from face to receive stakes at 12 inches o.c., and with aluminum stakes 12 inches long for each loop.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Brickstop Corporation.
   b. Curv-Rite, Inc.
   c. Permaloc Corporation.
   d. Sure-loc Edging Corporation.

B. .

2.3 AGGREGATE SETTING-BED MATERIALS

A. Regional Materials: Manufacture, extract, harvest, or recover aggregate and soil within 500 miles of Project site.

B. Regional Materials: Manufacture aggregate and soil within 500 miles of Project site.

C. Graded Aggregate for Base Course: Sound crushed stone or gravel complying with ASTM D448 for Size No. 57 .

D. Graded Aggregate for Leveling Course: Sound crushed stone or gravel complying with ASTM D448 for Size No. 8 .

E. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured according to test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Apparent Opening Size: No. 40 sieve, maximum; ASTM D4751.
3. Permittivity: 0.5 per second, minimum; ASTM D4491.
4. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.4 FILL MATERIALS

A. Soil Fill for Porous Paving: Planting soil according to Section 329115 "Soil Preparation (Performance Specification)."

PART 3 - EXECUTION

3.1 PREPARATION

A. Proof-roll prepared subgrade according to requirements in Section 312000 "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with porous paver installation only after deficient subgrades have been corrected and are ready to receive base course for porous paving.

3.2 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be structurally unsound or visible in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment or a block splitter to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Tolerances:

1. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch unit-to-unit offset from flush.
2. Variation from Level or Indicated Slope: Do not exceed 1/8 inch in 24 inches and 1/4 inch in 10 feet or a maximum of 1/2 inch.

E. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after porous paver installation.
2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below top edge.

F. Provide curbs as indicated. Install curbs before placing unit pavers.

1. Install curbs on a bedding of compacted base-course material over compacted subgrade. Install curbs before placing base course for pavers. Set curbs at elevations indicated, accurately aligned, and place and compact base-course material behind curbs as indicated.

3.3 INSTALLATION OF SETTING-BED

A. Compact subgrade uniformly to at least 95 percent of ASTM D698 ASTM D1557 laboratory density.

B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Place drainage geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.

D. Place aggregate base, compact by tamping with plate vibrator, and screed to depth indicated.

E. Place aggregate base , compact to 100 percent of ASTM D1557 maximum laboratory density, and screed to depth indicated.

F. Place drainage geotextile over compacted subbase, overlapping ends and edges at least 12 inches.

G. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches.

H. Place leveling course, and screed to a thickness of 2 to 2-1/2 inches , taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

3.4 INSTALLATION OF PAVERS

A. Set unit pavers on leveling course, being careful not to disturb leveling base. If pavers have lugs or spacer bars to control spacing, place pavers hand tight against lugs or spacer bars. If pavers do not have lugs or spacer bars, place pavers with a 1/16-inch- minimum and 1/8-inch- maximum joint width. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size pavers.

1. When installation is performed with mechanical equipment, use only unit pavers with lugs or spacer bars on sides of each unit.

B. Compact pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.

1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.

C. Place graded aggregate fill immediately after vibrating pavers into leveling course. Spread and screed aggregate fill level with tops of pavers.

1. Before ending each day's work, place aggregate fill in installed porous paving except for 42-inch width of unfilled paving adjacent to temporary edges (laying faces).
2. As work progresses to perimeter of installation, place aggregate fill in installed paving that is adjacent to permanent edges unless it is within 42 inches of laying face.
3. Before ending each day's work and when rain interrupts work, cover paving that has not been filled with nonstaining plastic sheets to protect it from rain.

D. As work progresses, remove and replace pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 32 14 43

SECTION 32 16 00 CURBS, GUTTERS, SIDEWALKS

PART 1 GENERAL

1.1 SUMMARY

A. Concrete for curbs, gutters, sidewalks.

1.2 RELATED SECTIONS

A. Section 31 20 00 – Earthwork

1.3 REFERENCES

A. Standard Specifications for Public Works Construction (SSPWC), latest edition.

B. ASTM Standards.

1.4 SUBMITTALS

A. Submit the following:

1. Product Data: Provide data on admixtures and curing compounds.

2. Concrete mix design(s).

3. Certificates from the batch plant.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with the SSPWC, latest edition; and ASTM Standards, latest edition.

B. Obtain cementitious materials from same source throughout.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F or surface is wet.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Form Materials: Section 303-5 of the SSPWC.

2.2 CONCRETE MATERIALS

A. Concrete Material for Curbs, Walk (Path of Travel), Pavement, and Cast-in-Place Catch Basin:

1. Class 560-C-3250 for cast-in-place catch basins, curbs, and gutters. Portland cement concrete per Standard Specifications for Public Works Construction Section 201-1.1.2.

2. Concrete reinforcements shall be constructed per the Project Plans and Specifications.

2.3 ACCESSORIES

A. Curing Compound shall conform to SSPWC Section 201-4. Pigmented compound shall not demonstrate any residual coloring of the concrete after one week.

2.4 CONCRETE MIX

A. Mix and deliver concrete in accordance with ASTM C94.

B. Use accelerating admixtures in cold weather only when approved by the District's Representative. Use of admixtures will not relax cold weather placement requirements.

C. Use calcium chloride only when approved by the District's Representative.

D. Use set retarding admixtures during hot weather only when approved by the District's Representative.

2.5 CONCRETE REINFORCEMENT

A. Concrete reinforcement shall conform to SSPWC Section 201-2.

2.6 SOURCE QUALITY CONTROL

A. Provide certificates of compliance from the batch plant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support imposed loads.

B. Verify gradients and elevations of subgrade are correct.

3.2 PREPARATION

A. Moisten subgrade to minimize absorption of water from fresh concrete. Compact subgrade material to a depth of 12" beneath 4” of sand below concrete pavements to a minimum 92% of the maximum dry density. Refer to geotechnical report for site subgrade preparation recommendations.

B. Coat surfaces of catch basin frames with oil to prevent bond with concrete pavement.

C. Notify District’s Representative a minimum of 24 hours prior to commencement of concrete placement operations.

3.3 FORMING

A. Place and secure forms to correct location, dimension, and profile.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.4 PLACING CONCRETE

A. Place concrete in accordance with SSPWC Section 303-5.

B. Install ½" thick fiberboard expansion joint and snap cap. Seal with Sikaflex self-leveling sealant after removal of snap cap (typical).

C. Construct weakened plane joints conforming to SSPWC Section 303-5.4.3, one inch deep, at intervals not exceeding 10 feet.

D. The top edges of curbs shall have 0.5" radius.

3.5 FINISHING

A. Concrete color & finishes to be per Architectural plans.

1. Concrete paving, smooth finish, natural color

2. Accent color concrete, charcoal gray – Color-Crete Charcoal CC150 or Dark Grey CC230/ Textured Finish by Increte Systems

3. Textured concrete - http://jmcontractors.com/sample-gallery/crushed-rock-collection/ - Crushed Stone Collection 12-189 by J&M Concrete

B. Concrete finishes shall be per SSPWC Section 303-5.5.

C. Portland cement concrete paving shall have a medium salted finish for slopes less than 6%, and slip-resistant at slopes of 6% or greater.

D. Walkway grades in excess of 5% shall conform to requirements of Section 1133B.7.3, California Building Code (2016 edition).

E. Place curing compound in accordance with SSPWC Section 303-5.6 on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.6 FIELD QUALITY CONTROL

A. Inspection and testing shall be performed by the District's Testing Laboratory.

B. District 's Testing Laboratory will perform slump and compressive strength tests.

C. Contractor shall maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.7 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, vandalism and mechanical injury.

B. It is the Contractor's responsibility to replace all concrete work subject to vandalism and graffiti at no extra cost to the District.

END OF SECTION 32 16 00

SECTION 323116 - WELDED WIRE FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metallic-coated-steel, welded-wire fences.
2. Swing gates.

B. Related Requirements:

1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for concrete and post concrete fill.
2. Section 281500 "Access Control Hardware Devices" for access control devices installed at gates and provided as part of a security system.
3. Section 312000 "Earth Moving" for site excavation, fill, and backfill where welded-wire fences and gates are located.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, gate locations, post spacing, and mounting attachment details , and grounding details.
2. Wiring Diagrams: Include diagrams for power, signal, and control wiring.

C. Samples: For each fence material and for each color specified.

1. Provide Samples 12 inches in length for linear materials.
2. Provide Samples 12 inches square for wire mesh.

1.5 INFORMATIONAL SUBMITTALS

1.6 CLOSEOUT SUBMITTALS

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 METALLIC-COATED-STEEL, WELDED-WIRE FENCES

A. Metallic-Coated-Steel, Welded-Wire Fences:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Ameristar Perimeter Security; ASSA ABLOY.

B. Fence Fabric: Metallic-coated-steel wire.

1. Spacing of Vertical Wires: 2 inches .
2. Vertical Wire Size: 0.187 inch 12 Gauge .
3. Spacing of Horizontal Wires: 2 inches .
4. Horizontal Wire Size: 12 Gauge .

C. Posts:

1. Line Posts: Square tubes 2 by 2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
2. End and Corner Posts: Square tubes 2-1/2 by 2-1/2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
3. Posts at Swing Gate Openings: Square steel tubing 2 by 2 inches with 3/16-inch wall thickness, hot-dip galvanized.

D. Post Caps: Formed from steel sheet and hot-dip galvanized after forming .

E. Rails: Rectangular tubes.

1. Size: 1-3/8 by 1-1/2 inches or 1-1/2 by 1-1/2 inches.
2. Metal and Thickness: 0.079-inch nominal-thickness, metallic-coated steel sheet or 0.075-inch nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.

F. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips.

G. Finish: Powder coating.

2.2 SWING GATES

A. Gate Configuration: Single leaf .

B. Gate Frame Height: 72 inches .

C. Gate Opening Width: 5'-0" Min. .

D. Frame Corner Construction: Welded or assembled with corner fittings and 5/16-inch-diameter, adjustable truss rods for panels 5 feet wide or wider.

E. Additional Rails: Provide as indicated, complying with requirements for fence rails.

F. Infill: Welded-wire fence fabric matching adjacent fence.

G. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

1. .

H. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.

1. Function: 320 - Gate spring pivot hinge. Adjustable tension .
2. Material: Malleable iron; galvanized.

I. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.

1. Function: 08 - Entrance by lever. Key locks or unlocks lever .
2. Mounting Channel: Bent-plate channel formed from 1/8-inch- thick, steel plate; hot-dip galvanized after fabrication. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch beyond push pad surface.

J. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay .

K. Metallic-Coated-Steel Finish: Galvanized finish.

2.3 FENCE AND GATE MATERIALS

A. Metallic-Coated-Steel Wire: Welded-wire fence fabric, hot-dip galvanized after fabrication. Weight of zinc coating shall be not less than 1.0 oz./sq. ft..

B. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

C. Uncoated Steel Sheet: or .

1. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior or coated with zinc-rich thermosetting coating to comply with ASTM F 2408.

D. Galvanizing: For components indicated to be galvanized and for which galvanized coating is unspecified, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

2.4 COATING MATERIALS

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.6 GROUNDING MATERIALS

A. Comply with requirements of Section 260526 "Grounding and Bonding for Electrical Systems."

B. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Aluminum.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1-5/8 inch wide and 1/16 inch thick, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Grounding Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic-welded type.
2. Grounding Rods: Copper-clad steel.
   a. Size: 5/8 by 96 inches.

2.7 METALLIC-COATED-STEEL FINISHES

A. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a zinc-phosphate conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780/A 780M.

B. Powder Coating: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat finish consisting of zinc-rich epoxy prime coat and TGIC polyester topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils.

1. Color and Gloss: to match adjacent existing fencing .
2. Comply with surface finish testing requirements in ASTM F 2408.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
   a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
   b. Concealed Concrete: Top 2 inches below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.
3. Space posts uniformly at 6 feet 8 feet o.c.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GROUNDING AND BONDING

A. Comply with Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet .
    a. Gates and Other Fence Openings: Ground fence on each side of opening.
        1) Bond metal gates to gate posts.
        2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

3.6 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.7 DEMONSTRATION

A. Train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 32 31 16

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Horizontal-slide gates.

B. Related Requirements:

1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for concrete post concrete fill.
2. Section 281500 "Access Control Hardware Devices" for access control devices installed at gates and provided as part of a security system.
3. Division 26 Sections for electrical service and connections for system disconnect switches and powered devices including, but not limited to, motor operators, controls, and limit switches.

1.3 PREINSTALLATION MEETINGS

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, gate locations, post spacing, and attachment details.
2. Wiring Diagrams: Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For decorative metallic-coated-steel tubular picket fences, including finish, indicating compliance with referenced standard.

1.6 CLOSEOUT SUBMITTALS

1.7 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 HORIZONTAL-SLIDE GATES

A. Gate Configuration: Single leaf .

1. Type: Overhead slide.

B. Gate Frame Height: 96" .

C. Gate Opening Width: 8'-6" .

D. Automated vehicular gates shall comply with ASTM F 2200, Class II .

E. Steel Frames and Bracing: Fabricate members from square tubing.

1. Frame Members: Steel U-Channel 6" by 6" with 1/8-inch wall thickness.
2.

F. Frame Corner Construction:

1. Welded frame with panels assembled with bolted or riveted corner fittings and 5/16-inch- diameter, adjustable truss rods for panels 5 feet wide or wider.
2. Overhead Slide Gates: Welded or assembled with corner fittings including 5/16-inch- diameter, adjustable truss rods for panels 5 feet wide or wider.

G. Additional Rails: Provide as indicated, complying with requirements for fence rails.

H. Infill: Comply with requirements for adjacent fence.

I. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

1. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence .

J. Overhead Track Assembly: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.

K. Hardware: Latches permitting operation from both sides of gate, locking devices hangers roller assemblies and stops fabricated from galvanized steel . Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

L. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay .

M. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

N. Metallic-Coated-Steel Finish: High-performance coating .

O. Steel Finish: High-performance coating.

P. Aluminum Finish: Baked enamel or powder coating.

2.3 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

D. Bar Grating: NAAMM MBG 531.

1. Bars: Hot-rolled steel strip, ASTM A 1011/A 1011M, Commercial Steel, Type B.
2. Wire Rods: ASTM A 510/A 510M.

E. Uncoated Steel Sheet: cold-rolled steel sheet, ASTM A 1008/A 1008M, Structural Steel, Grade 50.

F. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50, with G90 coating.

G. Aluminum-Zinc, Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50, with AZ60 coating.

H. Castings: Either gray or malleable iron unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30.
2. Malleable Iron: ASTM A 47/A 47M.

2.4 COATING MATERIALS

A. Shop Primers for Steel: Provide primers that comply with

B. Shop Primer for Steel: Manufacturer's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.6 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: Match Existing Aluminum site fencing color and finish .

2.7 STEEL FINISHES

A. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.

B. Powder Coating: Immediately after cleaning, apply manufacturer's standard two-coat finish consisting of epoxy primer and TGIC polyester topcoat to a minimum total dry film thickness of not less than 8 mils. Comply with coating manufacturer's written instructions.

1. Color and Gloss: Match existing steel fence color and finish .

C. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils per applied coat, to surfaces that are exposed after assembly and installation, and to concealed surfaces.

D. Shop-Painted Finish: Comply with Section 099113 "Exterior Painting."

E. High-Performance Coating: Apply intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

2.8 METALLIC-COATED-STEEL FINISHES

A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

B. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a zinc-phosphate conversion coating compatible with the organic coating to be applied over it. Clean welds,

mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780/A 780M.

C. Powder Coating: Immediately after cleaning and pretreating, apply manufacturer's standard TGIC polyester powder-coat finish to a minimum dry film thickness of 2 mils.

1. Color and Gloss: Match existing steel fence color and finish .

D. Powder Coating: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat finish consisting of zinc-rich epoxy prime coat and TGIC polyester topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils.

1. Color and Gloss: Match existing steel fence color and finish .
2. Comply with surface finish testing requirements in ASTM F 2408 except change corrosion-resistance requirement to 3000 hours without failure.

E. High-Performance Coating: Apply epoxy primer, polyurethane intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around and and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
   a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
   b. Concealed Concrete: Top 2 inches below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.
3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.
   a. Extend posts at least 5 inches into sleeve.
   b. After posts have been inserted in sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.
5. Space posts uniformly at 8 feet o.c.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 32 31 19

SECTION 323300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bicycle racks.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing pipe sleeves cast formed voids in concrete footings.
2. Section 312000 "Earth Moving" for excavation for installing concrete footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For site furnishings manufactured with preservative-treated wood.

1. Indicate type of preservative used and net amount of preservative retained.

1.5 CLOSEOUT SUBMITTALS

PART 2 - PRODUCTS

2.1 BISTRO TABLES AND CHAIRS

A. Manufacturers: Subject to compliance with requirements:

1. Tournesol Furnishing.

B. Huddle Table 30” Diameter Café Height Table and Host Chair Construction:

1. Dimensions: As indicated in a site furnishing schedule .
2. Quantity: As indicated in a site furnishing schedule .
3. Installation Method: Per MFR.

4. Accessories: Per MFR.

C. Aluminum Finish: As indicated in a site furnishing schedule .

1. Color: As indicated in a site furnishing schedule .

D. Steel Finish: Color coated.

1. Color: As indicated in a site furnishing schedule .

E. Wood Finish: As indicated in a site furnishing schedule .

2.2 COLORFUL SEATING

A. Manufacturers: Subject to compliance with requirements:

1. Tournesol Furnishing.

B. Host Chairs Construction:

1. Dimensions: As indicated in a site furnishing schedule .
2. Quantity: As indicated in a site furnishing schedule .
3. Installation Method: Per MFR.
4. Accessories: Per MFR.

C. Aluminum Finish: As indicated in a site furnishing schedule .

1. Color: As indicated in a site furnishing schedule .

D. Steel Finish: Color coated.

1. Color: As indicated in a site furnishing schedule .

E. Wood Finish: As indicated in a site furnishing schedule .

2.3 BENCH SEATING

A. Manufacturers: Subject to compliance with requirements:

1. Streetlife Furnishing.

B. Solid Staple Benches with Backrest Construction:

1. Dimensions: As indicated in a site furnishing schedule .
2. Quantity: As indicated in a site furnishing schedule .
3. Installation Method: Per MFR.
4. Accessories: Per MFR.

C. Aluminum Finish: As indicated in a site furnishing schedule .

1. Color: As indicated in a site furnishing schedule .

D. Steel Finish: Color coated.

1. Color: As indicated in a site furnishing schedule .

E. Wood Finish: As indicated in a site furnishing schedule .

2.4 STACKED BENCH SEATING

A. Manufacturers: Subject to compliance with requirements:

1. Streetlife Furnishing.

B. Solid Terrace System Stacked Benches Construction:

1. Dimensions: As indicated in a site furnishing schedule .
2. Quantity: As indicated in a site furnishing schedule .
3. Installation Method: Per MFR.
4. Accessories: Per MFR.

C. Aluminum Finish: As indicated in a site furnishing schedule .

1. Color: As indicated in a site furnishing schedule .

D. Steel Finish: Color coated.

1. Color: As indicated in a site furnishing schedule .

E. Wood Finish: As indicated in a site furnishing schedule .

2.5 BICYCLE RACKS

A. Manufacturers: Subject to compliance with requirements:

1. Belson.

B. Belson Type Rider Bike Racks Construction:

1. Dimensions: As indicated in a site furnishing schedule .
2. Quantity: As indicated in a site furnishing schedule .
3. Installation Method: Per MFR.
4. Accessories: Per MFR.

C. Aluminum Finish: As indicated in a site furnishing schedule .

1. Color: As indicated in a site furnishing schedule .

D. Steel Finish: Color coated.

1. Color: As indicated in a site furnishing schedule .

E. Wood Finish: As indicated in a site furnishing schedule .

2.6 LIBRARY SIGNAGE

A. Manufacturers: Subject to compliance with requirements:

1. Signarama Manufacturing (805) 447-0243. Contact Mike Reese

B. Aluminum Sign Construction:

1. Dimensions: As indicated.
2. Quantity: As indicated.
3. Installation Method: As indicated.

C. Aluminum Finish: As indicated in a site furnishing schedule .

1. Color: As indicated in a site furnishing schedule .

D. Steel Finish: Color coated.

1. Color: As indicated in a site furnishing schedule .

E. Wood Finish: As indicated in a site furnishing schedule .

2.7 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:

1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B 211.
2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B 221.
3. Structural Pipe and Tube: ASTM B 429/B 429M.
4. Sheet and Plate: ASTM B 209.
5. Castings: ASTM B 26/B 26M.

B. Steel and Iron: Free of surface blemishes and complying with the following:

1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53/A 53M, or electric-resistance-welded pipe complying with ASTM A 135/A 135M.
3. Tubing: Cold-formed steel tubing complying with ASTM A 500/A 500M.
4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513/A 513M, or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500/A 500M; zinc coated internally and externally.
5. Sheet: Commercial steel sheet complying with ASTM A 1011/A 1011M.
6. Perforated Metal: From steel sheet not less than nominal thickness; manufacturer's standard perforation pattern.
7. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F 1267.
8. Malleable-Iron Castings: ASTM A 47/A 47M, grade as recommended by fabricator for type of use intended.
9. Gray-Iron Castings: ASTM A 48/A 48M, Class 200.

C. Stainless Steel: Free of surface blemishes and complying with the following:

1. Sheet, Strip, Plate, and Flat Bars: ASTM A 666.
2. Pipe: Schedule 40 steel pipe complying with ASTM A 312/A 312M.
3. Tubing: ASTM A 554.

D. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.

1. Wood Species: Manufacturer's standard.
   a. Douglas Fir: Clear Grade, vertical grain.
   b. Pine: Southern pine; No. 2 or better ; preservative treated, kiln dried after treatment.
   c. Red Cedar: Select Grade or better.
   d. Redwood: Construction heart or better, free-of-heart center.
   e. Teak (Tectona Grandis): Clear Grade.

E. Certified Wood: Certify wood products as "FSC Pure" or "FSC Mixed Credit" in accordance with FSC STD-01-00 and FSC STD-40-004.

1. Finish: Manufacturer's standard .

F. Fiberglass: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.

G. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.

1. Polyethylene: Fabricated from virgin plastic HDPE resin.
2. Polyethylene with Recycled Content: Fabricated from HDPE and other resins with postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

H. Anchors, Fasteners, Fittings, and Hardware: Galvanized steel Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality , tamperproof, vandal and theft resistant , concealed, recessed, and capped or plugged.

1. Angle Anchors: For inconspicuously bolting legs of site furnishings to below-grade substrate; extent as indicated .
2. Antitheft Hold-Down Brackets: For securing site furnishings to substrate; extent as indicated on Drawings .

I. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M; recommended in writing by manufacturer, for exterior applications.

J. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

K. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:

1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear,

polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.

2. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

2.8 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment: Pressure-treat wood according to AWPA U1, Use Category UC3b, and the following:

1. Use preservative chemicals acceptable to authorities having jurisdiction and containing no arsenic or chromium. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
2. Kiln-dry lumber and plywood after treatment to a maximum moisture content, respectively, of 19 and 15 percent. Do not use materials that are warped or do not comply with requirements for untreated materials.

2.9 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.

E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

F. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.10 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.12 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.13 IRON FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.14 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run directional finishes with long dimension of each piece.
2. Directional Satin Finish: No 4.
3. Dull Satin Finish: No. 6.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

END OF SECTION 32 33 00

SECTION 328400 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings
2. Piping joining materials
3. Manual valves
4. Pressure-reducing valves
5. Backflow preventers
6. Master control valve
7. Automatic control valves
8. Transition fittings
9. Dielectric fittings
10. Miscellaneous piping specialties
11. Sprinklers
12. Quick couplers
13. Drip irrigation specialties
14. Public controller
15. Private controller
16. Central control system
17. Boxes for automatic control valves and other underground equipment

1.3 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

C. ET Controllers: EvapoTranspiration Controllers. Irrigation controllers which use some method of weather based adjustment of irrigation. These adjusting methods include use of historical monthly averages of ET; broadcasting of ET measurements; or use of on-site sensors to track ET.

D. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

C. Delegated Design: Design 100 percent coverage irrigation system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

D. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:

1. Irrigation Main Piping: 200 psig.
2. Circuit Piping: 150 psig.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Substitutions: Products by other manufacturers that comply with specifications will be considered in accordance with Section 012500 – Substitution Procedures.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Irrigation systems, drawn to scale, on which components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and light standards.

B. Qualification Data: For qualified Installer.

C. Zoning Chart: Show each irrigation zone and its control valve.

D. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

E. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sprinklers controllers and automatic control valves to include in operation and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Rotor Sprinklers: Equal to 5 percent of amount installed for each type and size indicated, but no fewer than 5 units.
2. Spray Sprinklers: Equal to 5 percent of amount installed for each type and size indicated, but no fewer than 10 units.
3. Bubblers: Equal to 5 percent of amount installed for each type indicated, but no fewer than 20 units.
4. Emitters: Equal to 5 percent of amount installed for each type indicated, but no fewer than 20 units.
5. Drip-Tube System Tubing: Equal to 10 percent of total length installed for each type and size indicated, but not less than 500 feet.
6. Soaker Tubes: Equal to 10 percent of total length installed for each type and size indicated, but not less than 100 feet.

1.9 QUALITY ASSURANCE

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

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.11 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Galvanized-Steel Pipe: ASTM A 53/A 53M, Standard Weight, Type E, Grade B.

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless-steel pipe with threaded ends.
2. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
3. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
4. Cast-Iron Flanges: ASME B16.1, Class 125.

C. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 40.

1. PVC Socket Fittings: ASTM D 2466, Schedules 40 and 80.
2. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
3. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.

2.2 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.3 MANUAL VALVES

A. Bronze Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following
   a. Apollo Valves; Conbraco Industries, Inc.
   b. NIBCO INC.
   c. Watts; a Watts Water Technologies company.
2. Description:
   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Threaded or solder joint if indicated.
   g. Seats: PTFE or TFE.
   h. Stem: Bronze.
   i. Ball: Chrome-plated brass.
   j. Port: Full or regular, but not reduced.

B. Plastic Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. Hayward Flow Control.
   b. NIBCO INC.
   c. Spears Manufacturing Company.

2. Description:
   a. Standard: MSS SP-122.
   b. Pressure Rating: 125 psig minimum.
   c. Body Material: PVC.
   d. Type: Union.
   e. End Connections: Socket or threaded.
   f. Port: Full.

C. Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following
   a. NIBCO INC.
   b. Watts; a Watts Water Technologies company.
2. Description:
   a. Standard: MSS SP-80, Type 2.
   b. Class: 125.
   c. CWP Rating: 200 psig.
   d. Body Material: ASTM B 62 bronze with integral seat and screw-in bonnet.
   e. Ends: Threaded or solder joint.
   f. Stem: Bronze, nonrising.
   g. Disc: Solid wedge; bronze.
   h. Packing: Asbestos free.
   i. Handwheel: Malleable iron, bronze, or aluminum.

2.4 PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   b. Watts; a Watts Water Technologies company.
   c. Zurn Industries, LLC.
2. Description:
   a. Standard: ASSE 1003.
   b. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
   c. Pressure Rating: Initial pressure of 150 psig.
   d. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.5 BACKFLOW PREVENTERS

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by the following
   a. Apollo Valves; Conbraco Industries, Inc.
   b. Watts; a Watts Water Technologies company.
   c. Zurn Industries, LLC.
2. Description:

a. The Reduced Pressure Principle Backflow Preventer shall be shall be ASSE® Listed 1013, rated to 180°F, and supplied with full port ball valves.
b. The main body and access covers shall be bronze (ASTM B 584), the seat ring and all internal polymers shall be NSF® Listed Noryl™ and the seat disc elastomers shall be silicone.
c. The first and second checks shall be accessible for maintenance without removing the relief valve or the entire device from the line. If Project has more than one type or configuration of water regulator, delete subparagraph below and schedule water regulators on Drawings.
d. The product should be listed as lead free.

2.6 MASTER CONTROL VALVE

A. Bronze, Master Control Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following
   a. Buckner; a Storm Manufacturing Group, Inc. brand.
   b. Netafim USA.
   c. Superior Controls Co., Inc.
2. Description: Cast-bronze body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

2.7 AUTOMATIC CONTROL VALVES

A. Plastic, Automatic Control Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Hunter Industries Incorporated.
   b. Rain Bird Corporation.
2. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid. Must be compatible with 2-wire decoder operation.
   a. Potable water: Standard configuration
   b. Greywater/Non-potable water: Purple color reclaimed water option.

B. Plastic, Drip Control Zone Kits:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following
   a. Hunter Industries Incorporated.
   b. Rain Bird Corporation.
   c. Netafim USA
2. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid. Pressure-regulating basket filter, regulating to 40 psi maximum. Must be compatible with 2-wire decoder operation.
   a. Potable water: Standard configuration
   b. Greywater/Non-potable water: Purple color reclaimed water option.
   c. Low Flow Control Zone Kit for dripline zones with flows from 0.2 to 3.0 GPM, including low flow valve (LFV) and pressure regulating filter (PRF).
      1) Low Flow Valve (LFV) component specifications include:

a) Valve body and bonnet constructed of high impact, weather-resistant plastic, stainless steel and other chemical/UV resistant materials
b) Diaphragm with a double-knife seal, constructed of durable Buna-N rubber with a clog-resistant metering orifice
c) Energy-efficient, low-power encapsulated solenoid with captured plunger and 90 mesh (200 micron) solenoid filter
d) External bleed for manual system flushing during start-up, internal bleed for manual zone activation during maintenance operations
e) Inlet pressure rating: 20 to 120 PSI (1,4 to 8,3 bar)
f) Female threaded inlet and outlet connections
g) Anti-siphon valve configuration includes listed features and incorporates atmospheric vacuum breaker with I.A.P.M.O and A.S.S.E. listing approval

2) Pressure Regulating Filter (PRF) combines filtration and pressure regulation in one integrated unit for protection of downstream components of drip irrigation system. PRF component specifications include:
a) Compact “Y” filter body and cap configuration constructed of glass-filled, UV-resistant polypropylene, with 120 PSI (8,3 bar) operating pressure rating. Maximum dimensions of filter body; Height: 4 1/2" (11,4 cm), Length: 5 1/2" (14 cm), Width: 2" (5,1 cm)
b) Standard 200 mesh (75 micron) filter screen constructed of durable stainless steel attached to a polypropylene frame. Screen is serviceable for cleaning purposes by unscrewing cap from filter body and removing filter element.
c) Normally-open pressure regulating device with preset outlet pressure of approximately 40 PSI (2,1 bar). Pressure regulating device allows full flow with minimal pressure loss unless inlet pressure is greater than preset level. As inlet pressure increases above preset level, internal spring compresses to reduce downstream pressure.
d) Male threaded 3/4” (19 mm) inlet and

d. Control Zone Kits for dripline zones with flows from 3.0 to 20.0 GPM (11.4 to 75.7 lpm), including, valve with PVC ball valve and pressure regulating quick-check basket filter.
1) Valve assembly component specifications must include:
a) 1” (25 mm) PVC full-port ball valve with female threaded inlet and outlet connections
b) Valve body and bonnet constructed of durable glass-filled nylon, stainless steel and other chemical/UV resistant materials
c) Diaphragm constructed of a durable Buna-N rubber material reinforced with nylon
d) One-piece solenoid with captured plunger and 90 mesh (200 micron) solenoid filter
e) External bleed for manual system flushing during start-up, internal bleed for manual zone activation during maintenance operations
f) Inlet pressure rating: 20 to 200 PSI (1,4 to 13,8 bar)
g) Female threaded inlet and outlet connections
2) Pressure Regulating Quick Check Basket Filter combines filtration and pressure regulation in one integrated unit for protection of downstream components of drip irrigation system. Pressure regulating basket filter component specifications must include:
a) Basket style body and jar-top cap constructed of heavy-duty glass-filled, UV-resistant polypropylene, with 150 PSI (10,3 bar) operating pressure rating. Maximum dimensions of filter body; Height: 6 1/2" (16,5 cm), Length: 6 1/2" (16,5 cm), Width: 3 1/2" (8,9 cm)
b) Indicator incorporated into filter cap that changes color from green to red during operation when the filter element requires cleaning.

c) Standard 200 mesh (75 micron) filter screen constructed of stainless steel attached to propylene frame. Screen is serviceable for cleaning purposes by unscrewing cap from filter body and removing filter element.
d) Normally-open in-line pressure regulating device, constructed of durable, UV resistant non-corrosive material able to accommodate an inlet pressure rating of not less than 150 PSI (10,3 bar), with preset outlet pressure of approximately 40 PSI (2,8 bar). Pressure regulating device allows full flow with minimal pressure loss unless inlet pressure is greater than preset level. As inlet pressure increases above preset level, internal spring compresses to reduce downstream pressure.
e) Male threaded 1” (25 mm) inlet and outlet connections.

2.8 TRANSITION FITTINGS

A. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following
   a. Spears Manufacturing Company.
2. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket end.

C. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. NIBCO INC.
   b. Spears Manufacturing Company.
2. Description: MSS SP-107, PVC four-part union. Include one brass threaded end, one solvent-cement-joint plastic end, rubber O-ring, and union nut.

2.9 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Description: Factory-fabricated union, NPS 2 and smaller.
   a. Pressure Rating: 150 psig minimum at 180 deg F.
   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
   a. Pressure Rating: 175 psig minimum.

b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.
   a. Pressure Rating: 150 psig minimum.
   b. Gasket: Neoprene or phenolic.
   c. Bolt Sleeves: Phenolic or polyethylene.
   d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Description: Galvanized-steel coupling.
   a. Pressure Rating: 300 psig at 225 deg F.
   b. End Connections: Female threaded.
   c. Lining: Inert and noncorrosive, thermoplastic lining.

F. Dielectric Nipples:

1. Description: Electroplated steel nipple complying with ASTM F 1545.
   a. Pressure Rating: 300 psig at 225 deg F.
   b. End Connections: Male threaded or grooved.
   c. Lining: Inert and noncorrosive, propylene.

2.10 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI WH 201, with bellows or piston-type pressurized cushioning chamber and in sizes complying with PDI WH 201, Sizes A to F.

B. Pressure Gages: ASME B40.1. Include 4-1/2-inch-diameter dial, dial range of two times system operating pressure, and bottom outlet.

2.11 SPRINKLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following
   a. Hunter Industries Incorporated.
   b. Rain Bird Corporation.
2. Description:
   a. Body Material: ABS.
   b. Nozzle: ABS.
   c. Retraction Spring: Stainless steel.
   d. Internal Parts: Corrosion resistant.
3. Capacities and Characteristics:
   a. Flow: 0.36 to 14.8 GPM.
   b. Pop-up Height: 6 inches aboveground to nozzle.5

c. Arc: 50 to 360 circle.
d. Radius: 17 to 46 feet.
e. Inlet: NPS 3/4.

C. Plastic, Pop-up Spray Sprinklers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following
   a. Hunter Industries Incorporated.
   b. Rain Bird Corporation.
2. Description:
   a. Body Material: ABS.
   b. Nozzle: ABS.
   c. Retraction Spring: Stainless steel.
   d. Internal Parts: Corrosion resistant.
   e. Pattern: Fixed, with flow adjustment.
3. Capacities and Characteristics:
   a. Nozzle: ABS.
   b. Pop-up Height: 6 inches aboveground to nozzle.
   c. The sprinkler body shall have a standard pressure-regulating device as an integral part of the pop-up riser. This regulator will provide optimal distribution uniformity of the rotator nozzle by maintaining a constant outlet pressure of 40 PSI with inlet pressures of up to 100 PSI, regardless of the rotator installed.
   d. The body of the sprinkler shall be constructed of corrosion and UV-resistant, heavy-duty A.B.S. The riser of the sprinkler shall be constructed of abrasion and UV-resistant A.B.S. and shall be adjustable for pattern alignment. The riser shall be compatible with female threaded nozzles and shall have a stainless steel spring for positive retraction when irrigation is complete.
   e. The sprinkler shall have a pressure-activated, multi-function, UV stable wiper seal that will clean debris from the pop-up stem while it retracts. The seal shall be molded around a rigid plastic ring to prevent seal deformation. This seal shall prevent the sprinkler from sticking in the up position and be capable of sealing the sprinkler riser stem to the sprinkler cap under normal operating pressures. The seal shall be removable from the cap for easy service and shall be replaceable.
   f. The sprinkler shall have a factory-installed, removable flush cap with a pull-up tab that shall prevent debris from entering the sprinkler during installation and allow the system to be flushed before installing the nozzle. The flush cap shall have a directional flushing action that allows the water to escape only in one direction. The flush cap shall open as the stem extends and completely close when the stem is in the retracted position.
   g. The sprinkler shall have an exposed surface diameter after installation of 2-1/4 inches (6 cm). The sprinkler shall have a 1/2-inch Female National Pipe Thread (FNPT) bottom inlet. In addition, the 6-inch (15 cm) and 12-inch (30 cm) sprinklers shall be available with a 1/2-inch FNPT side inlet. When specified with a factory-installed check valve, the 6-inch (15 cm) and 12-inch (30 cm) sprinklers will be supplied without the side inlet.
   h. The sprinkler body shall carry a five-year, exchange warranty (not prorated).
   i. The sprinkler nozzle shall be of the viscous fluid brake rotary type and be a multi-stream, multi-trajectory rotating stream sprinkler.
   j. In full or part circle mode the sprinkler nozzle shall be capable of covering a 30 foot radius at 40 psi pressure with an equivalent full circle discharge rate of 3-4 gpm.
   k. Sprinkler Nozzle Assembly models shall produce and maintain a matched precipitation rate no greater than 0.6” per hour throughout the arc adjustment range and radius adjustment range, (up to 25% of radius reduction), when spaced at 50% of wetted diameter.

l. The part circle sprinkler shall have an infinitely adjustable arc from 45° to 105°, 90° to 210° or between 210° to 270° depending on the model selected. The full circle sprinkler shall irrigate a full 360°. The 45° to 105° model shall not require coverage from adjacent sprinklers closer than 3' from the head.
m. Full or part circle sprinklers shall be capable of up to 25% radius reduction using a radius adjustment screw. The radius reduction screw shall have a slip clutch mechanism to prevent internal damage if turned past the minimum or maximum radius settings. The radius reduction screw shall reduce the pressure and flow upstream of the adjustable orifice thereby maintaining stream integrity.
n. Part circle sprinklers shall have arc adjustment capabilities using a stainless steel ring. The adjustment ring shall be effective only while the sprinkler is popped up and shall be ineffective while the sprinkler is popped down. When turned past the minimum or maximum arc limits the adjustment mechanism shall have a ratcheting action to prevent internal damage.
o. This same ratcheting action shall allow the orientation of the left edge of the variable arc when installed on a fixed riser or in a popup body. This is independent of and in addition to any ratchet that may exist in a popup body.
p. The sprinkler itself shall pop-up at approximately 15 psi of water pressure. Upon cessation of water pressure, the sprinkler itself shall retract. When installed in a pop-up body the sprinkler itself shall pop-up after the body stem is almost fully extended. Upon decreasing pressure the sprinkler itself shall pop-down before the pop-down of the body stem is complete.
q. The sprinkler nozzles adjustable orifice shall be manufactured from polyurethane and acetyl plastic materials for durability.
r. The sprinkler nozzle shall be fitted with a detachable filter.
s. Sprinkler Nozzle Assembly models shall be able to be installed in popup bodies having a 5/8-27 UNS male threaded stem, at all common popup heights. Sprinkler Assembly shall also be able to be attached to a 1/2 FIPT x 5/8-27 UNS male threaded adapter for use on fixed pipe risers. Sprinkler Assembly shall also be able to be attached to a 1/2 FIPT x 5/8-28 UNS female threaded adapter for use on fixed pipe risers.

2.12 QUICK COUPLERS

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

1. Buckner; a Storm Manufacturing Group, Inc. brand.
2. Hunter Industries Incorporated.
3. Rain Bird Corporation.

B. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

1. Locking-Top Option: Vandal-resistant locking feature. Include two matching key(s).

2.13 DRIP IRRIGATION SPECIALTIES

A. Sub-surface Products: Subject to compliance with requirements, provide the following

1. Hunter Industries Incorporated; ECO-MAT 17MM Subsurface Irrigation System.

B. Sub-surface Drip Tubes with Direct-Attached Emitters:

1. Tubing: Flexible PE or PVC with plugged end.
2. Emitters: Devices to deliver water at approximately 20 psig.
   a. Body Material: PE or vinyl, with flow control.
   b. Mounting: Inserted into tubing at set intervals.
3. Capacities and Characteristics:
   a. Tubing Size: 17mm.
   b. The Hunter Eco-Wrap shall be pre-assembled and constructed of a sheet of special polypropylene fleece matting with two rows of fleece-wrapped, pressure-compensating, non-draining inline emitter tubing.
   c. The wrapped emitter tubing shall be joined to the top of the fleece mat in regular intervals so as to provide uniform spacing in the lines at 14 in (35 cm) distance and to facilitate uniform installation.
   d. The wrapped emitter tubing shall have a nominal outside diameter of 17mm and shall have 0.6 GPH (2.3 l/h) emitters uniformly spaced at 12 in (30 cm) intervals.
   e. This tubing shall be made of landscape grade tubing with a nominal wall thickness not less than 1.1 mm.
   f. Each roll of Eco Mat 17 shall be 32 in (0,80 m) in width and 295 ft (76 m) in length, providing 785 sq ft (60 sq m) of coverage.
   g. Each roll of Eco-Mat 17 shall be able to hold 0.5 gallons (1,89 liters) of water at maximum saturation.
   h. The rolls shall be delivered with solid caps inserted to protect the tubing from debris during installation.

C. On-Surface Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following

1. Agrifim; NDS Inc.
2. Hunter Industries Incorporated.
3. NDS/Raindrip.
4. Netafim USA.
5. Rain Bird Corporation.

D. On-surface Drip Tubes with Direct-Attached Emitters:

1. Tubing: Flexible PE or PVC with plugged end.
   a. Potable water: Standard model
   b. Greywater/Non-potable water: Purple color reclaimed water option.
2. Emitters: Devices to deliver water at approximately 20 psig.
   a. Body Material: PE or vinyl, with flow control.
   b. Mounting: Inserted into tubing at set intervals.
3. Capacities and Characteristics:
   a. Tubing Size: 17mm.
   b. Emitter Spacing: 18 inches.
   c. Emitter Flow: 0.6 gallons per hour.

E. Application Pressure Regulators: Brass or plastic housing, NPS 3/4, with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig.

F. Filter Units: Brass or plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.

G. Air Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

H. Vacuum Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

2.14 CONTROLLER

A. Products: Subject to compliance with requirements, provide the following

1. Rain Bird Corporation; ESP-LXD WITH IQ COMMUNICATION CARTRIDGE AND FLOW SMART MODULE

B. Description: ESP-LXD irrigation controller specifications include but are not limited to:

1. The controller shall be of a hybrid type that is microelectronic circuitry capable of fully automatic or manual operation.
2. The controller shall be housed in a wall-mountable, weather resistant plastic cabinet with a key-locking cabinet door suitable for indoor or outdoor installation.
3. The controller shall be a two-wire path decoder based control system.
   a. The controller shall use the same decoder hardware as the MDC, MDC2 and SiteControl controllers.
   b. Output power for the decoders shall be adjustable from the controller
   c. Inrush and holding current values shall be adjustable from the controller.
4. The controller shall have the ability to be programmed and operated in any one of six languages:
   a. English
   b. Spanish
   c. French
   d. German
   e. Italian
   f. Portuguese
5. The display shall show programming options and operating instructions in the chosen language without altering the programming or operation information.
   a. The controller shall have user configurable formats for date, time, and units.
6. The controller shall have incorporated a base station ESPLXD-M50 Module capacity of 50 stations as well as two additional expansion slots capable of receiving ESPLXD-SM75 Modules to create a controller capacity of 200 stations.
   a. Each expansion ESPLXD-SM75 Module shall be able to increase controller capacity up to 75 additional stations.
   b. Modules shall be hot swappable and can be installed while in operation with the dial in any position and in any open module slot.
7. All stations shall have the capability of independently obeying or ignoring the weather sensor as well as using or not using the master valve.
   a. The controller shall have a weather sensor override switch.
8. The weather sensors shall include but are not limited to:
   a. Rain Bird™ WR2 Rain/Freeze sensor to respond to rainfall and cold temperatures
   b. Rain Bird™ RSD Rain Sensor for monitoring rainfall
   c. Rain Bird™ Anemometer to provide site-specific wind speed measurements with additional Rain Bird™ PT3002 pulse monitor.
   d. The ESP-LXD controller shall be compatible with a Rain Bird™ET Manager Cartridge (ETC-LX) that enables weather-based management for the irrigation controller.
9. Station timing shall be from 0 minutes to 12 hours.
10. The controller shall have a seasonal adjustment feature adjustable from 0% to 300% in increments of 1%.
    a. Seasonal adjustments shall be adjusted by each individual program.
11. The controller shall also have a monthly seasonal adjustment feature adjustable from 0% to 300% by month in increments of 1%.

12. Station timing with seasonal adjustment shall be from 1 second to 16 hours.
13. The controller shall have 4 separate and independent programs which can have different start time, start day cycles and station run times.
    a. Each program shall have up to 8 start times per day for a total of 32 possible start times per day.
    b. The programs shall be allowed to overlap operations based on user-defined settings which control the number of simultaneous stations per program and total for the controller.
14. The controller shall come standard with SimulStations™ which allows the user to define up to eight 24 VAC, 7VA solenoid valves to operate simultaneously per program and total for the controller, including the master valve/pump start circuit.
15. The controller shall have the capability of having a normally open or closed master valve programmable by station.
16. The controller shall have a programmable station delay by program to allow for water well recovery or slow closing valves.
17. The controller shall have an electronic, diagnostic circuit breaker that shall sense a station with an electrical overload or short circuit and shall bypass that station and continue operating all other stations.
18. The controller shall have a 365-day calendar with leap year intelligence. The leap year intelligence allows the use of “Odd” or “Even” day watering schedule without changing the date on leap years.
    a. The calendar shall include a permanent day off feature that allows a day(s) of the week to be turned OFF on any cycle (Custom/Odd/Odd31, and Cyclical).
19. A day set to “Permanent Off” shall override the normal repeating schedule and not water on the specified day(s) of the week.
20. The controller shall also have a calendar day off feature allowing the user to select up to 5 dates up to 365 days in the future when the controller shall not start programs.
21. The controller shall incorporate a rain delay feature allowing the user to set the number of days the controller should remain off before automatically returning to the automatic operation mode.
22. The controller shall have a Cycle+Soak™ water management software which is capable of operating each station for a maximum cycle time and a minimum soak time to reduce water run-off.
    a. The maximum cycle time shall not be extended by seasonal adjustments.
23. The controllers default operation shall be by station number.
24. The controller shall provide an option to assign station priorities to determine the order in which stations shall operate.
    a. The controller shall ignore the station number sequence and instead operate the highest priority stations first and the lower priority stations last. Station priorities will be utilized by the FloManager™ feature if the FloManager™ feature is enabled.
25. The controller shall offer a water window for each program
    a. The water window function sets the allowed start and stop time where watering is allowed.
    b. If watering cannot be completed by the time the water window closes, the stations with the remaining time are paused and watering automatically resumes when the next water window opens.
26. The controller shall incorporate a FloManager™ feature that shall provide real-time flow, power, and station management.
    a. The FloManager™ shall manage the number of stations operating at any point in time based on water source capacity, station flow rate, number of valves per station, station priorities, and user defined simultaneous stations per program and for the controller.
27. The controller shall offer a Flow Smart Module™ option which adds flow sensing functionality.
    a. The Flow Smart Module™ input shall accept a Rain Bird™ SD-210Turf sensor decoder input from 1-5 flow sensors with no flow scaling device required.

28. The flow sensor module shall include a FloWatch™ which learns the normal flow rates of each station.
    a. Each time a station runs the FloWatch™ shall compare the current real-time flow rate to the learned rates and take user defined actions if high flow, low flow, or no flow is detected.
    b. The FloWatch™ shall automatically determine the location of the flow problem and isolate the problem by turning off the affected station or master valve.
    c. The FloWatch™ shall be compatible with both normally closed and open master valves.
    d. The FloWatch™ shall manage hydraulic demand, making full use of available water.
29. A manual master valve water window shall be provided to coordinate daytime manual watering with the flow sensing.
30. The water windows shall offer programmable days of the week and manual watering additional flow rate.
31. The controller shall have an alarm indicator light with an external case lens on the front panel visible through the outer door with the door closed and locked.
    a. The alarm light shall prompt the user to select the alarm softkey to review the alarm condition(s).
32. The controller shall be compatible with the IQ v3.0 Central Control System utilizing IQ-NCC Network Communication Cartridges.
    a. The IQ-NCC Cartridge shall provide communication with the IQ Central Computer and other controllers via a variety of communication options (Direct Connect Cable, Phone, GPRS/Cellular, Ethernet, WiFi, Radio, and IQNet Communication Cable).
    b. The IQ v3.0 Central Control System shall provide remote computer control of the controller providing automatic or manual program adjustments.
33. The controller shall offer an optional Rain Bird™ LXMM metal wall-mounted lockable cabinet and/or Rain Bird™ LXMMPED pedestal.
34. The controller shall be capable of receiving ET Manager Cartridge (ETC-LX) that shall upgraded the controller to a Smart controller
35. The controller shall have multiple size wiring knockouts located on the bottom and the back side of the case to adapt to a wide variety of wiring applications, to facilitate installation and provide a clean professional look.
36. The controller door and front panel shall be removable to allow the case to be mounted to a wall.
37. The controller shall have a removable, programmable front panel for conveniently programming the controller away from the installation site or for teaching irrigation scheduling.
    a. The removable programmable front panel shall use a 9 volt battery.
38. Shall include non-volatile (100-year) program memory to maintain the irrigation schedule indefinitely during a power outage.
39. The controller shall operate on 120 VAC± 10% at 60Hz (230VAC ± 10% at 50Hz for international models; Australian models: 240VAC ± 10% at 50Hz).
40. Shall include a standard 10kV surge protection.
41. Shall include a diagnostic self-setting circuit breaker that identifies a valve or wire fault and continues to water operable stations.
42. Shall include a RASTER™ station wiring test to allow the installer to test the valve wires during installation to determine the valve that each wire is connected to.
43. The controller shall have Contractor Default™ settings that allow the contractor to set his/her own default program.
    a. The program can be automatically recalled up to 90 days in the future.
    b. Shall be used for ease in restoring a schedule that has been altered or to replace a temporary schedule for new vegetation.
44. The controller shall have the capacity for the program to be erased allowing the user to start programming with a blank controller.

45. The controller shall have a reset button to reset the controller in the case of micro-controller "lock-up" due to power surges or frequent interruption to the power supply.
46. The controller shall include a lithium coin-cell battery that shall maintain time and date during a power outage.
47. Shall have the dimensions of:
    a. Width:14.32 in. (36.4 cm)
    b. Height:12.69 in. (32.2 cm)
    c. Depth: 5.50 in. (14.0 cm)

C. Description: Rain Bird™ LXMM metal wall-mount case specifications include but are not limited to:

1. Field wiring connections shall occur in the controller.
2. The LXMM metal case shall be sized such that the standard plastic case of a ESP-LXD controller shall fit properly and securely in the case without altering the controller.
3. The controller shall be field installed into the metal case and can be mounted wall-mounted or attached to a Rain Bird™ LXMMPED free-standing pedestal.
4. The metal wall-mountable case shall include all necessary mounting bolt, nuts, and washers.
5. The metal wall-mount case shall be lockable.
6. The metal case shall be powder-coated steel.
7. The LXMM metal case shall have the dimensions of:
    a. Width:14.25 in. (36.2 cm)
    b. Height:12.875 in. (32.7 cm)
    c. Depth: 7.75 in. (19.7 cm)

D. Description: Irrigation decoder specifications include but are not limited to:

1. The decoder addresses shall be pre-coded to eliminate confusion associated with user-defined decoder addressing.
2. The decoders shall be fully encapsulated creating a completely waterproof seal.
3. The field decoder shall be gray in color for North America and black outside of North America.
4. The line surge protector decoder shall be yellow in color.
5. The sensor decoder shall be green in color.
6. The decoders mounting shall be recommend to be placed in a valve box but shall be direct burial capable.
7. The decoder electrical input shall be:
    a. Nominal Voltage: 34 Vpp (24V AC) from two wire line
    b. Minimum Voltage: 21 Vpp (15V AC)
    c. Maximum Voltage: 36 Vpp (25V AC)
8. The maximum 14 gauge cable run shall be:
    a. Star: 2.4 miles
    b. Loop: 9.6 miles
9. The decoder/solenoid wires shall have a maximum electrical resistance of 3 ohms.
10. The maximum decoder/solenoid 14 gauge cable run shall be a maximum of 456 feet.
11. Wiring for the decoders shall be a Maxi-Cable™ (double jacketed) wire.
12. The environment shall be:
    a. Working Range: 32° to 122° F (0° to 50° C)
    b. Storage Range: -4° to 158° F (-20° to 70° C)
    c. Humidity: 100%
13. Shall have five different field decoder options to allow the user to choose the precise amount of landscape irrigation control needed.
    a. Rain Bird™ FD101Turf field decoder interfacing signal line and valve.
    b. Rain Bird™ FD102Turf field decoder interfacing signal line and valve or pair of valves.

c. Rain Bird™ FD202Turf field decoder interfacing signal line and 2 valves or 2 pair of valves.
d. Rain Bird™ FD401Turf field decoder interfacing signal line and up to 4 individual valves.
e. Rain Bird™ FD601Turf field decoder interfacing signal line and up to 6 individual valves.

14. Rain Bird™ FD101Turf field decoder interfacing signal line and valve specifications include but are not limited to:
    a. Power Draw: 0.5mA (idle), 18 mA (per active solenoid)
    b. Dimensions: Length: 2.77 in. (70 mm), Diameter 1.5 in. (40 mm)
    c. Solenoids: 1 with individual control
    d. Wires: Blue to cable, white to solenoid
    e. Surge protection shall be required every 500 ft.
    f. The field decoder shall be gray in color for North America and black outside of North America.
15. Rain Bird™ FD102Turf field decoder interfacing signal line and valve or pair of valves specifications include but are not limited to:
    a. Power Draw: 0.5mA (idle), 18 mA (per active solenoid)
    b. Dimensions: Length: 3.35 in. (85 mm), Diameter 1.77 in. (45 mm)
    c. Solenoids: 1 or two simultaneously
    d. Wires: Blue to cable, white to solenoid
    e. Surge protection shall be required every 500 ft.
    f. The field decoder shall be gray in color for North America and black outside of North America.
16. Rain Bird™ FD202Turf field decoder interfacing signal line and 2 valves or 2 pair of valves specifications include but are not limited to:
    a. Power Draw: 1.0mA (idle), 18 mA (per active solenoid)
    b. Dimensions: Length: 3.35 in. (85 mm), Diameter 1.97 in. (50 mm)
    c. Solenoids: 1 to 4 simultaneously
    d. Wires: Blue to cable, white and brown to solenoids
    e. Surge protection shall be required every 500 ft.
    f. The field decoder shall be gray in color for North America and black outside of North America.
17. Rain Bird™ FD401Turf field decoder interfacing signal line and up to 4 individual valves specifications include but are not limited to:
    a. Power Draw: 1.0mA (idle), 18 mA (per active solenoid)
    b. Dimensions: Length: 3.94 in. (100 mm), Diameter 2.56 in. (65 mm)
    c. Solenoids: 1 to 4 with individual control
    d. Wires: Blue to cable, color coded to solenoids
    e. Surge protection shall be built into the decoder.
    f. The decoder shall have an input fuse of 300-500mA, thermal.
    g. The field decoder shall be gray in color for North America and black outside of North America.
18. Rain Bird™ FD601Turf field decoder interfacing signal line and up to 6 individual valves specifications include but are not limited to:
    a. Power Draw: 1.0mA (idle), 18 mA (per active solenoid)
    b. Dimensions: Length: 3.94 in. (100 mm), Diameter 2.56 in. (65 mm)
    c. Solenoids: 1 to 6 with individual control
    d. Wires: Blue to cable, color coded to solenoids
    e. Surge protection shall be built into the decoder.
    f. The decoder shall have an input fuse of 300-500mA, thermal.
    g. The field decoder shall be gray in color for North America and black outside of North America.
19. The Rain Bird™ LSP1Turf Line Surge Protector decoder specifications include but are not limited to:

a. The line surge protector decoder shall be grounded on a two-wire path every 500 feet (150 meters) or every 8 decoders, whichever is smaller.
b. The LSP1Turf Line Surge Protector decoder shall be placed on a two wire path with FD101Turf field decoder interfacing signal line and valves, FD102Turf field decoder interfacing signal line and valve or pair of valves, and FD202Turf field decoder interfacing signal line and 2 valves or 2 pair of valves.
c. The LSP1Turf Line Surge Protector decoder shall be used for surge protection only, and shall not have a decoder address.
d. The LSP1Turf Line Surge Protector decoder shall protect against 40V, 1.5kW trasil.

20. The Rain Bird™ SD-210Turf Sensor Decoder specifications include but are not limited to:
a. The SD-210Turf Sensor Decoder shall be an interface to flow sensors.
b. When the SD-210Turf Sensor Decoder is wired to a flow sensor it shall monitor the current flow rate at a flow monitor by sending a pulse signals to the controller.

2.15 CENTRAL CONTROL SYSTEM

A. Products: Subject to compliance with requirements, provide the following

1. HYPERLINK "http://www.specagent.com/Lookup?uid=123457050044" Rain Bird Corporation: The Rain Bird™ IQ™ v3.0 Central Control Software system shall be comprised of the requirements as outlined in this specification in order to meet the software and hardware requirements of the irrigation zones they service.

B. Description: Software

1. Rain Bird™ IQ™ v3.0 Central Control Software system specifications include but are not limited to:
a. The system shall be fully programmable, providing the operator with full control of the entire control system.
b. The system shall be capable of controlling all functions at a central computer that could be completed at the physical satellite controller.
c. The system shall have a Windows® graphical user interface (GUI) that allows programming and a graphical depiction of the satellite controller programming.
d. The system shall have modular satellite controller capacity and features.
1) The system shall allow the user to upgrade the system as the system requirements change.
e. The base software package IQSTARTCD shall have capacity to control 5-satellite controllers.
f. The system shall have the capacity to connect and manage 16,000+ satellites per system.
g. The IQ Software IQ5SATSWU and IQNet™ IQ5SATNCCU satellite controller capacity can be upgraded in 5-satellite increments.
1) The additional capacity shall be added through purchased software activation keycodes.
h. The system shall be compatible with the Rain Bird™ ESP-LXME and Rain Bird™ ESP-LXMEF series traditionally-wired controllers with 1 to 48 station capacity.
1) Shall be able to control 7,200+ satellite stations per site for the ESP-LXME and ESP-LXMEF.
2) Rain Bird™ ESP-LXME and Rain Bird™ ESP-LXMEF shall be capable of running 5 simultaneous stations.
3) Each Server Satellite shall be capable of connecting to 149 Client Satellites for a total of 150 Satellites per site.
4) The maximum number of simultaneous stations per site for the ESP-LXME and ESP-LXMEF shall be 750.

i. The system shall be compatible with Rain Bird™ ESP-LXD series 2-wire decoder controllers with 1 to 200 station capacity.
   1) Shall be able to control 30,000+ decoders addresses per site ESP-LXD.
   2) The maximum number of simultaneous stations per site shall be 1,200 for the ESP-LXD.
j. The system shall have the capacity to control 999 sites per system.
k. The system shall have an adjustable satellite controller capacity allowing the customer to expand the system capacity over time.
l. The system shall allow virtual log-on passwords to administer access privileges to multiple users of the system.
m. The controller shall have the ability to be programmed and operated in any one of six languages:
   1) English
   2) Spanish
   3) French
   4) German
   5) Italian
   6) Portuguese
n. The system shall have user configurable formats for date, time, number, and units formats.
o. The system shall allow virtual site configurations, allowing the user to group satellite controllers into a site to simplify common adjustments.
p. The system shall incorporate a satellite controller Dry-Run™ feature that graphically depicts the following program operation features:
   1) Minute-by-minute program activity
   2) Expected flow rates
   3) Programs/stations operating at any point in time.
   4) The order in which stations irrigate and which stations will be simultaneously run together.
q. The system shall incorporate program adjust values for each satellite controller program.
r. The system shall include a site-level daily or monthly seasonal adjust percentage
   1) Shall adjust the station run times for all satellite controllers in the site.
s. The system shall also offer site-level daily or monthly ET value adjustments as an alternative to seasonal adjustment percentage.
t. The software shall utilize IQNCC Network Communication Cartridges to interface with the system controllers.
u. The cartridges shall be available with internal Phone, GPRS/Cellular, Ethernet and WiFi modems, RS-232 external modem port, direct connect cable, radio, or IQNet™ Communication Cable.
   1) The controller shall be configured as a Direct, Server, or Client Satellite with the cartridge installed.
v. The Server satellite shall share its IQ central computer communication link with up to 149 Client satellites and be capable of sharing weather sensors and master valves amongst the 150 satellite controllers.
w. The software shall incorporate a site configuration utility that contacts the satellite controller and shall:
   1) Report the hardware configuration and retrieve the configuration and programming data
   2) Report any learned flow rates the controller may have.
   3) Verify the satellite hardware configuration has not changed each time it contacts the satellite controller.
x. The controller and IQNCC cartridge firmware shall be upgradeable (reflashed) from the system central computer.
y. The software shall be capable of manually starting a program, test a program, or station on any satellite controller.

z. The software shall be capable of overriding the satellite controller Auto/Off dial position and sensor Active/Bypass switch position.

aa. Satellite controllers equipped with flow sensors shall provide a learn flow utility to measure the nominal flow rate of each station.
   1) The satellite controllers shall come with Flo-Watch™.
   2) Flow-Watch™ shall provide protection for high and low flow conditions with user defined reactions.
   3) The learn flow rate shall be compared to the actual flow sensor flow rate each time the station operates.
   4) A user defined percentage above and below the learned flow rate shall be used to determine if the flow rate is problematic.
   5) User defined reactions shall be programmable including a diagnose mode where the cause of the problem flow rate is identified and the problem station or water source is shut off.

bb. A manual master valve water window shall be provided to automatically open the master valve and account for manual watering flow rates without turning off the flow sensing functions of the satellite controller.
   1) Both normally closed and open master valves shall be supported.

cc. All flow sensing features shall be programmable through the software.

dd. The system shall offer user definable station-level priorities and a program-level water window.

ee. Stations are selected to operate based on their priority with high priority stations operating first.

ff. The station operation shall be paused and resumed at the start of the next water window if a program cannot complete the run time of all stations in the water window.

gg. The system shall provide user definable number of simultaneous station to operate per program and for the whole satellite controller.
   1) The combination of these features shall be used to automatically shorten the overall operating time of the satellite controller programs.

hh. All satellite controller features listed shall be programmable through the software.

ii. The system shall offer optional software Rain Bird™ Feature Packs to expand the features of the system.
   1) The optional features shall be enabled through a purchased software keycode.
   2) Feature Pack features shall be enabled for all sites and satellites in the IQ software.

jj. The feature packs shall include:
   1) Advanced communications
   2) Advanced programming
   3) Advanced ET
   4) Advanced flow sensing.

kk. A system equipped with the Rain Bird™ Advanced Communication Feature Pack IQACOMFP specifications include but are not limited to:
   1) Shall provide automatic communication and email reports.
   2) Using Satellite IQ Call-in™ the satellite controller using phone communication shall be capable of initiating communication with the central computer to gather programming changes and sent log data.
   3) The Call-in™ feature shall be compatible with NCC-PH Phone Cartridge only.
   4) The Rain Bird™ Advanced Communication Feature Pack IQACOMFP shall function with any NCC cartridge.
   5) Automated satellites synchronize and retrieve logs and Weather Source retrieve weather data communications.
   6) Shall send automated e-mail reports indicating alarm/warnings and satellite station run time reports up to 250 e-mail addresses.

ll. A system equipped with the Rain Bird™ Advanced Programming Feature Pack IQAPGMFP specifications include but are not limited to:
   1) Shall provide satellite controller PIN-code lock-out and 2-way programming.
   2) Shall help prevent unauthorized personnel from making programming changes at satellites the PIN-Code protection.
   3) Each satellite shall have a maximum of 5 assigned PIN-codes.
   4) The satellite PIN-Code Protection shall be a 4-digit PIN-Code.
   5) Lockout options shall include full or partial lockout.
   6) All PIN-codes shall be programmed through the software.
   7) Changes made at the satellite shall be able to be viewed and accepted in the software.
   8) The Copy/Move Satellite Utility shall allow the user to copy or move a satellite to another site.
   9) The user shall be able to view a list of site personnel who have accessed each satellite with date and time access information.
   10) Shall allow the user to accept or reject programming changes made at the satellites to each IQ™ v3.0 satellite from the central computer.

mm. A system equipped with the Rain Bird™ Advanced ET Feature Pack IQAETFP specifications include but are not limited to:
   1) Shall provide automatic program adjustment based management allowed depletion scheduling.
   2) ET/rain weather sources shall include CIMIS Internet, ETMI ET Manager Weather Reach Service, and Rain Bird™ WSPROLT and Rain Bird™ WSPRO2 Weather Stations.
   3) Shall allow Automated MAD (Management Allowed Depletion) irrigation scheduling adjustments.
   4) The software shall use irrigation association terminology and formulas.
   5) Shall have four ET checkbooks per satellite controller.
   6) Shall have the functionality to export to Microsoft Excel® for customized reports.

nn. A system equipped with Rain Bird™ Advanced Flow Sensing Feature Pack IQAFSENFP specifications include but are not limited to:
   1) Shall provide minute-by-minute flow logs in a graph comparing actual flow and projected flow.
   2) Shall retrieve minute-by-minute flow logs from flow sensor equipped Rain Bird™ ESP-LXMEF and Rain Bird™ ESP-LXD satellite controllers.
   3) Station flow rates shall be learned by the Learn Flow Utility.
   4) Shall compare real-time flow rates to learned flow rates.
   5) Shall automatically diagnose problem flows to determine whether they are caused by a break in a main line or lateral line.
   6) Shall produce Flow Logs vs. Projected Flow Graphical Report identifying which programs and stations are running at any point in time.
   7) Shall automatically close the master valve or station valve to isolate the problem.
   8) Actual flow totals shall be added to the satellite station run time report, included in the automated email reports.
   9) Shall be able to monitor and automatically react to a breakage in the pipe by using the Flow Sensing Feature Pack, the Flow Smart Module and a flow sensor.

oo. The system shall include a context-sensitive help system.

pp. The system shall allow the user to create custom computer programming to meet specific needs.

qq. The system's recommended computer requirements shall be:
   1) Operating System: Windows® XP or Windows® 7 32 and 64-bit
   2) Processor: Intel I5-540M or equivalent
   3) RAM Memory: 3 GB

4) Available Hard Disk Space: 10 GB
5) CD-ROM Drive: 8X speed minimum
6) Display Resolution: 1024 x 768 minimum
7) 56K Flex Phone Modem (Phone communication)
8) Network Connection (for Ethernet, WiFi, GPRS communication)
9) Serial Port or USB to Serial Adapter (for Direct Connect and External Modem communication)

rr. The IQ v3.0 Central Control System™ shall be as manufactured by Rain Bird™ Corporation.

C. Description: Hardware

1. Rain BirdTM IQ™ v3.0 Central Control Hardware system specifications include but are not limited to:
   a. The hardware shall utilize IQNCC Network Communication Cartridges to interface between the system controllers and the Rain BirdTM IQ™ v3.0.
   b. The cartridge shall be designed to install Rain Bird™ ESP-LXME, Rain Bird™ ESP-LXMEF and Rain Bird™ ESP-LXD Series controller faceplate.
      1) No tools shall be required for the communication cartridge installation.
      2) The communication cartridge shall receive power through a ribbon cable connection to the controller front panel.
   c. The communication cartridge shall be configured and monitored through a dedicated dial position on the controller front panel.
      1) In this dial position the communication cartridge shall be in control of the controller display and user interface softkeys.
   d. The user interface shall include a setup wizard to guide the user through the required configuration settings.
   e. The communication cartridge shall be user configurable as a Direct, Server, or Client satellite controller.
   f. The communication cartridge shall incorporate three communication ports to communicate with the system central computer as well as communicate with other communication cartridge equipped controllers via high-speed data cable and/or radio communication.
   g. The communication cartridge shall incorporate status lights (LEDs) showing the real-time status of the cartridge communication ports.
   h. The controller shall be configured as a Direct, Server, or Client Satellite with the cartridge installed.
   i. Single controller sites shall use an IQ NCC cartridge configured as a Direct satellite.
      1) A Direct satellite shall have an IQ central computer communication connection but no network connections to other satellites in the system.
      2) Communication cartridges configured as a Direct satellite shall communicate directly with the system central computer via the primary (IQ) communication port.
      3) Configuring the communication cartridge as a Direct satellite shall disable the IQNet™ high-speed data cable (CM) and radio (Radio) communication ports.
   j. Multi-controller sites shall be able to use one IQ NCC cartridge configured as a Server satellite and the other NCC cartridges configured as Client satellites.
   k. The Server satellite has an IQ central computer communication connection and shares this communication connection with the Client satellites though high-speed data cable or radios.
   l. The communication connection between Server and Client satellites shall be called the IQNet™.
      1) The IQNet™ communication shall be either radio or two wire path from the server to the various clients the server communicates too.

2) The IQNet™ communication shall have the capability to mix-and-match between radio and hardwire clients.

m. Server and Client satellites using high-speed data cable for IQNet™ communication require installation of an IQ CM Communication Module.
   1) IQFSCMLXME Flow Smart Connection Module for the ESPLXME Controller.
   2) IQCMLXD Connection Module for the ESP-LXD Controller.

n. Server and Client satellites using radio communication for IQNet™ communication require installation of an IQSSRADIO radio.

o. Satellites on a common IQNet™ can share weather sensors and master valves.

p. Communication cartridges configured as a Server satellite shall communicate directly with the system central computer via the primary (IQ) communication port.
   1) Configuring the communication cartridge as a Server satellite shall enable the IQNet™ high-speed data cable (CM) and radio (Radio) communication ports for communication with Client satellite controllers.
   2) A single Server satellite shall be capable of networking up to 150 Client satellites across the IQNet™ network.

q. Communication cartridges configured as a Client satellite shall communicate via the IQNet™ network with a Server satellite.
   1) The Client satellite shall not have direct communication with the system central computer but shall instead use the Server satellite connection.
   2) Client satellite primary (IQ) communication port shall be disabled.
   3) Configuring the communication cartridge as a Client satellite shall enable the IQNet™ high-speed data cable (CM) and radio (Radio) communication ports for communication with a Server satellite controller.

r. Satellite controllers on a single IQNet™ network can share up to 8 master valves and 32 weather sensors.

s. Master valves and weather sensors shall be shared across ESP-LXME traditionally-wired and ESP-LXD 2-wire controllers.

t. The cartridges shall be available with internal Phone, GPRS/Cellular, Ethernet and WiFi modems, RS-232 external modem port, direct connect cable, radio, or IQNet™ Communication Cable.
   1) Communication cartridges with GPRS/Cellular, Ethernet, and WiFi shall utilize static IP addresses for communication with the system central computer.

u. IQ NCC cartridges shall be initially configured through a setup wizard provided in the ESP-LX Series Controller IQ Settings dial position.

v. Communication setting parameters shall be configured through the IQ software or the IQ Configuration Software designed for netbook/laptop use on the job site.

w. The Rain Bird™ IQ NCC-GP GPRS/Cellular Cartridge shall include an embedded GPRS/Cellular Data Modem with an antenna connector.
   1) Shall include an internal antenna for plastic controller enclosures.
   2) An optional external antenna shall be available for metal case controller enclosures.
   3) Shall require GPRS/Cellular data service plan with static IP address from cellular service provider.
   4) Used for Direct or Server satellite applications requiring wireless GPRS/Cellular communication with the IQ central computer.

x. The Rain Bird™ IQ NCC-EN Ethernet Cartridge shall include an embedded Ethernet Network Modem with RJ-45 port.
   1) Shall include a RJ-45e patch cable.
   2) Shall require a LAN network static IP address.
   3) Shall be used for Direct or Server satellite applications requiring Ethernet LAN network communication with the IQ central computer.

y. The Rain Bird™ IQ NCC-WF WiFi Cartridge shall include an embedded WiFi Wireless Network Modem with antenna connector.

1) Shall include an internal antenna for plastic controller enclosures.
2) An optional external antenna shall be available for metal case controller enclosures.
3) Shall require a LAN wireless network static IP address.
4) Shall support WPA/WPA2 encryption.
5) Shall be used for Direct or Server satellite applications requiring WiFi LAN wireless network communication with the IQ central computer.

z. Server and Client satellite controllers shall utilize a Connection Module to connect to the IQNet™ via high-speed data cable.
1) The Connection Module shall be controlled by the cartridge CM port.
2) Connection Modules shall provide quick connect terminals for connection to the 2 communication conductors as well as ground.

aa. Server and Client satellite controllers shall utilize a Frequency Hopping Spread Spectrum Digital Radio for wireless communication on the IQNet™.
1) The radio shall be controlled by the cartridge Radio port.
2) A connector cable to interconnect the cartridge and radio shall be supplied with the cartridge.

bb. The system central computer shall be capable of upgrading (reflashing) the communication cartridge firmware through the IQ communication port.
1) New features shall be implemented into the cartridge without the need to replace the existing communication cartridges.

cc. The communication cartridge shall keep a log of all controller and IQNet™ activity for upload to the system central computer.

dd. The IQ v3.0 Central Control System™ shall be as manufactured by Rain Bird™ Corporation.

D. Description: Flow Sensors

1. Rain Bird™ IQ™ v3.0 Central Control flow sensing system specifications include but are not limited to:
a. The Rain Bird™ flow sensing system shall be configurable to the following systems:
1) Rain Bird™IQ™ v3.0 Central Control Software Systems
2) Rain Bird™LXMEF
3) Rain Bird™LXD

b. Rain Bird™flow sensing system shall include Flo-Watch™.
1) Flo-Watch™ shall constantly monitors for low flow and excess flow conditions caused by broken lines or heads.
2) Flo-Watch™ shall automatically quarantine and shut down the problem area(s) and continue to irrigate non affected areas.

c. The flow sensing system flow sensors shall provide a learn flow utility to measure the nominal flow rate of each station.
1) The controller has the ability to automatically learn station flow rates.
2) The learn flow rate shall be compared to the actual flow sensor flow rate each time the station operates.
3) A user defined percentage above and below the learned flow rate shall be used to determine if the flow rate is problematic. The software shall allow the user to increase or decrease the length of time of a flow event before the controller reacts.
4) User defined reactions shall be programmable including a diagnose mode where the cause of the problem flow rate is identified and the problem station or water source is shut off.
5) The automatic collection of flow rates shall prevent the user from manually entering data from drawings or physically visiting each valve to collect flow data and manually entering the data collected into a controller.

d. Rain Bird™flow sensing system shall incorporate FloManager®.

1) The FloManager® shall provide real-time flow, power, and station management.
2) The FloManager™ shall manage the number of stations operating at any point in time based on water source capacity, station flow rate, station module assignment, number of valves per station, station priorities, and user defined simultaneous stations per program and for the controller.
3) The FloManager® shall determine the optimal station irrigating sequence.
4) The system shall run at its fullest capacity until all programs are complete.
5) The controller shall automatically select and run multiple valves at the same time within hydraulic parameters allowing for shorter water windows.
6) Flow rates may be manually measured and entered into the controller to utilize FloManager® functionality.

e. The flow sensing system shall be compatible with the Rain Bird™ ESP-LXMEF series traditionally-wired controllers with 1 to 48 station capacity.
1) Pulse transmitter and decoders shall not be required with traditionally-wired controllers.

f. The flow sensing system shall be compatible with Rain Bird™ ESP-LXD series 2-wire decoder controllers with 1 to 200 station capacity.
1) Rain Bird™ Two-Wire Decoder Sensor SD210TURF shall be required on two-wire decoder systems.

g. Surge protection shall be recommended for all systems.

h. One shall be located at the flow sensor, and if more than 50’ of wire run, one shall be located at the pulse transmitter.

i. The flow sensors system models include but are not limited to:
1) Rain Bird™ FS100B Flow Sensor
2) Rain Bird™ FS150B Flow Sensor
3) Rain Bird™ FS200B Flow Sensor
4) Rain Bird™ FS050P Flow Sensor
5) Rain Bird™ FS075P Flow Sensor
6) Rain Bird™ FS100P Flow Sensor
7) Rain Bird™ FS150P Flow Sensor
8) Rain Bird™ FS200P Flow Sensor
9) Rain Bird™ FS300P Flow Sensor
10) Rain Bird™ FS400P Flow Sensor
11) Rain Bird™ FS350B Flow Sensor
12) Rain Bird™ FS350SS Flow Sensor
13) Rain Bird™ PT322 Pulse Output Transmitter
14) Rain Bird™ PT3002 Flow Monitor

j. The Rain Bird™ FS100B Flow Sensor or Rain Bird™ FS150B Flow Sensor specifications include but are not limited to:
1) The flow sensor shall be an in line type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part.
2) The paddle wheel shall be a six-bladed impeller design.
3) The flow sensor shall be designed for outdoor or underground applications.
4) The electronics housing shall be glass-filled PPS.
5) The impeller shall be glass-filled nylon or Tefzel® with a UHMWPE or Tefzel sleeve bearing.
6) The shaft material shall be tungsten carbide.
7) The electronics housing shall have two, ethylenepropylene O-Rings and shall be easily removed from the meter body.
8) The sensor electronics shall be potted in an epoxy compound designed for prolonged immersion.
9) Electrical connections shall be 2 single conductor 18 AWG leads 48 inches (1,2 meters) long.
10) Insulation shall be direct burial “UF” type colored red for the positive lead and black for the negative lead.

11) The sensor shall be capable of operating in line pressures up to 400 psi (27,5 bars).
12) The sensor shall be capable of operating in liquid temperatures up to 220° F (105°C).
13) The sensor shall be capable of operating in flows of ½ foot (0,15 meters) per second to 15 feet (4,5 meters) per second with linearity of ±1% and repeatability of ±1%.
14) The meter body shall be cast 85-5-5-5 bronze, in 1" (25 mm) and 1½" (40 mm) , female iron pipe thread sizes.
15) The FS100B Flow Sensor and FS150B Flow Sensor shall be as manufactured by Rain Bird™ Corporation.

k. The Rain Bird™ FS200B Flow Sensor specifications include but are not limited to:
1) The flow sensor shall be an insertion type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part.
2) The paddle wheel shall be a six-bladed impeller design.
3) The flow sensor shall be designed for outdoor or underground applications.
4) The sensor sleeve shall be bronze, with the sensor housing being PPS.
5) The sensor shall be mounted in a 2" malleable bronze tee.
6) The sensor shall be a nonmagnetic, spinning impeller (paddle wheel) as the only moving part.
7) The impeller shall be glass-filled nylon with a UHMWPE sleeve bearing.
8) The shaft material shall be tungsten carbide.
9) The sensor electronics will be potted in an epoxy compound designed for prolonged immersion.
10) Electrical connections shall be 2 single conductor 18 AWG leads 48 inches long, U.L Style type PTLC wire.
11) The sensor shall operate in line pressures up to 200 psi.
12) The sensor shall operate in liquid temperatures up to 100° F.
13) The sensor shall be capable of operating in flows of ½ foot per second to 30 feet per second with accuracy of ± 1% of full scale and repeatability of ± 0.3%.
14) The FS200B Flow Sensor shall be as manufactured by Rain Bird™ Corporation.

l. The Rain Bird™ FS050P, Rain Bird™ FS075P and Rain Bird™ FS100P Flow Sensor specifications include but are not limited to:
1) The flow sensor shall be an in line type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part.
2) The paddle wheel shall be a six-bladed impeller design.
3) The flow sensor shall be designed for outdoor or underground applications.
4) The impeller shall be made of 300SST with a UHMWPE sleeve bearing.
5) The shaft material shall be tungsten carbide.
6) The electronics housing shall be made of PPS.
7) The electronics housing shall have two EPDM O-Rings and shall be easily removed from the meter body.
8) The sensor electronics will be potted in an epoxy compound designed for prolonged immersion with 2-conductor, 18AWG solid copper wire leads extending from the top of the sensor.
9) The sensor shall operate inline pressures up to 150 psi at liquid temperatures up to 73° F, or up to 75 PSIG at liquid temperatures up to 110° F.
10) The sensor shall operate in flows of 2 foot per second to 20 feet per second with linearity of ± 3% and repeatability of ± 1.5%.
11) The flow sensor shall generate a frequency which is proportional to flow rate.
12) The meter body shall be fabricated from Schedule 40 PVC Tees, Type 1, white, available in ½", ¾", and 1" solvent weld socket end connections.

13) The FS050P, FS075P and FS100P Flow Sensor shall be as manufactured by Rain Bird™ Corporation.

m. The Rain Bird™ FS150P, Rain Bird™ FS200P, Rain Bird™ FS300P and Rain Bird™ FS400P Flow Sensor specifications include but are not limited to:
1) The flow sensor shall be an in-line type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part.
2) The paddle wheel shall be a six-bladed impeller design.
3) The flow sensor shall be designed for outdoor or underground applications.
4) The electronics housing shall be glass-filled PPS.
5) The impeller shall be glass-filled nylon or Tefzel with a UHMWPE or Tefzel sleeve bearing.
6) The shaft material shall be tungsten carbide.
7) The electronics housing shall have two, ethylenepropylene O-Rings and shall be easily removed from the meter body.
8) The sensor electronics will be potted in an epoxy compound designed for prolongs immersion.
9) Electrical connections shall be 2 single conductor 18 AWG leads 48 inches (1,2 meters) long.
10) Insulation shall be direct burial “UF” type colored red for the positive lead and black for the negative lead.
11) The sensor shall be capable of operating in line pressure up to 100 psi (6.9 bars).
12) The sensor shall be capable of operating in liquid temperatures up to 140° F (60° C).
13) The sensor shall be capable operating in flows of 1⁄2 foot (0,15 meters) per second to 30 feet (9,2 meters) per second with linearity of ±1% and repeatability of ±1%.
14) The meter body shall be fabricated from Schedule 80 PVC Tees, available in 1 1⁄2”, 2”, 3”, and 4” (25mm, 40mm, 50mm,75mm, and 110mm) with socket end connections.
15) The FS150P, FS200P, FS300P and FS400P Flow Sensor shall be as manufactured by Rain Bird™ Corporation.

n. The Rain Bird™ FS350B and Rain Bird™ FS350SS Flow Sensor specifications include but are not limited to:
1) The flow sensor shall be an insertion type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part.
2) The paddle wheel shall be a six-bladed impeller design.
3) The flow sensor shall be designed for outdoor or underground applications.
4) The sensor sleeve will be brass (or 316 stainless steel) with the sensor housing being PPS.
5) The impeller shall be glassfilled nylon or Tefzel with a UHMPWE or Tefzel sleeve.
6) The shaft material shall be tungsten carbide.
7) The sensor will be supplied with a 2” (50mm) NPT adapter for installation into any commercially available weld-on fitting or pipe saddle.
8) The adapter shall have two, ethylenepropylene O-Rings.
9) The sensor electronics will be potted in an epoxy compound designed for prolonged immersion.
10) Electrical connections shall be 2 single conductor 18AWG leads 48 inches (1,2 meters) long.
11) Insulation shall be direct burial “UF” type colored red for the positive lead and black for the negative lead.
12) Insertion of the sensor into any pipe size shall be 1 1⁄2” (40mm) from the inside wall to the end of the sensor housing.
13) The sensor shall be capable of operating in line pressures up to 400 psi (27,5 bars).

14) The sensor shall be capable of operating in liquid temperatures up to 220° F (105°C).
15) The sensor shall be capable of operating in flows of 1⁄2 foot (0,15 meters) per second to 30 feet (9,2 meters) per second.
16) The FS350B and FS350SS Flow Sensor shall be as manufactured by Rain Bird™ Corporation.

2.16 BOXES FOR AUTOMATIC CONTROL VALVES AND OTHER UNDERGROUND EQUIPMENT

A. Plastic Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. NDS.
   b. Oldcastle Enclosure Solutions.
   c. Oldcastle, Inc.
   d. Rainbird.
2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
   a. Size: As required for valves and service.
   b. Shape: Round Square Rectangular.
   c. Sidewall Material: PE.
   d. Cover Material: PE.
   e. Cover and Sidewall Color: Black
      1) Master Control Valve Lettering: " IRR-MV."
      2) Control Valve Lettering: " IRR-CV."
      3) Quick Coupler Valve Lettering: " IRR-QC."
      4) Flush Valve Lettering: " IRR-FV."
      5) Other Irrigation Box Lettering: " IRR."

B. Polymer-Concrete Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by the following
   a. Oldcastle Enclosure Solutions.
2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
   a. Size: As required for valves or other equipment and service.
   b. Shape: Rectangular.
   c. Sidewall Material: Polymer concrete with lateral and vertical sidewall design loading of 10,000 lb minimum over 10 by 10 inches square.
   d. Cover Material: Reinforced polymer concrete with cover design loading of 10,000 lb minimum over 10 by 10 inches square.
      1) Master Control Valve Lettering: " IRR-MV."
      2) Control Valve Lettering: " IRR-CV."
      3) Quick Coupler Valve Lettering: " IRR-QC."
      4) Flush Valve Lettering: " IRR-FV."
      5) Other Irrigation Box Lettering: " IRR."

C. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch minimum to 3 inches maximum.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

B. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches, to 12 inches below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.

C. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 18 inches below finished grade.
2. Circuit Piping: 12 inches.
3. Drain Piping: 12 inches.
4. Sleeves: 24 inches.

3.2 PREPARATION

A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

3.3 PIPING INSTALLATION

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

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

F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.

G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.

H. Install expansion loops in control-valve boxes for plastic piping.

I. Lay piping on solid subbase, uniformly sloped without humps or depressions.

J. Install ductile-iron piping according to AWWA C600.

K. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.

L. Install piping in sleeves under parking lots, roadways, buildings and sidewalks.

M. Install sleeves made of Schedule 40 PVC pipe and socket fittings, and solvent-cemented joints.

N. Install transition fittings for plastic-to-metal pipe connections according to the following:

1. Underground Piping:
   a. NPS 1-1/2 and Smaller: Plastic-to-metal transition fittings.
   b. NPS 2 and Larger: AWWA transition couplings.
2. Aboveground Piping:
   a. NPS 2 and Smaller: Plastic-to-metal transition fittings.
   b. NPS 2 and Larger: Use dielectric flange kits with one plastic flange.

O. Install dielectric fittings for dissimilar-metal pipe connections according to the following:

1. Underground Piping:
   a. NPS 2 and Smaller: Dielectric coupling or dielectric nipple.
   b. NPS 2-1/2 and Larger: Prohibited except in control-valve box.
2. Aboveground Piping:
   a. NPS 2 and Smaller: Dielectric union.
   b. NPS 2-1/2 to NPS 4: Dielectric flange.
   c. NPS 5 and Larger: Dielectric flange kit.
3. Piping in Control-Valve Boxes:
   a. NPS 2 and Smaller: Dielectric union.
   b. NPS 2-1/2 to NPS 4: Dielectric flange.
   c. NPS 5 and Larger: Dielectric flange kit.

3.4 JOINT CONSTRUCTION

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

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

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

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.

F. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

3. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.5 VALVE INSTALLATION

A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.

B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.

1. Install valves and PVC pipe with restrained, gasketed joints.

C. Aboveground Valves: Install as components of connected piping system.

D. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves.

E. Throttling Valves: Install in underground piping in boxes for automatic control valves.

F. Drain Valves: Install in underground piping in boxes for automatic control valves.

3.6 SPRINKLER INSTALLATION

A. Install sprinklers after hydrostatic test is completed.

B. Install sprinklers at manufacturer's recommended heights.

C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries unless otherwise indicated.

3.7 DRIP IRRIGATION SPECIALTY INSTALLATION

A. On-surface dripline.

1. Install on-surface drip tubes with direct-attached emitters on ground. Scratch lines 1 inch to 2 inch into finish grade.
2. Install application pressure regulators and filter units with drip control zone kits, and in control-valve boxes.
3. Install air relief valves and vacuum relief valves in piping, and in control-valve boxes.

B. Sub-surface dripline.

1. Install sub-surface drip tubes 4-6” below proposed finished grade and per manufacturer’s recommendations.
2. Install application pressure regulators and filter units with drip control zone kits, and in control-valve boxes.
3. Install air relief valves and vacuum relief valves in piping, and in control-valve boxes.

3.8 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

A. Equipment Mounting: Install interior controllers on wall.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Equipment Mounting: Install exterior freestanding controllers on precast concrete bases.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Install control cable in same trench as irrigation piping and at least 2 inches below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

3.9 CONNECTIONS

A. Comply with requirements for piping specified in Section 221113 "Facility Water Distribution Piping" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.

C. Connect wiring between controllers and automatic control valves.

3.10 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.

1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Section 312000 "Earth Moving" for warning tapes.

3.11 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Any irrigation product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.12 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that controllers are installed and connected according to the Contract Documents.
3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.13 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.14 CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

3.15 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic control valves and controllers.

3.16 PIPING SCHEDULE

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control-valve boxes and aboveground may be joined with flanges or unions instead of joints indicated.

C. Underground irrigation main piping, shall be the following:

1. For Potable Water Supply – Standard Schedule 40, PVC pipe and socket fittings, and solvent-cemented joints.
2. For Greywater/Non-potable Water Supply – Purple Colored Schedule 40, PVC pipe and socket fittings, and solvent-cemented joints.

D. Circuit piping, shall be the following:

1. For Potable Water Supply – Standard Schedule 40, PVC pipe and socket fittings, and solvent-cemented joints.
2. For Greywater/Non-potable Water Supply – Purple Colored Schedule 40, PVC pipe and socket fittings, and solvent-cemented joints.

E. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.

1. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.

F. Risers to Aboveground Sprinklers and Specialties: Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.

G. Drain piping shall be the following:

1. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.

3.17 VALVE SCHEDULE

A. Underground, Shutoff-Duty Valves: Use the following:

1. NPS 2 and Smaller: Curb valve, curb-valve casing, and shutoff rod.
2. NPS 3 and Larger: Iron gate valve, resilient seated; iron gate valve casing; and operating wrench(es).

B. Aboveground, Shutoff-Duty Valves:

1. NPS 2 and Smaller: Bronze gate valve.

C. Drain Valves:

1. NPS 1/2 and NPS 3/4: Plastic ball valve.
2. NPS 1 to NPS 2: Plastic ball valve.

END OF SECTION 328400

SECTION 32 91 15 - SOIL PREPARATION (PERFORMANCE SPECIFICATION)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes planting soils specified according to performance requirements of the mixes.

B. Related Requirements:

1. Section 329300 "Plants" for placing planting soil for plantings.

1.3 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. CEC: Cation exchange capacity.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

F. Imported Soil: Soil that is transported to Project site for use.

G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

M. SSSA: Soil Science Society of America.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

Q. USCC: U.S. Composting Council.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for application and use.
2. Include test data substantiating that products comply with requirements.
3. Include sieve analyses for aggregate materials.
4. Material Certificates: For each type of imported soil and soil amendment and fertilizer Five (5) working days before delivery to the site, according to the following:
    a. Manufacturer's qualified testing agency's certified analysis of standard products.
    b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
    c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each bulk-supplied material, 1-gal. volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1. Laboratories: Subject to compliance with requirements, provide testing by the following:
   a. Wallace Laboratories, 365 Coral Circle, El Segundo, CA 90245. (310) 615-0116.
   b. Fruit Growers Lab, Santa Paula , CA. (805) 392-2000.
2. Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil.

1. Notify Owner and Landscape Architect seven days in advance of the dates and times when laboratory samples will be taken.

B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.8 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Landscape architect or state-certified, -licensed, or -registered soil scientist under the direction of the testing agency.

1. Number and Location of Samples: Minimum of eight representative soil samples where directed by Landscape architect for each soil to be used or amended for landscaping purposes.
2. Procedures and Depth of Samples: Two (2) depths in each testing location as directed by Landscape architect.
3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.9 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing: Must Comply with State Model Water Efficient Landscape Ordinance requirements for 'Soil Analysis Report.'

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
   a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
   b. Hydrometer Method: Report percentages of sand, silt, and clay.
2. Bulk Density: Analysis according to core method of SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
5. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85 percent compaction according to ASTM D 698 (Standard Proctor).
6. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

C. Fertility Testing: Soil fertility analysis according to standard laboratory protocol of SSSA NAPT NCR-13, including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

D. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3-Chemical Methods."

E. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inchdepth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inchdepth of soil.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOILS SPECIFIED ACCORDING TO PERFORMANCE REQUIREMENTS

A. Planting-Soil: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Using preconstruction soil analyses and materials specified in other articles of this Section, amend existing, on-site surface soil to become planting soil complying with the following requirements:

1. Particle Size Distribution by USDA Textures: Classified as sandy loam soil according to USDA textures.
2. Percentage of Organic Matter: Minimum 6 percent by volume.
3. Soil Reaction: pH of 6 to 7.

B. Planting-Soil: Imported, naturally formed soil from off-site sources and consisting of sandy loam loam soil according to USDA textures; and modified to produce viable planting soil. Amend imported soil with materials specified in other articles of this Section to become planting soil complying with the following requirements:

1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from agricultural land, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants.
2. Additional Properties of Imported Soil before Amending: Minimum of 6 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration. Clean soil to be of the following:
   a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine,

tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.

c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 3 inches in any dimension.

C. Planting-Soil: Manufactured soil consisting of manufacturer's basic topsoil, sandy loam according to USDA textures, blended in a manufacturing facility with sand, stabilized organic soil amendments, and other materials as specified in other articles of this Section to produce viable planting soil.

1. Basic Properties: Manufactured soil shall not contain the following:

a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 5 percent by dry weight of the manufactured soil.

c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.

D. Garden Bed Planting-Soil: Well-draining outdoor container and raised bed soil product

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Agromin, 201 Kinetic Drive, Oxnard, CA 93030

b. 1.805.485.9200 HYPERLINK "https: //agromin.com/contact/" https

c. Product: Container Blend

d. Substitutions: Products by other manufacturers that comply with specifications will be considered in accordance with Section 012500 – Substitution Procedures.

2.2 INORGANIC SOIL AMENDMENTS

A. Inorganic soil amendments shall match recommendations provided by soil testing agency in required soil testing report.Insert percentages of carbonates, calcium, and magnesium in "Lime" Paragraph below if required.

B. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
3. Form: Provide lime in form of ground dolomitic limestone.

C. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.

D. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.3 ORGANIC SOIL AMENDMENTS

A. Organic soil amendments shall match recommendations provided by soil testing agency in required soil testing report.

B. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:

1. Feedstock: Limited to leaves.
2. Reaction: pH of 5.5 to 8.
3. Soluble-Salt Concentration: Less than 4 dS/m.
4. Moisture Content: 35 to 55 percent by weight.
5. Organic-Matter Content: 30 to 40 percent of dry weight.
6. Particle Size: Minimum of 98 percent passing through a 2-inch sieve.

C. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.

D. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. Partially Decomposed Wood Derivatives: In lieu of shredded and composted wood derivatives, mix shredded and partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

A. Fertilizers shall match recommendations provided by soil testing agency in required soil testing report.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

E. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

B. Planting soil is expected to be incorporated in the planting areas to bring the site to finish grade where required.

C. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

D. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Excavation: Excavate or rip soil from designated area(s) to the following a depths

1. General Planting areas shall be over-excavated to a depth of 12 inches. and stockpile until amended.
2. Sunken stormwater planters shall be over-excavated to a depth of 30 inches.

B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

C. Unsuitable Materials: Clean soil to contain a combined maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

D. Screening: 3-inchnamended soil through a 3-inchRemove rocks and other inorganic material greater than 3” in diameter sieve to remove large materials.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply and mixReturn unamended soil with amendmentsto planting areas on-site. to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. 6 inches<~/St<~Style:IP~>3 inches Preparation: Till subgrade to a minimum depth of 6 inches. Remove stones larger than 3 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Sub-grade within parkways and sunken stormwater planters shall be over-excavated to a depth of 30” before tilling and re-compacting to 85% relative density.
2. 4 inchesdd soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

C. MixingSpreading: Spread una8 incheswithin 4 inches of finish surfacehin 4 inches of finish surface, but not less than required to meet finish grades after mixing with amendments, and natural settlement, and application of mulch. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Amendments: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.
   a. Mix lime with dry soil before mixing fertilizer.
   b. Mix fertilizer with planting soil no more than seven days before planting.
2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each blended lift of planting soil to 80-85 percent of maximum Standard Proctor density according to ASTM D 698 except where a different compaction value is indicated on Drawings.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply manufactured soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. 8 inches<~/St<~Style:IP~>3 inches Preparation: Till subgrade to a minimum depth of 8 inches. Remove stones larger than 3 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. 4 inchesproximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

C. 8 inchesion: Spread planting soil to total depth of 8 inches, but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. 8 inches<~/St<~Style:IP~>4 inchespply planting soil in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each lift of planting soil to 80-85 percent of maximum Standard Proctor density according to ASTM D 698 except where a different compaction value is indicated on Drawings.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.5 BLENDING PLANTING SOIL IN PLACE – GROUNDCOVERS AND TURF PLANTING AREAS

A. General: For planting areas to receive turf or groundcover plantings, Mmix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of 12 4 inches. Remove stones larger 3 inchesnches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Apply soil amendments and fertilizer as directed by soils test recommendations, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

1. Mix lime with dry soil before mixing fertilizer.
2. Mix fertilizer with planting soil no more than seven days before planting.

D. Compaction: Compact blended planting soil to 80-85 percent of maximum Standard Proctor density according to ASTM D 698 except where a different compaction value is indicated on Drawings.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.6 BLENDING PLANTING SOIL– CONTAINER PLANTS

A. General: For planting areas to receive container plants (trees or shrubs), mix amendments with backfill soil to produce required planting soil. Do not apply materials if existing soil or subgrade is frozen, muddy, or excessively wet.

B. 3 inchesion: Excavate plant pits per Section 329200 “Plants”. Remove stones larger than 3 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

1. Mix lime with dry soil before mixing fertilizer.
2. Mix fertilizer with planting soil no more than seven days before planting.

D. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.7 PLACING MANUFACTURED PLANTING SOIL IN GARDEN BEDS

A. General: Apply manufactured soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. 4 inches<~/St<~Style:IP~>3 inches Preparation: Till subgrade to a minimum depth of 4 inches. Remove stones larger than 3 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. 4 inchesproximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

C. Application: Spread planting soil to total depth within 6 inches from the top of the garden planters, but not less than required after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. 8 inches<~/St<~Style:IP~>4 inchespply planting soil in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each lift of planting soil to 80-85 percent of maximum Standard Proctor density according to ASTM D 698 except where a different compaction value is indicated on Drawings.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.8 APPLYING COMPOST TO SURFACE OF PLANTING SOIL

A. Application: Apply compost component of planting-soil mix to surface of in-place planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Finish Grading: Grade surface to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests:

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 1000 sq. ft. of in-place soil or part thereof.
2. Performance Testing: For each amended planting-soil type, demonstrating compliance with specified performance requirements. Perform testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

C. Soil will be considered defective if it does not pass tests.

D. Prepare test reports.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.10 PROTECTION

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Landscape landscape architect and replace contaminated planting soil with new planting soil.

3.11 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 32 91 15

SECTION 32 93 00 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plants.
2. Tree stabilization.

B. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 129200 "Interior Planters and Artificial Plants" for planters for live and artificial interior plants.
3. Section 329200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.
4. Section 329600 "Transplanting" for transplanting non-nursery-grown trees.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

B. Unit prices apply to authorized work covered by quantity allowances.

C. Unit prices apply to additions to and deletions from the Work as authorized by Change Orders.

1.4 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Area: Areas to be planted.

G. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329115 "Soil Preparation (Performance Specification)" for drawing designations for planting soils.

H. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

I. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

J. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

K. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.5 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to

be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Samples for Verification: For each of the following:

1. Trees and Shrubs: Three Samples of each variety and size delivered to site for review. Maintain approved Samples on-site as a standard for comparison.
2. Organic Mulch: 1-quart volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
3. Root Barrier: Width of panel by 12 inches.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Sample Warranty: For special warranty.

1.9 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.10 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
2. Experience: Three years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:
   a. Landscape Industry Certified Technician - Exterior.
   b. Landscape Industry Certified Interior.
   c. Landscape Industry Certified Horticultural Technician.
5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1. Selection of plants purchased under allowances is made by Architect, who tags plants at their place of growth before they are prepared for transplanting.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

C. Deliver bare-root stock plants within 24 hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.

D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

E. Handle planting stock by root ball.

F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

G. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

H. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

I. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.12 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Fall Planting: September 01 - November 20 .

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.13 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
   b. Structural failures including plantings falling or blowing over.
   c. Faulty performance of tree stabilization .
   d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Periods: From date of Substantial Completion .
   a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
3. Include the following remedial actions as a minimum:
   a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
   b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
   c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
   d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 FERTILIZERS

A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Gro-Power Planting Tablets placed 2" deep and 2" outside root (3) per 1 gal; (9) per 5 gal;(15) per 15 gal, (16) per 24" box .
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.3 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Ground or shredded bark .
2. Size Range: 3 inches maximum, 1/2 inch minimum .
3. Color: Natural.

2.4 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood softwood with specified wood pressure-preservative treatment, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.

2.5 MISCELLANEOUS PRODUCTS

A. Root Barrier: Black, molded, modular panels 36" high (deep), 85 mils thick, and with vertical root deflecting ribs protruding 3/4 inch out from panel surface; manufactured with minimum 50 percent recycled polyethylene plastic with UV inhibitors.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Century Products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

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

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329115 "Soil Preparation (Performance Specification)."

B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade .

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations .

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately three times as wide as ball diameter for container-grown stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
8. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting soil . For trees, use excavated soil for backfill.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly

before placing remainder of backfill. Repeat watering until no more water is absorbed.

4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
   a. Quantity: As indicated on Drawings .
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Watering Pipe: During backfilling, install watering pipe 4 feet deep into the planting pit outside the root ball with top of pipe 1 inch above the mulched surface.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Do not apply pruning paint to wounds.

3.7 TREE STABILIZATION

A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying:
   a. Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
   b. Stake trees with two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
3. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

B. Trunk Stabilization by Staking and Guying: Install trunk stabilization as follows unless otherwise indicated on Drawings. Stake and guy trees more than 14 feet in height and more than 3 inches in caliper unless otherwise indicated.

1. Site-Fabricated, Staking-and-Guying Method: Install no fewer than three guys spaced equally around tree.
   a. Securely attach guys to stakes 30 inches long, driven to grade. Adjust spacing to avoid penetrating root balls or root masses. Provide turnbuckle for each guy wire and tighten securely.

b. For trees more than 6 inches in caliper , anchor guys to wood deadmen buried at least 36 inches below grade. Provide turnbuckle for each guy wire and tighten securely.
c. Support trees with bands of flexible ties at contact points with tree trunk and reaching to turnbuckle . Allow enough slack to avoid rigid restraint of tree.
d. Support trees with guy cable , connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to turnbuckle . Allow enough slack to avoid rigid restraint of tree.
e. Attach flags to each guy wire, 30 inches above finish grade.
f. Paint turnbuckles with luminescent white paint.

2. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

C. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.

1. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of the vertical stakes.
a. Install stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation. Saw stakes off at horizontal stake.
b. Install screws through horizontal hold-down and penetrating at least 1 inch into stakes. Predrill holes if necessary to prevent splitting wood.
c. Install second set of stakes on other side of root trunk for larger trees.
2. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

D. Palm Bracing: Install bracing system at three or more places equally spaced around perimeter of trunk to secure each palm until established unless otherwise indicated.

1. Site-Fabricated Palm-Bracing Method:
a. Place battens over padding and secure battens in place around trunk perimeter with at least two straps, tightened to prevent displacement. Ensure that straps do not contact trunk.
b. Place diagonal braces and cut to length. Secure upper ends of diagonal braces with galvanized nails into battens or into nail-attached blocks on battens. Do not drive nails, screws, or other securing devices into palm trunk; do not penetrate palm trunk in any fashion. Secure lower ends of diagonal braces with stakes driven into ground to prevent outward slippage of braces.
2. Proprietary Palm-Bracing Device: Install palm-bracing system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

3.8 INSTALLATION OF ROOT BARRIER

A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.

B. Align root barrier vertically , and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.

C. Install root barrier continuously for a distance of 60 inches in each direction from the tree trunk, for a total distance of 10 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.

1. Position top of root barrier flush with finish grade .
2. Overlap root barrier a minimum of 12 inches at joints.
3. Do not distort or bend root barrier during construction activities.
4. Do not install root barrier surrounding the root ball of tree.

3.9 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 36-inch radius around trunks or stems. Do not place mulch within 6 inches of trunks or stems.
2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.
3. Mineral Mulch in Planting Areas: Apply 3-inch average thickness of mineral mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.11 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction

operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced for each tree of 6 inches or smaller in caliper size.
2. Provide two new tree(s) of caliper size for each tree being replaced that measures more than 4 inches in caliper size.
3. Species of Replacement Trees: Species selected by Architect .

3.12 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion , remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.13 MAINTENANCE SERVICE

A. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: Six months from date of Substantial Completion .

END OF SECTION 32 93 00

SECTION 329600 - TRANSPLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes transplanting non-nursery-grown trees by tree spade .

B. Owner-Furnished Material: .

C. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 329300 "Plants" for new trees from nursery-grown sources.

1.3 DEFINITIONS

A. General: See definitions in ANSI A300 (Part 6) and in ANSI Z60.1 pertaining to field-grown trees, except as otherwise defined in this Section.

B. Caliper: Diameter of a trunk as measured by a diameter tape at a height 6 inches above the root flair for trees up to, and including, 4-inch size at this height; and as measured at a height of 12 inches above the root flair for trees larger than 4-inch size.

C. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape at a height 54 inches above the ground line.

D. Root-Ball Depth: Measured from bottom of trunk flare to the bottom of root ball.

E. Root-Ball Width: Measured horizontally across the root ball with an approximately circular form or the least dimension for non-round root balls, not necessarily centered on the tree trunk.

F. Root Flare: Also called "trunk flare." The area at the base of the tree's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review methods and procedures related to transplanting work include, but are not limited to, the following:

a. Construction schedule. Verify availability of materials, personnel, equipment, and unimpeded access needed to make progress and avoid delays.
b. Tree and plant protection.
c. Tree maintenance.
d. Arborist's responsibilities.
e. .

1.5 ACTION SUBMITTALS

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified tree-service firm and arborist.

B. Certification: From arborist, certifying that transplanted trees have been protected during construction and that trees were promptly and properly treated and repaired when damaged.

C. Tree-Transplanting Program: Submit before work begins.

D. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Tree-Service Firm Qualifications: An experienced landscaping contractor or tree-moving firm that has successfully completed transplanting work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

1. Arborist Qualifications: Certified Arborist as certified by ISA .

B. Tree-Transplanting Program: Prepare a written plan by arborist for transplanting trees for the whole Project, including each phase or process, tree maintenance, and protection of surrounding materials during operations. Describe in detail the materials, methods, and equipment to be used for each phase of the transplanting work.

1. Include transplanting times appropriate for each species at the Project location unless otherwise indicated on Drawings or directed by arborist.
2. Include a transplanting schedule for each species to be transplanted, coordinated with the Project schedule.
3. Include site plans clearly marked to show tree-moving routes from extraction to planting locations. Indicate proposed equipment, weight, and turning radii.
4. Show details of temporary protective barriers where needed.
5. Include diagrams showing clearances to utility lines and other encumbrances along route.
6. Include care and maintenance provisions and eventual removal of tree stabilization.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or trees.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery with appropriate certificates.

C. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees in such a manner as to destroy their natural shape.

D. Completely cover foliage when transporting trees while they are in foliage.

E. Handle trees by root ball. Do not drop trees.

F. Move trees after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after moving, set trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify final grade elevations and final locations of trees and construction contiguous with trees by field measurements before proceeding with transplanting work. Perform transplanting only after finish grades are established.

B. Weather Limitations: Proceed with transplanting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Do not transplant during excessively wet or frozen conditions. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

C. Coordination with Planting Beds: Perform transplanting before planting bedded areas unless otherwise indicated.

1. When transplanting after planting bedded areas, protect bedding plants, and promptly repair damage caused by transplanting operations.

1.10 WARRANTY

A. Installer's Special Warranty: Tree-service firm agrees to repair or replace trees and related materials that fail within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Death and unsatisfactory growth except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
   b. Death and unsatisfactory growth is defined as more than 25 percent dead or in an unhealthy condition or failure to meet general performance requirements at end of warranty period.
   c. Structural failures including trees falling or blowing over.
   d. Faulty performance of materials and devices related to tree plantings including tree stabilization and watering devices .
2. Warranty Periods from Date of Substantial Completion :

a. Trees: 12 months.

3. Include the following remedial actions as a minimum:
   a. Remove dead trees and trees with unsatisfactory growth at end of warranty period; replace when directed.
   b. A limit of one replacement of each tree will be required except for losses or replacements due to failure to comply with requirements.
   c. Replace materials and devices related to tree plantings.
   d. Provide extended warranty for period equal to original warranty period, for replaced trees.

1.11 MAINTENANCE SERVICE

A. Initial Maintenance Service: Provide tree maintenance by skilled employees of tree-service firm and as required in Part 3. Begin maintenance immediately after trees are installed and continue until plantings are healthy and well established but for not less than maintenance period below.

1. Maintenance Period: 12 months from date of Substantial Completion .

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Transplanted trees shall be healthy and resume vigorous growth within one year of transplanting without dieback due to defective extracting, handling, planting, maintenance, or other defects in the Work.

2.2 PLANTING MATERIALS

A. Backfill Soil: Excavated soil mixed with planting soil of suitable moisture content and granular texture for placing and compacting in planting pit around tree, and free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Mixture: Well-blended mix of two parts excavated soil to one part planting soil .
2. Planting Soil: Planting soil as specified in Section 329115 "Soil Preparation (Performance Specification)."

2.3 WATERING DEVICES

A. Slow-Release Watering Device: Standard product manufactured for drip-irrigation of plants and emptying its water contents over a period of 2 to 9 hours; manufactured from UV-light stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Spectrum Products, Inc.
   b. Turf Chemicals Plus, Inc.

2.4 MISCELLANEOUS PRODUCTS

A. Organic Mulch: Ground or shredded bark as specified in Section 329300 "Plants."

B. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 5-gram tablets.
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross transplanting areas.

B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to transplanting work and tree protection and health.

C. Proceed with transplanting only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, other facilities, turf areas, and other plants and planting areas from damage caused by transplanting operations.

B. Utility Locator Service: Notify utility locator service "Miss Utility" "Call Before You Dig" for area where Project is located before beginning excavation.

C. Locate and clearly identify trees for transplanting. Flag each tree at 54 inches above the ground.

D. Lay out individual transplant locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before transplanting. Make minor adjustments as required.

3.3 PREPARATORY PRUNING

3.4 EXCAVATION AND PLANTING EQUIPMENT

A. Tree Spade: Track-mounted mechanized tree mover; sized according to manufacturer's size recommendation for each tree being transplanted.

3.5 EXCAVATING PLANTING PITS

A. General: Excavate under supervision of the arborist.

1. Excavate planting pits or trenches with sides sloping. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately two times as wide as root ball.
3. Keep excavations covered or otherwise protected until replanting trees.

B. Subsoil and topsoil removed from excavations may be used as planting soil.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Seepage: Notify Architect if subsoil conditions evidence unexpected water seepage into tree-planting pits.

E. Drainage: Fill planting pit or trench with 6 inches of water and time the infiltration rate of the soil. If the drainage rate is less than 0.25 inch per hour, notify Architect to determine need for subsurface drainage.

F. Saline or Sodic Soils: Completely fill excavations with water and allow to percolate away before positioning trees.

3.6 EXTRACTING TREES

A. General: Extract trees under supervision of the arborist.

B. Orientation Marking: Mark the north side of each tree with non-permanent paint before extracting.

C. Root-Ball Width: Minimum 10 inches of root-ball diameter, or least dimension for non-round root balls, for each inch of tree caliper being transplanted.

1. Out-of-Season Planting: If planting before or after the in-season period for tree, provide a minimum root-ball diameter of 12 inches for each inch of tree caliper being transplanted.

D. Root-Ball Depth: As determined by the arborist for each species and size of tree and for site conditions at original and planting locations.

E. Digging:

1. Dig and clear a pit by hand or with tree spade to the depth of the root system. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Use narrow-tine spading forks to comb soil to expose roots with minimal damage to root system.
3. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking.

4. Cut exposed roots manually with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not paint or apply sealants on cut root ends.
5. Construct box tight against root system sides and bottom as pit is dug. Brace and support box to prevent breaking of root ball.
6. Temporarily support and protect exposed roots from damage until they are permanently redirected and covered with soil. Cover roots with burlap and keep them moist until planted.

F. Extracting with Tree Spade: Use the same tree spade to extract the tree as will be used to transport and plant the tree.

1. Do not use tree spade to move trees larger than the manufacturer's maximum size recommendation for the tree spade being used.
2. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

3.7 PLANTING

A. Planting Standard: Perform planting according to ANSI A300 (Part 6) unless otherwise indicated.

B. Before planting, verify that root flare is visible at top of root ball. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

C. Ensure that root flare is visible after planting.

D. Remove injured roots by cutting cleanly; do not break. Do not paint or apply sealants on cut root ends.

E. Orientation: Position the tree so that its north side, marked before extracting, is facing north in its new location.

F. Set tree plumb and in center of planting pit with bottom of root flare 1 inch above adjacent finish grades.

1. Use specified backfill soil for backfill.
2. If area under the tree was initially dug too deep, add backfill to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
3. After placing some backfill around root ball to stabilize plant, begin backfilling.
4. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
5. Redirect exposed root ends downward in backfill areas where possible. Hand-expose roots as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
6. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended by arborist. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
7. Continue backfilling process. Water again after placing and tamping final layer of soil.

G. Planting with Tree Spade: Use the same tree spade for planting as was used to extract and transport the tree. Do not use tree spade for trees larger than the manufacturer's maximum size recommendation for the tree spade being used.

H. Slopes: When planting on slopes, set the tree so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.8 CROWN PRUNING

A. Prune branches as directed by arborist.

1. Prune to remove only broken, dying, or dead branches. Do not prune for shape.
2. Do not remove or reduce living branches to compensate for root loss caused by cutting root system or to improve natural tree form.
3. Pruning Standards: Perform pruning according to ANSI A300 (Part 1).

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance during Contract period as recommended by arborist.

F. Chip removed branches and spread over areas identified by Architect .

3.9 MULCHING

A. Organic Mulch: Apply 3-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.

3.10 INSTALLING SLOW-RELEASE WATERING DEVICE

A. Provide one device for each tree.

B. Place device on top of the mulch at base of tree and fill with water according to manufacturer's written instructions.

3.11 TREE MAINTENANCE

A. Perform tree maintenance as recommended by arborist. Maintain arborist observation of transplanting work.

B. Maintain trees by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Treat as required to keep trees free of insects and disease.

C. From time of tree extraction measure soil moisture adjacent to edge of each root ball weekly . Record findings and weather conditions.

D. Fill areas of soil subsidence with backfill soil. Replenish mulch materials damaged or lost in areas of subsidence.

E. Apply treatments as required to keep tree materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

F. Reports: Have arborist prepare monthly inspection reports.

3.12 REPAIR AND REPLACEMENT

A. General: Repair or replace transplanted trees and other plants indicated to remain or be relocated that are damaged by construction operations, in a manner recommended by the arborist and approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced for each tree of 4 inches or smaller in caliper size.
2. Provide two new tree(s) of 4-inch caliper size for each tree being replaced that measures more than 4 inches in caliper size.
3. Species of Replacement Trees: Species selected by Architect .

3.13 CLEANUP AND PROTECTION

A. During transplanting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect trees from damage due to transplanting operations and operations of other contractors and trades. Maintain protection during transplanting and maintenance periods. Treat, repair, or replace damaged plantings.

C. After planting and before Substantial Completion , remove tags, markings, tie tape, labels, wire, burlap, and other debris from transplanted trees, planting areas, and Project site.

3.14 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Except for materials indicated to be recycled, remove surplus soil, excess excavated material, waste materials, displaced plants, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Except for materials indicated to be retained on Owner's property or recycled, remove excess excavated material, waste materials, displaced plants, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 32 96 00

SECTION 33 40 00 STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Catch basins.

1.2 RELATED SECTIONS

A. Section 31 20 00 Earthwork.

1.3 REFERENCES

A. Standard Specifications for Public Works Construction (SSPWC), latest edition.

B. ASTM Standards.

1.4 SUBMITTALS

A. Submit the following in accordance with provisions in Division 1:

1. Product Data: Provide data indicating pipe, pipe accessories and catch basin grates.

2. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

3. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

4. Layout diagram for storm drain components per plan.

1.5 PROJECT RECORD DOCUMENTS

A. Submit record drawings. Accurately record locations of pipe runs, connections, catch basins, structures, manholes and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated on drawings.

B. Complete pothole work per plans and notify the District of any discrepancy prior to commencing construction.

1.7 COORDINATION

A. Coordinate the work with connection to existing storm drain mains, and trenching.

PART 2 PRODUCTS

2.1 CATCH BASINS AND MANHOLES

A. Precast catch basins shall include traffic rated grate, as manufactured by Brooks or approved equal.

2.2 METAL

A. All exposed metal parts are to be galvanized in accordance with SSPWC, Section 210-3.

2.4 CONCRETE

A. All concrete shall be Class 560-C-3250, per SSPWC Section 201.

2.5 BEDDING MATERIALS

A. 2” washed rock.

2.6 FILTER FABRIC

A. Filter fabric shall be non-woven geosynthetic per SSPWC Section 213-5.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that trench cut is ready to receive Work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with compacted bedding material.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.5 INSTALLATION - CATCH BASINS, MANHOLES

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base with provisions for storm drainage pipe end sections.

C. Level top surface of concrete base to receive shaft sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated on drawings.

E. Compact top 12" of native materials below the bottom of catch basins and manholes to minimum 95 percent of maximum dry density.

3.6 FIELD QUALITY CONTROL

A. Inspection and testing shall be performed by the District's representative.

B. Request inspection prior to and immediately after placing backfill cover over pipe.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to the District.

3.7 PROTECTION

A. Protect pipe and backfill cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 40 00